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(Contributions of Women Scientist-2009)

2ND NATIONAL WOMEN'S SCIENCE CONGRESS

Rashtriya Mahila Vijnana Sammelana

7-9th November 2009, AIISH, Mysore

PROCEEDINGS

Organised by

MATRU VEDIKE (Women Scientists Forum)

SWADESHI VIJNANA ANDOLANA-KARNATAKA

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Infosys Foundation, Bangalore
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Foreword

FORWARD TO THE FOREFRONT

Swadeshi Vijnana Andolana-Karnataka (SVAK) is the biggest science movement of Karnataka with the largest number of dynamic District Units, and Academic Faculties (Vedikes). It is not confined to modern sciences but gives a greater thrust to traditional sciences and Scientific Heritage. In addition to being a popular science movement it gives greater emphasis on professional levels including research and entrepreneurship. SVAK covers the entire spectrum of sciences-spiritual, social and secular-material sciences. Most of its activities are carried out through its Vedikes. Matru Vedike is the Academic Forum of Women Scientists, and Yuva Vidyarthi Vedike is for youth and students.

Most of the women's organizations throughout the world are "activist" movements leading mostly to conflicts and negativity is society while Matru Vedike is typically a "positivist" movement aiming at the overall elevation of women in society, especially amongst the women scientists. A career in science, engineering and technology (SET) is highly demanding, and requires total concentration, dedication, commitment and involvement. At the same time, a women has her natural duty of motherhood. Madame Marie Curie is the ideal model for women scientists. She received a Nobel Prize in Physics (1903) along with her husband and a second Nobel Prize in Chemistry (1911). It is prudent to recall that her daughter Irene Joliot Curie got all her training inspiration from her parents, especially her mother; and she got the Nobel Prize in 1935! Marie Curie is thus an ideal model, as a scientist and as a mother (Mata). It is for this reason that Matru Vedike decided to conduct the National Women's Science Congress from 7th Nov.2008 the birth anniversary of Madame Marie Curie. The Mahila Vijnana Puraskara is also named after Madame Marie Curie. As an important coincidence, Nov.7 is also the birth anniversary of Dr. C. V. Raman. We are indeed blessed by this coincidence. We recall how Raman inspired a galaxy of leaders in science-K.S.Krishnan, Vikram Sarabhai, Homi Bhabha, Ramanathan, Pisharoty et al. We have now instituted the C. V. Raman Mahila Vijnana Puraskara for outstanding contributions in Physical and Mathematical Sciences.

The Main objective of this Science Congress is to present before women the vast scope and opportunities in SET along with the exciting possibilities for pleasure, happiness and contentment in a career of diverse nature-teaching, research, industry or business. By this process, we hope to attract a larger percentage of women to SET and later encourage them to rise to greater levels of achievement. Of more than 300 individuals who received Nobel Prize, hardly a dozen were Women-If more women are encouraged into science, more of them will be candidates for the Nobel. Certainly, they can be empowered to become leaders in science. And in 2009, it is indeed gratifying that five of the thirteen Nobel Laureates are women scientists.

The second objective is to build a camaradere amongst women. This will initiate a process of creating pride and confidence amongst them.

The next objective is to lead them on to the frontline areas of SET, and finally to the forefront of leadership in entrepreneurship, science administration (eg. Dr. Manju Sharma) and technocfahcy (Dr. Sudha Murty) the like. Scientific acumen is quite distinct from socio-political acumen. India has an abundance in the sociopolitical leadership from amongst women, and we are indeed fortunate. We miss such abundance of scientific acumen amongst women in India especially at the level of top leadership. It is to analyse the reasons for this imbalance that we have the Focal Theme on *Problems*

and Prospects of Women in Science for an in-depth and open discussion in 2008 and The Need of Women Leadership in S&T in 2009. The outcome may not be the final word in this topic, but it will certainly open up a national debate. That is all what we expect from this series of annual Women's Science Congresses.

A word on our "modus operandi". Many of the Seminars, Congress or Symposia in India are just a "Conference of a few selected speakers", and nothing fresh or novel or original will come out of such conferences. We have scrupulously avoided such an approach, and deliberately opened up the arena to any one who has something to present before the public. Each one will get an almost equal chance for presentation. We hope to succeed. Time will judge. We have to evolve a new class of literature-the women's literature in science. We have to project the exclusive identity of women scientists. In 2008, we had just 62 papers and in 2009, we received more than double this number!

In India, women scientists come from different backgrounds: rich or poor families, educated or illiterate families, different religious denominations (Hindu, Christian, Islam, Sikh, Parsee etc.,), diverse caste groups, diverse language areas, urban or rural families etc. In spite of all these divergent backgrounds, the problems faced by women in science are more or less similar, and have to be tackled unitedly. And this process should be continued for years before a sane and sensible condition is created for a conducive atmosphere for a creative career in science-It is for this reason that SVAK decided to conduct the National Women's Science Congress annually on 7th November, and present the Marie Curie Mahila Vijnana Puraskara to an eminent women scientist, and the C. V. Raman Mahila Vijnana Puraskara to an outstanding scientists in the field of Physical and Mathematical Sciences.

SVAK conducts the Kannada Vijnana Sammelana (Karnataka Science Congress) on 15th September every year when the prestigious Visvesvaraya Vijnana Puraskara is presented to erudite scholars in spiritual, social and or Secular-material sciences. And one of the three or four Puraskaras goes exclusively to Women (Dr. Gangubhai Hangal, Dr. R. Nagarathna, Dr. Vijayalakshmi Deshmane, Dr. Vijayalakshmi Basavaraj, Prof. M. S. Shaila etc.)

Rashtriya Mahila Vijnana Sammelana is our humble attempt to take women in science forewards towards the forefront of SET- to encourage and empower women scientists to take up frontline leadership .

Prof. K.I. VASU
Chief Coordinator, NWSC-2009, Mysore

H. RAMESH
Coordinator,NWSC-2009, Mysore

Our Experience in organizing the 2nd National Women's Science Congress on 7th, 8th & 9th November 2009 at All India Institute of Speech and Hearing, Mysore

All India Institute of Speech and Hearing (AIISH), Mysore enthusiastically accepted the invitation of SVAK to host the 2nd National Women's Science Congress in early March 2009. This proposal was discussed with the Heads of Departments at AIISH who in turn were much interested in organizing the same. SVAK nominated Dr. Vijayalakshmi Basavaraj, Director as the Patron and Chairman of the Organizing Committee. With this beginning, the preparation to host the 2nd National Women's Science Congress was initiated. Dr. SR Savithri, Professor of Speech-Language Sciences & HOD-CREDM was nominated as the Vice Chairman of the organizing committee. One woman faculty each was nominated as the thematic conveners of the 10 themes already finalized by SVAK. AIISH requested SVAK to include an additional theme of "Speech, Language, Hearing Sciences and Disorders" which was readily agreed upon and thus it was planned to have plenary sessions, key note addresses and invited papers for all the 11 themes. Inclusion of additional theme of Speech Language, Hearing Sciences and Disorders gave an opportunity to create awareness amongst scientists and showcase the research done in the area of speech, language, hearing sciences and disorders in the past five decades in the country. Inclusion of this theme was also expected to provide opportunities for professionals in these areas to interact with other scientists attending the congress which could result in meaningful interdisciplinary collaborative research and was also expected to enthuse the scientists in other areas to do research for the cause of communication disorders either directly or indirectly.

Apart from this allocation of faculty of AIISH as thematic convenors, a local organizing committee was formed as follows:

Reception Committee

1. Dr. Asha Yathiraj, Prof. & HOD-Audiology	Chairperson
2. Mr. Brajesh Priyadarshi, Lecturer in Linguistics	Member-Secretary
3. Mr. Priti G Nair, Lecturer in Special Education	Member

Registration Committee

1. Dr. Venkatesan, Professor of Cli. Psychology	Chairman
2. Dr. N Sreedevi, Lecturer in Speech Sciences	Member-Secretary
3. Ms. N Parimala, PA to Director	Member

Accommodation Committee

1. Dr. G Jayarama, Reader & HOD-Clinical Psychology	Chairman
2. Mr. Gopisankar, Research Officer	Member-Secretary
3. Mr. Appaji Gowda, Asst. Registrar	Member

Stage Committee

1. Mr. Ajish K Abraham, Reader & HOD-Electronics	Chairman
2. Mr. Rajeev, Lecturer in Electronics	Member-Secretary
3. Mr. S R Srinivas, JTO	Member

Catering Committee

1. Dr. S P Goswami, Reader & HOD-Speech Lang. Path.	Chairman
2. Ms. Vijayashree, Clinical Assistant	Member-Secretary
3. Mr. Narasimhan, Registrar	Member

Transport Committee

1. Mr. M K Seetharam, Electronics Engineer	Chairman
2. Mr. Mallikarjunaiah, Security Officer	Member-Secretary
3. Mr. L Manjunath, Asst. Engineer	Member

Accounts

1. Mr. K Purushothama, Accounts Officer	Chairman
2. Mr. R. Md. Kaleemulla	Member-Secretary
3. Ms. B V Jyothi, Sr. Accountant	Member

Public Relations

1. Mr. G H Anandaram, O.S.	Chairman
2. Mr. A R Keerthi, Publicity & Information Officer	Member-Secretary
3. Ms. Kavitha, Photographer	Member

Coordinator for Scientific Session

1. Dr. Animesh Barman, Lecturer in Audiology	Chairman
2. Ms. Sangeetha Mahesh, Lecturer in Cli. Services	Member-Secretary
3. Mr. N Manohar, Lecturer in Electronics	Member

Apart from these nominees, a large number of UG/PG students of the institute were roped in to assist in organization.

It was heartening to note that male faculty/staff/student members were equally enthusiastic in organizing this congress. It was only due to their well planned systematic work, the congress could be conducted very smoothly.

AIISH provided the addresses, email IDs of all the speech and hearing professionals in the country as well as those who work in the area of communication disorders across the country to SVAK so that intimation about the conference may be sent to them for their active participation.

Very eminent women personalities in the country were identified for the inaugural and valedictory functions as well as to deliver key note address. With the timely invitation, AIISH succeeded in getting Prof. Saroj Chooramani Gopal, Vice Chancellor, Chhatrapati Shivaji Maharaj Medical University Lucknow, an eminent paediatric surgeon in the country to inaugurate the function. AIISH was also successful in making the participation of Prof. K Sudha Rao, Ex-Vice Chancellor, Karnataka State Open University, Mysore as the Guest of Honour. Dr. Leelavathi, Director, Avinanshalingam Univerity for Women Studies, Coimbatore; graced the occasion. The other eminent women in the country in various disciplines who participated in the congress responding to the invitation by AIISH were Mrs. Ganga Murthy, Addl. Chief Economic Advisor, Ministry of Railways, GOI; Dr. Deepti Dongaokar, Dean, Government Medical College, Nagpur; Dr. Prathibha Karanth, Director, Com DEALL, Bangalore; Dr. K S Premavalli, Head, Food Production Division, DFRL, Mysore; etc.

Unique arrangements were made to given a touch of Mysore tradition to the congress, such as

- Environment friendly designer cotton conference bags using natural colours for printing, made by Charaka Foundation, a tribal women organization at Sagara, Shimoga District ;
- Local rosewood elephants as mementos;
- Receiving participants by offering kumkum and 'Mysore Mallige' flower;
- Cycle brand Agarbathi and DFRL food products to all the participants.
- Public education pamphlets covering wide range of communication disorders prepared by the institute.

The scientific deliberations were carried out very professionally by the excellent work of the local organizing committee at the Academic block of the institute. It was a great experience to see the whole block bubbling with scientific discussion by only women who were dressed colourfully with esthetic appeal for two days. 180 delegates were registered and 30 staff and students of AIISH also participated in the congress. Three parallel sessions per day (total nine sessions) were conducted to accommodate large number of papers covering 11 themes. A dedicated time for the participants to go around the institute to see its activities was also scheduled.

A panel discussion on the focal theme "Need for women leadership in Science and Technology" was scheduled on 7.11.2009. This session was chaired by Dr. Vijayalakshmi Basavaraj, Director, AIISH. The recommendations of the panel discussion were as follows:

- Recommended "Gender responsive budgeting" to Government of India / States to promote the cause of women in the country.

Action: Mathruvedike to send a request regarding the above. The request may be drafted and circulated to member of Mathruvedike before finalizing the same.

- Initiate a network of women to establish a database regarding issues such as finance, work, training skills, etc.

Action: It is recommended that a sub committee be formed to:

- Network the members of SVAK and Mathruvedike to ensure continued communication amongst the members.
- Survey the existing networks and the data available in different domains for further plan.

- Work towards overcoming the myth about science to reach and involve the lowest strata of the society in order to:
  - Make science as a passion
  - As a means of living
  - To initiate a social movement and thus promote societal change.

Action: It is recommended that a sub committee be formed to survey the existing organization already working in this ara and to join hands with the existing educational, health and other national schemes which are being implemented.

- Address the realistic needs of women such as opportunities for flexible working hours for the women scientists, relaxation of upper age limit in educational set up, promotion of girl child empowerment, provision of crèche, transport facilities etc.

Action: It is recommended that a sub committee including members from multidisciplinary specializations to:

- Prepare a proposal for submission to the Government of India and the states for initiating action.
- Present the proposal at various platforms to get feedback on the proposal, sensitize and motivate various organizations to consider the same for implementation.

It was recommended that the above action plans be subjected to quarterly review to monitor and guide the progress.

SVAK had finalized the recipients of two prestigious awards they give on the occasion namely Marie Curie Mahila Vijnana Puraskara and C.V. Raman Mahila Vijnana Puraskara. Prof. Sujatha Ramadorai, Professor at TIFR & Member, National Knowledge Commission received C.V. Raman Mahila Vijnana Puraskara during the inaugural function and delivered an impressive acceptance lecture. Marie Curie Mahila Vijnana Puraskara awardee Dr. G V Satyavati, former DG-ICMR & President, Dr. D N Prasad Memorial Foundation could attend the congress and received the award on 2nd day. It was heartening to note that several of her classmates and contemporaries joined the participants in watching her receive the award. Dr. Satyavati's address of acceptance of the award was memorable. It was full of valuable information on Ayurveda delivered with full of wit.

The organization of the congress completed with excellent arrangement of food by the catering committee which included a dinner on 7.11.2009 at Panchavati campus preceded by an esthetically planned entertainment program by the students of AIISH.

Mysore in particular and Mysore District in general responded very positively for this congress in terms of the press and the media giving an excellent coverage of the congress. AIISH would like to thank SVAK for giving an opportunity to organize the 2nd National Women's Science Congress as it gave a platform to showcase the activities of the institute.

AIISH was humbled by the shower of praises at the valedictory function by not only the SVAK members but also by several of the participants. Thus, organizing National 2nd Women's Science Congress at AIISH was indeed a memorable experience. AIISH eagerly looks forward to the follow up work by SVAK in pursuing the recommendations made at the panel discussion with the concerned authorities.

DR. VIJAYALAKSHMI BASAVARAJ
Director AIISH & Patron and Chairman,
Organizing Committee-2nd NWSC

Message from
PROF. SUJATHA RAMADORAI

Prof. at TIFR & Member, National Knowledge Commission
First C. V. Raman Mahila Vijnana Puraskrutha

I am deeply honoured to be awarded the C.V. Raman Mahila Vijnana Purasakara in the second National Women's Science Congress. I acceptthe award with pleasure and a feeling of humility, as I am conscious of the fact that I am among the privileged minority of women in this country who have been fortunate enough to pursue an academic career. It is highly commendable that SVAK is committed to bringing awareness among women and the general population, of an academic and scientific career focusing on women.

I would like to comment briefly on the global nature of scientific and academic research. The internet and the World wide web has indeed severely contracted the geographic landscapes in a virtual sense while enlarging the academic and information landscape beyond belief. Barriers are being broken constantly in terms of access to knowledge and information. Of course, this broadly enlarges the competing arena as well and future generations who aspire to frontline research will have to compete globally. It is in this context that I would like to remind the citizens of this country that English is currently the language of scientific research and we should bear this in mind while educating the children. Let us not let linguistic chauvinism create intellectual barriers by promoting an English vs. Vernacular language debate. We are fortunate to be a nation where multilingualism is natural and we can very easily achieve a mindset of promoting true proficiency in English *and* vernacular languages.

Let me now bring the attention of the gathering, and the dedicated members of SVAK to a book called 'Lilavati's Daughters', published by the Indian Academy of Sciences. It consists of a series of essays by women scientists in the country and it would be a great service if these essays were translated in regional languages and made available to a larger audience. While it is true that Science is still not a dominant profession among women, the Science and Technology wings of the Government of India are making policy changes to make way for greater participation of women in this field. This is a welcome step. I would like to draw your attention to the rapidly expanding Higher Education sector in the country. This expansion calls for a large influx of committed and dedicated people to take to the teaching profession and an academic career. Women have a real opportunity here and I am confident that the next generations will see greater participation of women. The National Knowledge Commission (NKC) (the term of the NKC came to an end on March 31, 2009) made a series of holistic recommendations on education and one particular recommendation was implementing a National Knowledge Network (NKN) which will leverage technology and bandwidth in widening access and sharing resources.

Let me end now by recounting the life stories of two women mathematicians from the previous century. This will serve both as a reminder of the large barriers that still remain and also as a beacon of hope by reminding us all of the enormous distances women have traversed, both in an intellecutal and real sense!

The first story is that of Sofia Kovalevsky, born in Moscow on January 15, 1850. She established the first significant result in the general theory of partial differential equations and was the first woman Member of the Russian Academy of Sciences. She was also the first modern European woman to occupy a Chaired Professorship, at the University of Stockholm. She won the Prix Bordain, a prestigious prize given by the French Academy, in 1858. However, she was never considered even for a teaching position in Russia and was excluded from Academy meetings. Here is what she had to say about mathematics:

"Many who have never had occasion to learn what mathematics is, confuse it with arithmetic and consider it a dry and arid science. In reality however, it is the science which demands the utmost imagination which is more than just making things up. It seems to me that the poet must see what others do not see, must look deeper than others look. And the mathematician must do the same thing. As for myself, all my life, I have been unable to decide for which I had the greater inclination, mathematics or literature."Sofia Kovalevsky died relatively young, on February

10, 1891.

The second story is that of the German mathematican, EMMY NOETHER, born on March 23, 1882. Her father was Max Noether, a mathematics Professor at the University of Erlangen in Germany. Women were not allowed to formally attend classes then in Europe, and Emmy Noether attended the mathematics lectures informally. It was only in 1904 that University of Erlangen admitted women students. She was recognised as a creative mathematical genius fron very early on. After completing her studies, she embarked on a research career at University of Erlangen without a salary. She was made a Member of the German Mathematical Society in 1909. In 1915, Felix Klein and David Hilbert, two leading German mathematicians of that era, invited her to join the Goettingen Institute, which she did, without compensation. In 1919, she won the right to teach, however, without pay! In 1922, she was offered an Adjunct Position, with very little salary. She was a great teacher and is widely regarded as a distinguished mathematician who made fundamental contributions to modern Algebra, as we know it today. In addition, she raised a whole generation of eminent mathematicians. Being jewish, she had to flee Germany during the second world war. She spent the remaining years at Bryn Mawr in the United States. She died on April 14, 1935. Germany today recognises the grave injustices meted out to Emmy Noether during her lifetime.

In conclusion, it is my hope and belief that things will get better for women to pursue acdemic and research careers in the future, and any conscious policy decision taken to bring this about should be welcomed. I would like to thank SVAK once agin for conferring this honour on meand commend them for the great work that they are doing. Thank you all for being here and for your kind attention.

Preface from

Matru Vedike (Women Scientists Forum) of Swadeshi Vijnana Andolana-Karnataka

There are those who talk about women's "liberation". And women's liberation is indeed the path for men's liberation from the shackles of outmoded thought processes resulting in the current differentiation in the social and societal status of women vis-à-vis men.

There are also those who talk about women's "empowerment" – economically, legally, and socially. This is taking place through out the world, and we are glad.

"Liberation" and "empowerment" are laudable issues, but they are however one-sided. They create more animosity than amity in society, more harshness or hatred than harmony, more friction than fraternity.

We in the Women Scientists Forum of SVAK have much more noble ideals and idealogy. We work for amity and harmony in society; equity and equality in society; fraternity and camaraderie in society; and the name that we gave to Women Scientists Forum viz Matru Vedike, is indicative of this basic philosophy. "Motherhood" of humanity is the greatest and noblest asset of humanity, and while retaining motherhood, women in large numbers should work for a successful career in science-as a researcher, as dedicated teacher, as an entrepreneur, as a science administrator and ultimately as a leader in science. The world trend is indicative of this phenomenal growth of women leadership in science. In 2009, five women scientists received Nobel Prize out of a total of thirteen !! The march of women in science from Madame Marie Curie in 1903 to Dr. Ada Yonath, Dr. Elizabeth H. Blackburn, Dr. Carol W. Greide and Dr. Elinoor Ostrom in 2009 in addition to the one in literature is indeed impressive as well as gratifying. We look forward to a future where women will outnumber men in science. We look forward to a future when women and men would work together zealously towards greater achievements in their joint efforts. We have the example of Madame Marie Curie and her husband Piere Curie sharing the Nobel Prize for Physics in1903, before Marie Curie alone received the Nobel Prize for Chemistry in 1911. And their daughter also became a famous scientist on her own right. And we were impired by this story for naming our Women Scientists Forum as Matru Vedike. Motherhood is the greatest and noblest feature of Nature, and it is "science" that reveals the truth and reality of Nature. Here emotional fruition joins the intellectual and creative fruition of humanity.

In the first Women's Science Congress at Bijapur in 2008, we had just 62 papers and 130 delegates. There is a fantastic improvement in the response to the 2nd National Women's Science Congress: There are over 120 papers and about 300 delegates (200 was the maximum that we planned!). We could not reach out to all Universites and R&D Institutions (DRDO, CSIR, ICAR, ICMR, ISRO, DAE etc). If we can reach out to Industries in addition to these Institutions, unimaginable participation could be expected. We are planning with that objective in our future programs. We seek your help and cooperation.

This is the only Science Congress organized exclusively for Women Scientists, exclusively by the Women Scientist Forum of Swadeshi Vijnana Andolana, covering the entire spectrum of science, engineering and technology, spanning over traditional as well as modern sciences, spreading over spiritual, social and secular materials sciences.

This leads us to the broader field of activities planned for Matru Vedike-the Women Scientists Forum. ***The National Women's Science Congress*** is of course our prime activity. But the creativity of women does not begin and end with modern science alone. For those wo do not have a flair to express their creativity and creative power towards motherhood, their creativity could very well be expressed in a scientific career. Perhaps, they could be better in this sphere of creative activity. Or, they could show their creative capability in music or Natyasastra in its widest sense. Or, they could be equally creative and original in literature. Matru Vedike is thus essentially a forum of women with creativity or originality in any field of activity. Indeed, we have plans to take up all these aspects of women's creativity power one by one. Our strength is our solidarity and our camaraderie-Let us begin with "women in science"

By : **DR. K. S. RAMAA, DR. Y. S. GAYATHRI, PROF. M. V. PRAPHULLA AND TEAM MATRU VEDIKE**

INVITED & PLENARY LECTURES

Plenary Note for the theme Socio-cultural sciences including Arts & Music

Dr. R. N. Sreelatha,
Professor and Head, Department of Music, Fine Arts College for Women, University of Mysore 570 005
sreesisu@hotmail.com

All branches of knowledge other than sciences come under the heading of humanities. The 64 arts mentioned in ancient works include ordinary arts and fine arts. Fine arts appeal to the sense of beauty in us. Fine arts are important in promoting human culture and progress. Music, dance,drama come under the heading of performing arts. Music is both an art and Science

Musicology is the science of Music or Sangitha shastra but the singing took birth first and shastra was framed afterwards. Music is the most natural of all arts. To enjoy music one does not require any detailed knowledge of its science. But the same is not the case with other fine arts like poetry, painting, sculpture and architecture. Music has been based and developed on principle, Which holds good in all countries and at all times. Consonance and dissonance are universally felt experience.

The mind in musical by nature. A rude shock is felt when one sings a wrong note or an apaswara. Music is the language of pure and sweet sound.

A study of music develops an independent and critical thinking. It brings about a harmoniously developed personality and also develops the creative and constructive abilities in children. Music is above all important factor in removing the feeling of strain from life. Music is a social virtue. The music has no language or territorial barriers. Hence it is universal language.

Features of Music:

1) Nada is musical sound. In the word Nada, Na denotes the prana and Da denotes the fire. Pranaagni leads to the origin of 'OM' or praanavaayu. It admits of the two varieties. Ahata and Anaahata. From the point of view of the notes produced. Ahata is the sound made with an effort, Anaahata is the music of nature .

2) Sruthi is minute audible sound.

3) Swara : " swato ranjayati iti swaraha" means swara is that which is able to please the listener on its own accord. There are basic seven swaras in music, They are Shadja,Rishabha, Gaandhaara, Madhyama, panchama, Dhaivatha and Nishaada.These are called sapta swaras. In the series of sapta swara Shadja and Panchama are prakrithi (no varieties), remaining are vikrithi swaras, developed in to sixteen varieties. The syllables used for singing these seven notes are S R G M P D N.

4) Arohana: The swaras are arranged in an ascending order like srgmpdn.

5) Avarohana: This is opposite to arohana, in the sense that swaras are arranged in descending order like sndpmgr.

6) Sthaayi: is an octave. The range from the tonic note Shadja to Nishaada is a Sthaayi. Normally three sthaayi is used in Indian Music. They are Mandra, Madhya and Thaara.

7) Dhaatu and Maathu: The solfa or swara part of a composition is dhaathu. The saahithya or textual part is maathu.

8) Mela: Mela is a parental scale or Janaka raga or Melakarta raga. All the seven notes in regular order starting from Shadja to Nishaada, both in ascending and descending order is the main characteristic feature of mela. There will not be any foreign note either in the arohana or in the avarohana. RGMDN will be the same variety in arohana and avarohana.

The mela system or parent scale system was established by Saint Vidyaaranya(13-14th century). The present day scheme of mela was evolved by Venkatamakhi (17^{th} cen). He classified ragaas under Janaka-Janya system, which is being followed till date.

9) Raaga: Raaga is the basis of Indian classical music. Raga is derived from the Sanskrit root 'Ranj'(colour). "Ranjayati iti raagah", means that , which pleases the mind of the listener is called Raaga. Hence raga may be defined as a combination of musical notes that is pleasing to the ear. The concept of raga was established for the first time by Saint Matanga(5^{th} cen) in his treatise " Brihaddesi". He defines raga as " Yo sou dhvani visheshastu swaravarna vibhushitha, Ranjako jana chittaanaam sa cha raga udaahritaha". That which is distinct in tone (dhvani visheshat) adorned (vibhushitha) with swara and varnas(melodic patterns) is pleasing (ranjako) to the minds (chittaanaam) of the people (jana) is called Raaga.

10) Taala:Tala is a very important aspect of Indian Music. The taala has a di vine origin in the dance of Shiva and Paarvathi. Ta denotes Taandava of Shiva La denotes Laasya of Paarvathi. Taala is to music what meter is to poetry. 'Tal' literally means clap. In Sanskrit the word Taal means to "establish". It is the measure of time that regulates the action of music. This is a regulating factor of musical compositions. Taala is essentially a rhythmic cycle. The commencing point is called edupu. The completion of rhythmic cycle is called an aavartha. The reckoning of a taala in Karnaatak music is done, with three angaas, viz. aLaghu (a beat with finger counts), Dhrutha (a beat and a wave), Anudhruta (a single beat).

Saint Purandaradaasa, Karnaataka Sangitha Pithaamaha codified the teaching of Karnaataka music by composing several swara excersizes like sarale, janta alankaraas. Who popularized sulaadi sapta taalas by composing alamkaaraas. These taalas are the basic seven taalas.

11) Musicography or Notation : Notation is the method of representing any music with specific signs and symbols. This type of written music helps to preserve the music for long.

The two streams of Indian music

The origin of Indian music dates back to the Vedic age. When we think and speak of Indian music, we have in our mind both the systems of music i.e. Karnaatak and Hindustaani. Probably up to 14th cen.AD this demarcation was not there i.e. to say, up to Mughal invasion, Indian music remained as one single system, which spread across the length and breadth of the subcontinent. Hence forth there have been tremendous changes in Socio-economic conditions of North India. As a result the single system of Indian music too, gave way for two streams. Viz. Karnaatak and Hindusthaani. Both the systems are governed by the same basic principles. The salient features like Nada, Sruthi, Swara, Raaga, Taala, are identical in both the systems. Both the systems consider Bharata's Naatyashaastra, Matanga's Brihaddesi, Saarangadeva's Sangitha Ratnaakara as the basic texts.

12) Gamaka : This is another important feature of Karnaatak music. "Swarasya kampo gamakaha shrotruchitta sukhaavaha" gamakas are produced by the shake or quiver of the notes in a peculiar way and they please the listener. Gamaka is an essential part of the melodic structure. It is an integral part of the music and the note with its grace makes one utterance. We have ten types of gamakas in practice. In the ten gamakas some have applied to vocal music and some are to instruments.

Manodharma Sangitha or Creative Music

Manodharma sangitha is the soul of Karnaatak music. This is also called Improvisation or extemporization. Originality of mind and the creative exposition capacity of the musicians are manifested here. The divisions of Manodharma sangitha are

1) Raagaalapana
2) Taana(Madhyamakaala Aalapana)
3) Pallavi (Singing pallavi shows creative ability,mastery over both rhythm and melody of a musician)
4) Neraval(a meaningful line of a composition is improvised)
5) Swarakalpana.(is the permutation and combination of swaras) Manodharma is a creative extempore of spontaneous musical delineation. It calls for deeper levels of concentration and proficiency.

Musical Instruments

There are many Musical instruments in India. Without them music is incomplete and it has a unique place in classical music. Musical instruments are divided into four main categories on the basis of sound produced, they are:

1) Tata or Chordophonic (string instruments)
2) Sushira or Aerophonic (Wind instrument)
3) Avanadhdha or Membranophonic (Percussion instruments) Ghana or Idiophonic (Metallic Instrument)

Musical Forms

Karnaatak music may be broadly divided into Abhyaasa gana and Sabhaa gana. Abhyaasa gana is a training excercises, that enables a student to get proficiency in the art of music. The Sabhaa gana includes varna,krity, kirtana,pada, jaavali raagamaalika, Raaga Taana pallavi,tillana that are sung in the concerts.

Several great personalities have contributed immensely to the growth and development of Indian music.A new chapter opened up in the history of music by the Musical Trinity, in whose hand music was at its zenith during the golden age (18th-19th cen). During this period immemorable musical compositions of different varieties forming the important part of modern music concerts, came to be composed and presented to the music world by great composers.

Though the musicology is a very vast subject I have tried my best to put it in a nutshell to suit the plenary note in stipulated time of 15 minitues. If my plenary note is useful by any measure to all the delegates and others, I feel obliged.

PSYCHO-SPIRITUAL AND PHILOSOPHICAL SCIENCES

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Science is defined as a "dispassionate enquiry into truth". Quest of truth is inclusive of both the material and spiritual domains. Lots of studies have been done in both these domains. The material sciences facilitate the method of probing through experimentations and technology because the world around is perceptible to the senses. But for those seeking the truths related to the psychic and spiritual truths that are beyond the normal sensory world, a subtler and intuitive study becomes necessary. In case of study of the psyche, at least the context of the person's lifestyle, his innate nature and his relationship with the outer world provide some data for study. But the spiritual plane, which is independent of any influence within or without, is much too subtle and lofty to comprehend. It requires extraordinary genius and focus to tap the secrets of spiritual truths. **Unlike material and psychic sciences, it is purely experiential in nature and not inferential.** (When I say experience, it does not denote the sensory but super sensory / spiritual experience) We should take note of this in the very beginning of the study of spiritual and metaphysical sciences. It is in this sense that Swami Vivekananda said – **"Where (material) science ends, there (the science of) religion begins"**

Indian philosophical perspective - a bird's eye view

From time immemorial, Indian thinkers have ventured in both the directions- material and spiritual. Just as we see many sciences and arts based on their experiments with the material world around, so do we see a treasure of their hypothetical and experiential theories of the spirituality too. Since the oldest vedic ages, Indian thinkers have never ceased to venture into the subtle world of lofty spiritual truths. They also recorded these for posterity in the Upanishads, *darshanas* and other scriptures. Added to these time and again were the experiences and insights of many realized souls.

The striking nature of the *bharatiya darshana* or Indian philosophical perspective is that the direct experience of the seers has been valued the more than mere logical expositions. That is why a scholar, however adept in intellectual exercises and logical analysis, is never given the place that a realized soul or spiritual seer commands. Adi Shankaracharya rightly opines-

Vaivaikhari shabdajhari shaastravyaakhyaana koushalam
vaidushyam vidushaam ete bhuktaye na tu muktaye

(Viveka chudamani)

(The brilliance of *shastric* knowledge and oratory are only for material profit(or intellectual satisfaction) and not liberation)

On the other hand, in western philosophical heritage, a philosopher need not always be a realized soul. If only he can logically analyze and convincingly present his views with a sound contextual understanding of the available philosophical treatises he qualifies as a 'philosopher' and his works get accepted. But in the Vedantic tradition, Scholarship and logic are only a part of the path and never the final qualifications to spiritual realization. Here only a rishi's words based on his direct experience or intuition or those based on vedic injunctions get accepted. **Not that scholarship and logic are dismissed off as insignificant, but they should rather supplement to the spiritual contemplation than proceed on its own.** (Infact it is in India that the schools of Logic have developed to very sophisticated levels ever).

This perspective, wherein the true seeker stops at nothing but direct experience, is what makes the Indian philosophical view a 'science' and not merely a path of belief. In this context we see numerous examples of great yogis who have dared to break through the conventional thought lines in order to access spiritual experiences on their own. That is why in India, from ages, a amazing number of schools of philosophy and *saadhana margas*(paths to realization) have come into being. Never in the *Bharatiya darshana,* can a single school of thought propounded by a particular seer dictate the conscience of all at all times. **This openness to choose, analyze, accept or refute is the mark of Vedanta-** the glorious Indian psycho-spiritual and philosophical science.

The main questions that captured the attention of Indian philosophers

The main questions that captured the attention of the Indian spiritual seekers were the natures of *Brahman, jeeva* and *jagat, maayaa* and *moksha*. All other questions, discussions and inferences about *karma, dharma, sadhana,* creation, the layers of human personality and its inherent faculties, the different planes of human consciousness, heaven and hell, spiritual awakening and many more may be included within these. The *Upanishads*, *aaranyakas* and *darshanas* are collections of the experiential and inferential knowledge of different seers at different times.

Before we go into the details, we first need to be informed about the whole style in which our predecessors proceeded. Spiritual seeking is a methodical process and begins from the outside towards the inside world- *mrtyormaa amrutam gamaya*— Unlike the material sciences no technological parameters or sensory perception can qualify to establish spiritual sciences clearly. Both the physical and mental planes need to be first understood thoroughly in order to transcend them to soar to the world of spiritual experience. **Therefore the first step in the journey of philosophy or spirituality is to know and master the psyche / mind**, for it is the mind that either liberates or binds - *mana eva manushyaanam kaaranam bandha mokshayoh*—(Adi Shankaracharya).

In the journey towards the core of existence i.e. the *atmatattva* within, one needs to pass through many other layers of the personality. A thorough study of all these has been done in

the *upanishadic* tradition. Their inferences about the many layers of human personality, the inner instrument, the faculties dormant there, the process of *saadhana* (the process of inner cleansing and strengthening) etc., have been documented.

It is bewildering to see how systematically and relatively all these have been discussed under different terminologies. The classifications, generalization, analysis and inferences are all based on the *tarkayukta shaili*(logical style) Within the limits of time now; lets glance over just a few significant ones.

Antahkarana chatushtaya

One of the wonderful logical classifications of our seers is that of the *antahkarana chatushtaya*. This makes our study systematic and meticulous. The *antahkarana chatushtaya* or 'four-fold inner instrument' in us comprises - ***manas***(mind), ***buddhi***(intellect) ***chitta***(memory) and ***ahankaaram*** (**I** consciousness). While the physical body and the world outside are the outer expressions, the *antahkarana* forms the inner world subtler than the outer but grosser than the *aatmatattva*. The *antahkarana* having its base in the *aatma-tattva*, dictates human feelings and actions at all levels.

The *manas* or mind is the emotional aspect that feels, likes or dislikes.

The *buddhi* is the intellect that thinks, discriminates and dictates the *manas*.

The *chitta* stores all the *samskaras*, memories and experiential knowledge gathered through *manas* and processed by the *buddhi*. The habits, tastes, aptitudes and nature are dictated by the *chitta* which has in it the *vaasanas* or *samskaaras* i.e imprints of his past actions, experiences and births. This is what guides the *buddhi - Buddhih karmaanusaarini* and influences the mind to a large extent.

The *ahankaram* is the sense of 'I' that exists in all the *jeevas*. This is almost pure consciousness but comprising the *lepa* (tinge*)* of '*jeeva- aham bhava'.*

The human personality is nothing but an outer expression of what the *aham, chitta, buddi* and *manas* dictate. *Antahkarana shuddi* or purification and clarity of these are necessary for the aspirant to transcend these.

However, the *antahkarana chatushtaya* is indeed a treasure house of immense potentials based on the experiences of the past as well as the insights of '*chit'*(wisdom) factor of the *atma-swarupa*. Therefore with a clean and clear *antahkarana*, the human personality can sore amazing heights. When the *antahkaranam* is pure and strong, an outpour of superhuman potentials begins in him. He develops intuitive thinking and insightful understanding of every thing within and without. He is considered a *manishi* (genius) or *rishi* (*rishih kraantadarshanaat*) who can think beyond the apparent existence and visualize the subtler truths. Like an ice cube in water, wherein a greater part is under the surface of the water and only a little edge seen above the surface, the real human worth is mostly dormant and unexplored in this *antahkaranam*. The whole process of *saadhana* is to explore this inner world and gain mastery over them so that his journey into material or spiritual world will gain complete fruition.

When a person begins to manifest these powers, what ever field in life, material or spiritual, he pursues, he soars extraordinary heights there. He is free from fear, desire and passions. No mortal temptations or bindings can stop him. If he seeks so, he proceeds as speedily into the inner world and attains *moksha*.

Panchakosha viveka

Observations about the human personality fetched the panchakosa viveka tp our seers. The human personality is just not the outer body and a feeling person within, but much more complex with amazing attributes. There are layers within us that run the show of life.

The Upanishads propound the theory of the *pancha kosas*, the 5 *kosas* (layers of existence planes) that a *jiva* lives in- the ***annamaya-kosa***(the physical body), the ***praanamaya-kosa***(the aural or *praanic* body), the ***manomaya-kosa***(the mental plane), the ***vijnanamaya-kosa***(the intellectual plane) and the ***aanandamaya-kosa***(the I consciousness).

The *annamaya-kosa* or physical body is the visible one wherein activities like eating, drinking, digestion, metabolism, sleep, reproduction etc., take place. The *panchendriyas* or sense organs namely *tvak, chakshus, shotra, jihva and ghraana* (eye, ear, skin, nose and tongue) in the physical body become the media in perception of sight, sound, touch, smell and taste.

The *praanamaya-kosa* is subtler and comprises the 5 *praanas* namely *praana, apaana, udaana, samaana* and *vyaana*. These *praanas* or vital energy chambers monitor the functions of the *annamaya-kosha*. They are rather active energy channels that activate the whole system through continuous flow. Breath is the main source of food for the *praana*. The *praanic* body is also capable of absorbing energy from sunlight, food particles and the atmosphere in general(in this context we can find many great yogis who lived merely on sunlight, breath or water or minimal food intake). The *praanic* body determines the energy flow and healthiness of the *annamaya-kosha*. (I myself witnessed the aura around a living leaf and an aura-less dry leaf through a kirlian's microscope in NIMHANS, Bangalore under the guidance of Dr. Shiva shankara methi(1995)

The *manomaya kosa* is the plane wherein the experiences of feeling, likes and dislikes and perception through the senses happen.

The *vijnanamaya kosa* is the intellect that discriminates and dictates the mind. Only a small part of this is active and applied in normal human life the rest of its extraordinary potentials remain unexplored in most cases. Only a rare few geniuses manifest these faculties and develop amazing intuition and insights.

The *Aanandamaya kosa* is the plane of bliss and consciousness. This is the source of energy and bliss and rest to all the other *koshas*. It is the closest to the *atma swarupa*. It is the

state which every *jeeva* enters regularly to enjoy peaceful moments of *sukhanidra* (sound sleep devoid of dream) and recharge himself totally everyday.

Concepts of Mind management in the spiritual tradition

In the *antahkarana chatushtaya*, the *buddhi* and *chitta* are pre-conditioned by the past experiences and instincts. They can be cleansed and strengthened through right *viveka*. But the one that directly perceives feels through the senses and soon gets influenced by the outer world is the *manas*. Therefore the control of this becomes most necessary to avoid further draining out of the inner potentials. Since nothing can be achieved without 'inner silence', controlling mind is vital in spiritual study. Although spirituality is itself much loftier than the study of psyche, mind needs to be given utmost attention because otherwise it plays havoc in the process of comprehension and concentration.

That is why all scriptures and paths emphasize upon *manonigraha*. Like a stubborn and naughty child, the mind always tends to give a slip and play havoc in concentration and contemplation of subtle truths. It needs to be handled tactfully. Bhagavadgeeta says- *shanaih shanaih uparamair buddhyaa dhrutagrheetayaa*—- The toughest achievement is self mastery. Adi Shankaracharya says- *Jitam jagat kena? Mano hi yena.* Numerous stories from *puranas*, epics and classical literature present stories and instances try to establish this fact. **The greatest challenge of any true spiritual seeker therefore lies in escaping the pull of the mind.** Patanjali even considers this as one significant step in *astaangayoga*. The process of collecting back the mental energies dispersed in outer names and forms is termed *pratyaahaara*. The control of the mind such that it does not run back is called *dhaarana*. The flow of the *antahkarana* towards the *dhyeya*(the object pf meditation) is called *dhyana*. When this is perfected it culminates into *samaadhi*, a state wherein the *antahkarana* sublimates into the *aatmaswarupa* and attains perfect tranquility. This is the state of truth realization and supreme bliss.

The mind is constantly swayed hither and thither by the wind of delusion caused by the *jeeva bhaava* created by *maaya*. Adi Shankara explains with the examples of *kasturi mrga*, *patanga*(a kind of insect), elephant, fish and the deer explaining how each of them succumb to the greed of pleasure through each of their sense organs. The human being has all the five senses strongly distracting his mental energies outwardly. What then could be his plight!(vivekachudamani)

Merely controlling the outwardly flow of mind by force is of no use. The more we force it to silence down, the more it tends to drift away. I may quote a folk anecdote in this regard- A greedy man once forced a yogi to give him a mantra to suddenly become rich. The yogi disgusted by his greed wanted to teach him a lesson. He gave him a mantra and said, this mantra will soon fetch you the desired, but while you chant it you never ever for a moment remember 'a monkey', beware! The man was more then happy. He did everything t keep away the thoughts of the monkey but it kept coming to him. The more he avoided the thought the more it rebounded!

Thus not mere negation, but indeed culturing and channelizing the mental energies is the purpose of *saadhana*

Till the true identity or *aatmaswarupa* reveals itself, the mind is bound down by the *jeeva bhaava*. This mind under the strong influence of delusion constantly nurtures a greed for enjoyment through senses. But as the aspirant slowly develops a capacity to discriminate between the material and spiritual existences, the transience of matter and its ways, the true nature of his soul i.e *sat- chit- aananda*, his mind gets back to track by itself. Thus *chitta shuddhi* through right act, speech, discrimination and meditation need to be constantly carried on so as the harness the mental energies inwards.

Managing the mind is important both for peace and balance in normal human life and even more for higher intellectual or spiritual comprehensions. The greatest contribution of Indian spiritual schools lies in devising various methods for mind management. This has also promoted many an effective yogic method of counseling, healing and health therapies. The concepts of mind management that we come across in Bhagavadgeeta, Upanishads, the numerous accounts and dialogue available in ancient literature and traditions including the folk and native ideologies, are today of great practical use in applications such as stress management, concentration techniques, memory boosting, control of mentions, BP and many more.

We are all very familiar with the revolutions that have been made world wide by our schools of *yogasanas*, *pranayama*, meditation and *ayurveda* systems. The yoga therapy system is nothing but medical application of the available mind management concepts in vedic and later vedic lore. In my own experience of life skills training and counseling, I have seen how handy and useful the Indian concepts of mind management and spirituality are. Indeed even books on secular topics like *arthashaastra*, *kaamashaastra*, and others do not fail to emphasize on the necessity of *indriyajaya* and *manonigraha*. There are many *darshanas*, logical disputations, refutations and interpretations based on the vedic concepts. There are still many others that stood independent of the vedic injunctions like the Buddhism and Jainism. However all systems (except the *charvaka*!), unanimously support the concept of *manonigraha*.

Even for those who are least interested in spiritual probing, the concepts of mind and its mastery are of great use. What then to say about its use to sincere spiritual aspirants!

The concepts of soul and almighty in *vedanta*

Coming to the discussions about the *atma, brahma* and *paratattva*, the following are some brief inferences gathered from the Indian philosophical schools. (The present concepts stick to the *advaitic* school in general)

The *jeeva-swarupa*

The core of human existence is the *atma-svarupa.* **It is purely**

***sat, chit* and *ananda.* It is essentially the *brahmatattva* itself.** But by the play of *maayaa* it is apparently enveloped in the *pancha kosas* and the *jeeva bhaava* as well as the *jagat swarupa.* But all this only a temporal being and the *aatma* in reality is always *nityamukta* and one with the *brahma swarupa- jeevo brahmaiva na parah*. It is indeed the *akhanda*(infinite)*brahma swarupa* that is bound in *akhanda*(finite) *jeevatva*.. The soul bound in the *pancha kosa* with the sense of lower ego is *jeeva*. It attains the *kartrtva bhaava* (the sense of I am the doer) and *bhoktrtva*(the sense of 'I experience') *bhaava* through which it experiences joy and sorrows. So long as the *jeeva bhava* exists, the attachment to body and the outer world remains. Through the *pravrttis* radiating forth through the *antahkarana* and the interaction with the outside world, the *jeeva* carries on the play of *janma* and *marana*. The *jeeva* is bound in the illusion of joys and sorrows, loss and gain and love and hatred. This is *bandhana*. But when the illusion vanishes, the *jeeva* attains *moksha*.

Jagat swarupa

The *jagat* is only a *vivarta* (apparent illusion) of the infinite *brahma swarupa*. Like the *jeeva*, it is only a projection of *maayaa.* The basic elements called *panchabhutas* namely *prithvi, ap, tejas, vaayu and aakaasha* (earth, water, fire, air and space) form the content of the *jagat* and all the physical manifestations. Being a play of *maayaa* it is prone to *srshti*(creation), *sthiti*(sustenance) and *laya*(dissolution) which cause constant change and evolution. The physical body of the *jeevas* and their *antahkarana* too are sustained and nourished through this process of evolution and dissolution till mukti is attained.

Maayaa swarupa

***Maayaa* is the divine power of illusion.** It is indefinable, unfathomable and uncontrollable. Lord Krishna states in Bhagavadgeeta- *daivi hyesha gunamayi mama maayaa duratyayaa*—- (My *maayaa* is unparalleled and never conquered. It is mystic, divine and unpredictable. Shankara defines it as *anirvachaneeya* (undefinable) Howeever the two major powers of *maayaa* are recognized as *aavarana shakti* and *vikshepa shakti*. The *aavarana* is the power to conceal the truth. It is this power that eclipses our wisdom of the true *atmaswarupa*. The *vikshepa shakti* is the power that creates in us the delusion of believing the untrue as true. We believe that what we see around as the manifest world is true and permanent and that our apparent *jeevatva* is a permanent feature. This causes in us *raga* and *dvesha*(passion or hatred) due to which we identify with worldly ties and bondages. This results in joy and sorrow and the cycle of rebirth and misery.

All the *saadhakas* indeed aspire to escape the jolt of maayaa and proceed to experience *sat-chit-aananda*.

Mokshaswarupa

Moksha is nothing but liberation from the dictates of *antahkarana* that is bound by the *jeevabhaava* that in turn causes bondage with the outer world. **It is experiencing oneness with the *akhanda sat-chit-aananda brahma swarupa.*** When the illusion of *jeevabhaava* perishes, the *jeeva* becomes one with *brahma*. Adi Shankaracharya gives the example of a pot immersed in water- As long as the *upadhi* (sense) of 'pot' remains the apparent difference between 'water in the pot' and water outside the pot remains. Similarly the *jeevatva upadhi* creates a sense of separation form Brahman. But when the illusion vanishes, the *jeeva* attains *brahmatva,* oneness with *Brahman- Brahmavid brahmaiva bhavati*—- That is *moksha*.

Brahmasvarupa

Brahman is the cosmic existence, the ultimate truth that is to be realized and by knowing that the secrets of all existence begin to reveal themselves to us. Upanishadic seers record their observations of *brahman* that it is the only eternal, imperishable and all pervading entity. **The features of *Brahman* are *Sat* (truth) *Chit*(wisdom)** and ***Aananda*(bliss).** It is also termed as *asti*(that which exists), *bhati*(that which shines or radiates knowledge) and *priyam*(love). It is the source, base and sustaining support for all creation. It is therefore termed as '*hiranyagarbha'*. All that is manifest is only a transient projection of this infinite abstract existence called *brahman*. It is formless, nameless and beyond the perception of senses, mind and intellect. The *Taittiriya Upanishad* observes- *Yato vacho nivartante apraapya manasaa saha*—-(That from where mind and speech return unable to comprehend—).

It is the source of all knowledge spiritual and material. **The Upanishads proclaim- "By knowing it, one knows all".** The knowledge of Brahman destroys the *jeeva bhava* and he attains oneness with it. The knower of *Brahman* thus becomes *brahman - Brahmavid brahmaiva bhavati*— The realization reveals that every thing manifest is a *leela* or play of the *Brahman*. The *jeeva* is thus freed from the sense of *aham*, experiences of joys and sorrows, rebirth and bondage.

***Saadhanaa maargas* (paths to realization)**

Every science has a method of approach based on its nature and course. Of course the material sciences depend upon direct perception, experimentation and inferences. The psychic sciences depend on factors like innate personality traits, human behaviour at the social and personal levels, relationships etc., But the spiritual truths cannot be thus inferred through any outer criteria for it is beyond all sensory and even super humanly perceptions. The human mind and intellect are not equipped enough to fathom the subtlety of the *brahma-swarupa*. The realization begins from the intuitive level and culminates at the experiential level..

There are numerous paths to truth realization. It is a very personal journey for every *jeeva*. That is why there is no "single path' for all as is popularly said- there is no *ekamulikaa prayogah*- 'one prescription for all ills'. Depending on the

person's taste, aptitude and mind set and capabilities, he is free to choose his *saadhanaamaarga*. This is the unique feature of the *bharatiya-darshana-paddhatis*. The popular broad classifications of *saadhanaa pathaas* are however ***Bhakti yoga*, *Karma yoga*, *Raaja yoga*** and ***Jnanayoga.*** These in turn comprises countless number of schools, sects, styles and opinions. The trends and mass following are existent too. But the final inner journey is too personal and unique for each. The classification is very logical and practically applicable. That is why all these *maargas* have survived the test of ages.

The person whose psyche is more bent towards aesthetic, emotional and devotional feelings is prescribed the ***Bhakti yoga.*** The *paramaatma* (*brahma swarupa*) is worshipped in the name and form of choice, mostly as dictated by the *puranas*, *aagamas* or epic texts. It is an outpour of all his feelings towards the divine truth adored as the *ista devataa*.

Those with a very strong will, physic and metaphysical interest usually chose *raajayoga*, a very challenging and hard path to *moksha*. Methodical mastery over the voluntary and involuntary actions of the physical body as well as extraordinary control over the basic instincts forms the theme of ***Rajayoga***. This culminates into spiritual experience by itself.

Karmayoga is for those who can commit to rigorous ritualistic disciplines and practices for a long time, or in the modern context, those with a selfless urge to serve unmindful of the sacrifice and stress. The aspirant is thus purified and qualifies for *brahmajnaana*.

Those with intellectual prowess, who sincerely probe into a logical apprehension of truth, negation of baseless conceptions and intuitive understanding of subtle truths choose ***Jnaanayoga***. The *jaani* transcends the layer of consciousness and planes to access the highest i. e Brahman through deep meditation alone.

However for all the paths, the primal qualification is *chittashuddhi.* In *vivekachudamani*, Adi Shankaracharya mentions '*Shamaadishatkam' (shama, dama, titiksham uparati, samaadhana* and *shraddhaa* which for the basic ethics) as the primary qualification for a *saadhaka*. Patanjali goes to the extent of defining *yoga* itself as *'chitta-vrtti nirodhah'*. Without purity of thought action and speech, *sadhana* will be hypocrisy. A person who is devoid of purity carries on merely the outwards formalities of *saadhana* is termed as a *mithyaachaari* in Bhagavadgeeta.

There are also many religious paths that dictate means to gain material benefits like progeny, prosperity, heavens etc. Not all of them are to be mistaken to be paths to realization. According to Sri Shankara, only where there is *iha-amutra phala bhoga virakti* (a sure disinterest in the pleasures of this and the other worlds), *nitya-anitya vastu viveka* (a constant sense of discrimination between truth and transient) and *mumukshutva* (a burning urge for liberation) there is the eligibility for proceeding to realize truth.

This establishes that mere intellectual prowess, fervent devotion or external practices are not enough. That is why spiritual science is indeed 'A dispassionate enquiry into truth'.

Conclusion

The Indian philosophical and spiritual sciences comprise a very vast arena of hypothetical as well as experiential knowledge recorded down the ages. Many of them have even developed into independent schools of thought with many more sub divisions. Apart form the *bhakti- karma- jnana* and *raja* yoga schools there are many complex and sophisticated *tantric* schools in practice. There are also lends of *tantra, agama* and *veda* as well as regional and folk traditions. The very topic is extremely wide and deep as well. What could be depicted here is a very brief note about some salient features in general.

Finally, experience commands the prime place in Indian spiritual and philosophical domains than mere logical expositions or beliefs. Although there are indeed co-existent features like innocent or ignorant beliefs conditioned by communal aspects, still the *tarkayuta maarga* or logical exposition and support of the source vedic injunctions and the reformatory work done by saints and yogis time and again have kept alive the process of upgrading and reconstructing the spiritual doctrines at all times. That is why Indian spiritual sciences are flexible and open to truth and experience. That is why, despite the weeds like sectarianism, fanaticism and superstition that have crept in, **Vedanta is truly scientific and rational in its purest form and verily opens up a pathway to intellectual and spiritual evolution and experience.**

THEME 1

CHEMICAL BIOLOGICAL AND MATERIALS SCIENCES (NAGARJUNEEYAM)

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C.B.M.Sc:-1

URBAN AIR POLLUTION EFFECTS ON CHLOROPHYLL CONTENT OF AZADIRACHTA INDICA A. JUSS

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INTRODUCTION: Plants are constantly exposed to air. They absorb, accumulate and integrate pollutants confining on their foliar surfaces and show specific response too. Thus plants are used as bio indicators.

Mysore city is well known in the world for its historical significance and tourism promotion. Bioindicators are a method of monitoring or detecting the negative impacts of industrial and transportation activities on the environment. It is highly relevant to analyse the role of *Azadirachta indica* A. Juss (neem) as bioindicator of air pollution in urban areas. Air quality monitoring studies were conducted in Mysore city during 2000-02 in order to understand the need and importance of planting suitable bioindicators of air pollution on the road sides.

Neem is a tree in the mahogany family Meliaceae. Neem is a fast-growing tree that can reach a height of 15-20 m rarely to 35-40m. It is evergreen, but in severe drought it may shed most or nearly all of its leaves. Neem is known to clear air pollution; absorbing carbon in the environment and constantly purifying the air. It is medicinally known as a blood purifier. Plants growing in and around the selected traffic intersections are thus exposed to variety of pollutants such SPM, SO_2, and NO_x. During the field study of various polluted areas the leaves of *A. indica* showed chlorosis, marginal necrosis and deposited with dust. To confirm this chlorophyll level estimation was undertaken.

MATERIALS AND METHODS : Leaf samples were collected from the *A.indica* (Fig.1) at five selected sites including control area during all the seasons for two years. The circles selected for the study include: K.R. Circle, Suburban bus stand area, Canara bank circle - Nazarbad area and Fountain circle (Fig. 3). Mahadevapura which lies 20 km away from Mysore city was selected as control as there was negligible traffic at this region (Fig. 4). Leaf samples were washed and stored in polythene bags until further process. Fresh leaves were used for the estimation of chlorophyll a, chlorophyll b, total chlorophyll and carotenoids.

Chlorophyll contents were ascertained using absorption coefficient of Arnon (1949). Air quality monitoring was done in all the selected sites and control area. Leaves were also collected from Mahadevapura forest which is used as control area (Fig. 2). Air quality monitoring was done in all the selected sites and control area in accordance with Bureau of Indian Standards BIS-5182. The parameters selected were SPM, SO_2, and NO_x

Photographs of selected circles are shown in Fig.3 and control area in Fig.4. The sampling was carried out for duration of 8 hours per day / season at each of the five sites during all the seasons (rainy, winter and summer during 2000 to 2002).

Counting of vehicles : The number of Two Wheelers (TW), Light Motor Vehicles (LMV) (Cars, Jeeps and Autorickshaws) and Heavy Motor Vehicles (HMV) (Mini-bus, Lorries and Buses) plying during peak hours of the day (9.00 am to 11.00 am) were counted for 2 hours using hand tally counter, at the time of monitoring.

RESULT : Correlation between LMV, HMV and pollutants - SPM, SO_2 and NOx has been depicted in the Table 1. There was a proportional change in the SPM content depending on the raise or fall in the number of LMV and HMV, except at Canara Bank circle, where approximately 200 fold increase in SPM was observed, although there was no significant increase in the number of LMV. However SPM correlated perfectly, with HMV at Canara bank circle. These results suggest that SPM pollution may be contributed more from HMV than either two wheelers or LMV. Despite wide fluctuation in the number of vehicles varying from ~4 to >200 fold, no significant change in SO_2 and NOx contents were observed. This indicates that LMV and HMV were not contributing towards the pollutants SO_2 and NOx in the ambient air. Of the pollutants studied such as SPM, SO_2 and NOx, only SPM level showed significant correlation. Correlation factors were relatively higher in summer season followed by winter season and rainy season.

The response of plants to air pollution at physiological and biochemical levels can be understood by analyzing the factors that determine resistance and susceptibility. The dose of the pollutant absorbed by plant tissue plays a key role in determining effects on metabolism and physiology.

In photosynthesis and associated chemical processes there are numerous steps that could be blocked and interrupted by outside agents such as air pollutants. Not only chemistry in the plant cell but the sites and chemical reactions themselves can be destroyed. Chlorophyll pigments such as chlorophyll a, chlorophyll b, total chlorophyll and carotenoid are reduced by various types of air pollutants.

In the present study Chlorophyll a, Chlorophyll b, total Chlorophyll and carotenoid in the leaves of the selected avenue trees from selected circles showed a reduction when compared with that of trees growing at control area (Table 2a and Table 2b).

Chlorophyll 'a': There was not much significant reduction in the chlorophyll 'a' content in the leaf samples from polluted areas. A. *indica* showed two fold reduction at Fountain and

Canara Bank circles during rainy and summer seasons respectively. During winter season no significant reduction was observed (table -2a).

Chlorophyll 'b' : Compared to chlorophyll 'a', chlorophyll 'b' showed significant reduction in plants from polluted area when compared to plants from control area (table-2a).

No significant reduction was observed during rainy season. Canara Bank, Fountain and Highway circles showed two-fold decrease during winter season whereas significant three-fold reduction was observed at Suburban bus stand and Fountain circles during summer season.

Total chlorophyll : The total chlorophyll content was found to be reduced in the leaf samples of the *A.indica* collected from all the circles compared to control area.

It showed two-fold decrease at Fountain circle during rainy and during summer at Suburban bus stand circle (table - 2b).

Carotenoids : Reduction in carotenoid content was observed in different plants at different circles and seasons.

A. indica at Suburban bus stand circle showed two-fold reduction during winter seasons respectively. No significant reduction was observed during summer seasons (table-2b).

DISCUSSION : Photosynthetic activity is based on the quantity of chloroplast pigment and is directly proportional to the amount of photosynthetic area of the leaves. Reduction in the leaf size in all the tree species was associated with reduction in chlorophyll 'a', chlorophyll 'b', total chlorophyll and carotenoid pigments in the present study.

The high SO_2 sensitivity of chlorophyll 'b' was suspected to be due to induced chlorophyllase activity or inhibition of chlorophyll 'b' synthesis (Joshi *et al.,* 1993).

Reduction in chlorophyll due to SO_2 induced activity resulting in removal of Mg^{++}ions which converts it into phaeophytin has been expressed by many. Plants exposed to air enriched by SO_2 leading to chlorophyll reduction have been observed earlier also**.** Ziegler (1977) opined that reduction in chlorophyll was due to toxic ions formed by dissolution of SO_2 in water inside the leaf tissue, which gets preferentially incorporated in the thylakoid membrane. Production of superoxide radicals, as a result of reactions of sulphite with chlorophyll, under illumination has been observed by Schimazaki *et al.* (1980).

Awasti (1998a) observed a reduction in chlorophyll content in *Cassia nodosa* due to oxidation of chlorophyll by the products of SO_2 and NOx. Combined effect of SO_2, NO_2 and O_3 reduced the chlorophyll content in *Picea abies* without the appearance of any visible injury. Similar observations were made in tomato plants exposed to O_3 and SO_2 (Khan & Khan, 1994) and in *Vigna radiata , Triticum aestivum, Beta vulgaris* and *Brassica compestris* exposed to SO_2, NO_2 and O_3. Longer exposure of naturally growing trees to SO_2 was found to show more percent change in total chlorophyll than tree saplings transplanted at same site.

Agarwal *et al.* (1984) have observed reduction in the amount of chlorophyll 'a', chlorophyll 'b', total chlorophyll and carotenoids in O_3 exposed leaves of *vicia faba*. It has been suggested that O_3 may either cause direct injury to chlorophyll structure or through oxidation or may impair chlorophyll synthesis through enzyme inactivation.

Sakaki *et al.* (1983) opined that O_2– formed in O_3 exposed plants may cause destruction of chlorophyll and carotenoid pigments, following toxicity to physiological defence mechanism against free O_2– radicals. Loss of total chlorophyll pigment has altered chlorophyll function and light-harvesting capacity in acid rain and ozone affected pine.

REFERENCE:

Agarwal, M., Nandi, P.K. and Rao, D.N., 1984. Ozone induced metabolic changes in leaves of gram plants. *Indian J. Air. Poll. Contr*. **5:** 1-4.

Arnon D.I., 1949. Copper Enzymes in isolated chloroplasts, poly phenoloxidase in *Beta vulgaris*. *Plant physiology*. **24(1):** 1-15.

Awasthi, A., 1998a. Chlorophyll estimation – A simplified procedure. *J. Environ. poll.* **5(3):** 169-174.

Joshi, O.P., Pawar, K. and Wagela, D.K., 1993. Air quality monitoring at Indore city with special reference to SO_2 and tree bark pH. *J. Environ. Biol*. **14(2):** 157-162.

Khan, M.R. and Khan M.W., 1994. Single and interactive effects of O_3 and SO_2 on tomato. *Environ. Expt. Bot.* **34:** 461-469.

Sasaki, K. and Sakamoto, K., 2006. Diurnal characteristics of suspended particulate matter and PM_{25} in the urban and suburban atmosphere of the Kanto Plain, Japan. *Water, Air and Soil Pollution*. **171(1-4):** 29-47.

Schimazaki, K., Sakaki, T. and Sugahara, K., 1980. Active SO_2 participation in chlorophyll destruction and lipid peroxidation in SO_2, fumigated leaves of Spinach. In : Studies on the effects of air pollutants on plants and mechanism of phytotoxicity. Research report of National Institute of Env. Studies, Japan: 81-101

Ziegler, I., 1977. Subcellular distribution 35-S sulphur in spinach leaves after application of 35 SO_4^{-2}, 35 SO_3^{-2} and 35 SO_2. *Planta*. **135:** 25-32



Fig.1. *Azadirachta indica*

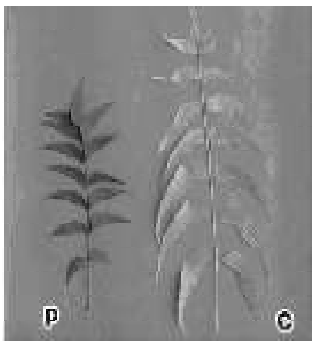


Fig.2. Leaves of *A. indica* at polluted (p) and control (c) areas

PHOTOGRAPHS OF CIRCLES SELECTED FOR THE STUDY

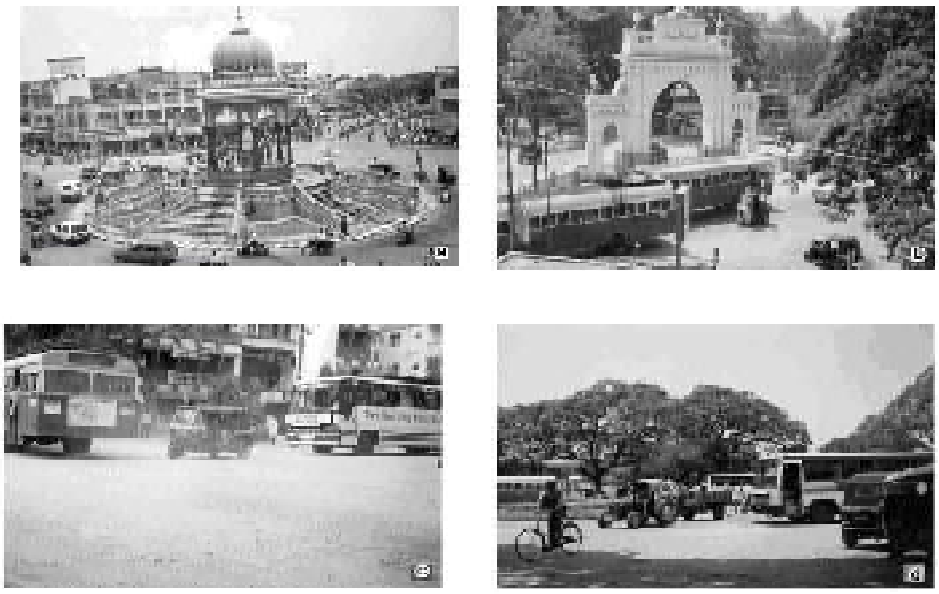


FIG. 3 : a. K.R. Circle (KR); b. Suburban Bus-stand Circle (SU); c. Canara Bank Circle (CB); d. Fountain Circle (FT);

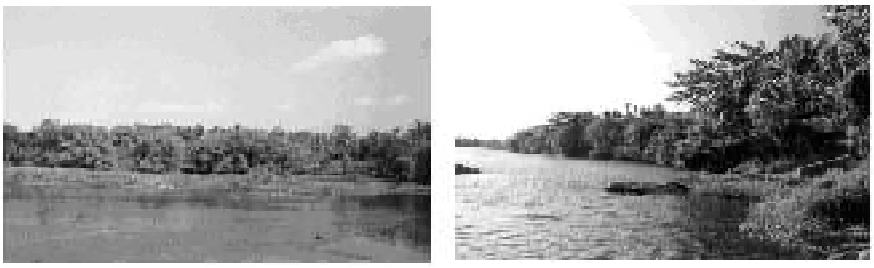


FIG. 4 a & b. Mahadevapura (Control)

Table 1. Result of 2-way ANOVA of different type of vehicles and pollutants

Source	F-ratio	P (Sig.)	Source	F-ratio	P (Sig.)	Source	F-ratio	P (Sig.)
Two wheelers			**LMV**			**HMV**		
Circle	26.220	.000	Circle	34.916	.000	Circle	2.586	.020
Season	3.559	.040	Season	.519	.600	Season	1.618	.214
Circle *season	1.628	.105	Circle *season	.894	.595	Circle *season	.605	.880
SPM			**SO2**			**NOx**		
Circle	11.717	.000	**Circle**	.545	.845	**Circle**	1.417	.216
Season	.379	.688	**Season**	8.33	.001	**Season**	12.678	.000
Circle*season	1.086	.406	**Circle*season**	.295	997	**Circle *season**	.435	.973

Table 2a: Shows the Chlorophyll 'a' and chlorophyll 'b' content in *A. indica* in different seasons and circles.

	Chlorophyll a (mg/g)						Chlorophyll b (mg/g)					
	Rainy	**± SD**	**Winter**	**± SD**	**Summer**	**± SD**	**Rainy**	**± SD**	**Winter**	**± SD**	**Summer**	**± SD**
Kr	0.331	0.01	0.324	0.02	0.297	0.01	0.332	0.01	0.365	0.02	0.459	0.03
Su	0.284	0.07	0.211	0.01	0.26	0	0.312	0.07	0.308	0.01	0.157	0.02
Cb	0.318	0.01	0.299	0.01	0.144	0.02	0.292	0.08	0.279	0.02	0.462	0.03
Ft	0.163	0.01	0.238	0.02	0.277	0.01	0.267	0.02	0.209	0.02	0.242	0.02
Control	0.342	0.01	0.328	0.01	0.343	0.01	0.454	0.03	0.558	0	0.576	0.01

Table 2b: Shows the total chlorophyll content and carotenoids in *A. indica* in different seasons and circles.

	Total Chlorophyll (mg/g)						Carotenoids (mg/g)					
	Rainy	± SD	Winter	± SD	Summer	± SD	Rainy	± SD	Winter	± SD	Summer	± SD
Kr	0.667	0.02	0.689	0	0.756	0.04	0.25	0.01	0.156	0.02	0.182	0.01
Su	0.697	0.02	0.52	0.02	0.417	0.03	0.207	0	0.109	0	0.191	0.01
Cb	0.565	0.09	0.579	0.03	0.607	0.05	0.234	0.02	0.177	0	0.179	0.03
Ft	0.389	0.07	0.448	0.04	0.519	0.01	0.227	0.02	0.132	0.02	0.204	0.02
Control	0.797	0.02	0.886	0.02	0.919	0.02	0.275	0.01	0.241	0.03	0.241	0

SD – Standard Deviation
Kr – K.R.Circle, **Su** – Suburban Bus-stand Circle,
Cb – Canara Bank Circle, **Ft** – Fountain Circle,

C.B.M.Sc:-2

COMPARATIVE ENZYME ACTIVITY IN GENETICALLY MODIFIED *SORGHUM* CULTIVARS

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Abstract: *Sorghum bicolar* is susceptible to large number of pests. It is an important food crop cultivated in many parts of the world. Controlled techniques have been disastrous. In order to overcome this problem many new cultivars which are genetically modified are released annual. The present paper is aimed at comparing the activity of two enzymes in five cultivars of *Sorghum*.

RUDP carboxylase is unable to directly accept CO_2 in C4 plants, but malate dehydrogenase and pyruvate dikinase activity are key enzymes in plants with C4 cycle. Five cultivars of *Sorghum* namely Wild type, CSH-14, Naani-666, CSH-5 and Q-204. Which are genetically modified crops were selected to study the enzyme activity, a few biochemical parameters and their morphology.

Morphological parameters indicated that shoot length and root length varied from cultivar to cultivar while difference in biochemical parameters like chlorophyll and total protein were not significant. Enzyme activity, malate dehydrogenase and pyruvate dikinase is an important aspect in C4 plants. Naani-666 and Q-204 have the highest activity and can be suitably used for cultivation.

Introduction: *Sorghum bicolar* (Jowar) is susceptible to a large number of pests and fungi and has poor yield due to such infection. In order to overcome the loss many new cultivars are released quite often. *Sorghum* is one of the important C4 plant and the two key enzymes that are involved in the synthesis of starch are malate dehydrogenase and pyruvate dikinase. The present work deals with the comparison of the activity of these two enzymes in five cultivars of *Sorghum* mainly in wild type, CSH-14, Naani-666, CSH-5, and Q-204 cultivars.

Materials and Methods: Seed samples of 5 cultivars of *Sorghum bicolor* (CSH-5, CSH-14, Q-204, Naani-666 and wild type) were obtained from Agricultural science college. Dharwad. However these are inbred cultivars and are quoted as resistant to foliar diseases. The process of surface sterilization of seeds and germination methods are as described in ISTA-1996. Chlorophyll estimation in leaf samples were done as per the method described in Arnon 1949. Determination of Malate dehydrogenase and Pyruvate phosphate dikinase activity was determined as per the procedure by Sawhney and Randhir Singh 2006. Chlorophyll a was determined on 4th, 8th and 14th days of growth and expressed as ìg/gm fresh weight of tissue. Shoot and root length and other biochemical parameters like protein in plants were also determined but varied from cultivar to cultivar and were not significantly increased and hence they have not been included in the discussion. Both enzymes were determined on 8th and 14th days after germination and expressed as ì moles activity per minute. The data obtained were subjected to DMRT test.

Results and discussion: Chlorophyll a constitutes the principle component of photosynthetic activity and hence its importance in plants is stressed. The Post hoc test for chlorophyll a is presented in table-1. The consideration of subsets indicates that there is no difference in the means of the 4th day. All cultivars behave in a similar way and constitute one sub set only. After the 8th day of germination all means differ, with Naani-666 being the highest and CSH-5 indicating least chlorophyll a. cultivar Q-204 has medium range of chlorophyll a as compared to other cultivars. But as growth proceeds to 14th day the wild type develops high chlorophyll a content and Naani-666 posses the least chlorophyll a.

The leaves that appeared during the 4th day were too little to be weighed and hence enzyme activity was not determined. The results of the statistical analysis for malate dehydrogenase and pyruvate dikinase activity were presented in table-2. During the 8th day Malate dehydrogenase activity was high in CSH-5 and least in CSH-14 while Naani-666 showed moderate activity. During the 14th day the activity becomes high in Naani-666 followed by Q-204. On the contrary pyruvate kinase activity was very low in Naani-666 but high in CSH-5, during 8th day after germination which drastically decreased

during the 14th day in comparison to the other cultivars. On the 14th day wild type had highest pyruvate kinase activity and CSH-5 had least activity. Such differences have been reported by Amujoyegbe et al. (2007), Bansai et al (1999), Carr et al (1999), Johansson et al (1999), Bhaskar Rao et al (2003).

Conclusion: From the data obtained it is quite difficult to arrive at precise conclusions. However as far as the enzyme activity in concerned. Naani-666 and CSH-5 have high malate dehydrogenase activity, while pyruvate dikinase activity is also high in Naani-666 and CSH-5. The relation of chlorophyll a to the enzyme activity still remains unexplained as observed, where Naani-666 has least amount of chlorophyll a. Since this study was restricted to primary level of growth, further studies related to yield of grains versus number and size of tillers may provide a better understanding of the efficiency of these cultivars for crop production.

TABLE 1: Chlorophyll a content of selected cultivars of Sorghum at 4th, 8th and 14th day seedlings

Parameter	Selected cultivars	Mean	Standard error	F-value	P-value
Chlorophyll a 4th day	Wild type	0.124[c]	±0.16	1.337	0.322
	CSH-14	0.021[b]	±0.00		
	Naani-666	0.233[e]	±0.00		
	CSH-5	0.010[a]	±0.00		
	Q-204	0.190[d]	±0.00		
Chlorophyll a 8th day	Wild type	0.052[d]	±0.00	683.05	0.000
	CSH-14	0.032[b]	±0.00		
	Naani-666	0.071[e]	±0.00		
	CSH-5	0.010[a]	±0.00		
	Q-204	0.426[c]	±0.00		
Chlorophyll a 14th day	Wild type	0.072[d]	±0.00	765.24	0.000
	CSH-14	0.066[c]	±0.00		
	Naani-666	0.019[a]	±0.00		
	CSH-5	0.062[b]	±0.00		
	Q-204	0.067[c]	±0.00		

Mean values followed by the different superscripts letter within a column are significantly different as indicated by DMRT ($P \leq 0.05$).

TABLE 2: Malate dehydrogenase and Pyruvate dikinase activity of selected cultivars of Sorghum at 8th and 14th day seedlings

Parameter	Selected cultivars	Mean	Standard error	F-value	P-value
Malate dehydrogenase 8th day	Wild type	1.030[c]	±0.01	593.69	0.000
	CSH-14	0.150[a]	±0.01		
	Naani-666	0.310[b]	±0.01		
	CSH-5	2.300[d]	±0.10		
	Q-204	0.300[b]	±0.10		
Malate dehydrogenase 14th day	Wild type	0.310[a]	±0.01	5457.70	0.000
	CSH-14	0.470[b]	±0.01		
	Naani-666	4.800[d]	±0.10		
	CSH-5	0.310[a]	±0.01		
	Q-204	0.643[c]	±0.01		
Pyruvate dikinase 8th day	Wild type	0.633[b]	±0.02	1657.09	0.000
	CSH-14	0.800[c]	±0.10		
	Naani-666	0.320[a]	±0.01		
	CSH-5	4.800[e]	±0.10		
	Q-204	1.400[d]	±0.10		
Pyruvate dikinase 14th day	Wild type	1.043[d]	±0.01	65.57	0.000
	CSH-14	0.650[c]	±0.01		
	Naani-666	0.433[b]	±0.15		
	CSH-5	0.160[a]	±0.01		
	Q-204	0.560[c]	±0.10		

Mean values followed by the different superscripts letter within a column are significantly different as indicated by DMRT ($P \leq 0.05$).

Reference

Amujoyegbe, B.G., Opabode, J. T. and Olayinka, A. 2007. Effect of organic and inorganic fertilizer on yield and chlorophyll content of maize (*Zea mays* L.) and *Sorghum bicolour* (L.) Moench. **African Journal of Biotechnology** 6(16):1869-1873.

Arnon D.I. 1949. Copper enzymes in isolated chloroplasts. Polyphenol oxidase in *Beta vulgaris*. **Plant. Physiol**. 24: 1-15.

Bansai, U. K., Saini R.G. and Kaur, A. 1999. Genetic variability in leaf area and chlorophyll content of aromatic rice. **Int. Rice Res. Notes**. 24(1): 21.

Bhaskar Rao, C., Murmu, J. and Raghavendra, A.S. 2003. Dramatic difference in the responses of phosphoenolpyruvate carboxylase to temperature in leaves of C_3 and C_4 plants. **Journal of Experimental Botany**, 54 (383): 707-714.

Carr, P.D., Verger, D., Ashton, A. R. and Ollis, D. L. 1999. Chloroplast NADP malate dehydrogenase: structural basis of light dependent regulation of activity by thiol oxidation and reduction. **Structure**, 15:7(4):461-475.

Corlett, J.E., Jones, H. G., Massacci, A. and Masojidek, J. 1994. Water deficit, leaf rolling and susceptibility to photo-inhibition in field grown *Sorghum*. **Physiologia Plantarum** 92(3): 423-430.

Dixon, M. and Webb, E. C. 1979. Enzymes. Longman Group Ltd., London.

Gnanam, A. and Francis, K. 1976. **Plant Biochem**. **J**. 3:11.

Johansson, K., Ramaswamay, S., Saarinen, M., Lemaire-Chamley, M., Issakidis Bourguet, E., Miginiac-Maslow, M. and Eklund, H. 1999. Structural basis for light activation of a chloroplast enzyme: the structure of *Sorghum* NADP malate dehydrogenase in its oxidized form. **Biochemistry**. 38(14): 4319-4326.

Sadasivam and A Manikam. **Biochemical methods**. New Age International publishers. New Delhi. P.98-99.2005.

Sawhney and Randhir Singh. **Introductory Practical Biochemistry**. Narosha Publishing House. New Delhi. P.-142-147.2006.

C.B.M.Sc:-3

SYNTHESIS, STRUCTURAL CHARACTERIZATION AND ANTIOXIDANT ACTIVITY EVALUATION OF IRON(III) AND COPPER(I) COMPLEXES OF VITAMIN B_6

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INTRODUCTION: It has been proposed that reactive oxygen species (ROS) are involved in the pathogenesis of various diseases, such as lifestyle-related diseases including hypertension and photoaging due to exposure to ultraviolet radiation. Superoxide anions (O_2^{-}°) are formed by the leakage of high energy electrons along mitochondrial electron transport chains and by a variety of cytosolic and membrane bound enzymes, including xanthine oxidase and cytochrome P_{450} complexes. Superoxide anions (O_2^{-}°) mediates direct cell damage and reacts with hydrogen peroxide (H_2O_2) and nitric oxide radicals to generate the extremely reactive species hydroxyl radical (OH°) and peroxynitrite ($ONOO^-$), respectively. The deleterious effects of ROS are counter balanced by antioxidant enzymes such as superoxide dismutase (SOD), catalase and glutathione peroxidase as well as by small molecular antioxidants [1, 2]. Under oxidative stress conditions, ROS can induce molecular and cellular damages to DNA, lipids and proteins. Such events lead to the development of many serious diseases e.g.: cancer, atherosclerosis, asthama and neurodegenerative disorders. SOD, in particular, is the antioxidative enzyme, which can convert O_2^{-}° to a less reactive form, e.g.: H_2O_2. The utilization of SOD as a therapeutic agent has been reported, however there are many limitations, which hinder its application, such as its high molecular weight, high cost, size, charge and rapid clearance. Likewise, a variety of OH° scavengers are known, but their application is also limited. Many researchers have been working hard to develop small molecular weight SOD mimics by transition metal complexes as alternatives. Some e.g. includes metalloporphyrins, metal-drug complexes, metallopyridine complexes and metal-vitamin complexes. Pyridine derivatives possess a diverse array of bioactivities as well as playing crucial roles for physiological functions [1]. They have been extensively used as ligands in the formation of coordination compounds as medicinal agents e.g.: nicotinic acid, 6-aminonicotinic acid ester, 3-aminomethylpyridine, 2-chloro-5-pyridinemethanol etc. The transition metals are most frequently intergrated into essential biochemical pathways. There are a number of biologically important molecules showing the catalytic activity or molecules involved in transfer processes, like oxygen transfer, and incorporating transition metals to their active sites. The cyclic redox process enables these ions to act as pro- or anti-oxidants. The most striking one to our interest is pyridoxine (Py) also known as vitamin B_6. Metal complexes of Py have been an interesting area of study for bioinorganic chemists. Enzymatic reactions utilizing vitamin B_6 can be mimicked by systems containing pyridoxamine or pyridoxal, an amino acid and a metal ion. Thus vitamin B_6-metal complexes have been extensively studied as models of enzymatic behavior [3]. Vitamin B_6 displays a reasonable variety of coordination sites with different charges and hard/soft character exhibiting rich coordination chemistry [4]. The interest for the coordination chemistry of vitamin B_6 constituents has increased since Metzler and coworkers [5] have shown that many different reactions of amino acids are catalyzed by pyridoxal phosphate containing enzymes. These include, among other im-

portant biological reactions, transamination [6], racemization, decarboxylations and serine and threonine dehydration [4, 7]. Among biological ligands, heterocyclic compounds such as vitamins are of special importance. Metal-vitamin complexes and their derivatives have applications in curing certain syndromes involving metal ion and vitamin deficiencies and have promising applications as anticancer agents [8-9]. The aforementioned statements have motivated us, to synthesize low molecular weight metal complexes of pyridoxine as SOD mimics.

EXPERIMENTAL: All chemicals employed were of the analytical grade (Merck). Molar conductivities of freshly prepared 1mg/ml methanol solutions were measured using a conductivity meter make ELICO CM 180. The FTIR spectra were recorded in Nuzol mull on FT/IR-4100 type A spectrometer. Mass spectra were recorded on Q-tof Ultima mass spectrometer, School of chemical sciences, Mass spectrometry lab, University of Illinois, Urbana. Absorption spectra were recorded on UV-Visible spectrophotometer, Systronics 117. Magnetic data were measured on Gouy magnetic balance. Melting points were obtained with a Gallenkamp CAP MPD-350 apparatus. The phosphate buffer (pH 6.6, 7.4 and 7.8) used in antioxidant activity evaluation was prepared using KH_2PO_4 and K_2HPO_4. All solutions were prepared using double distilled water.

SYNTHESIS OF Fe-py AND Cu-pyH COMPLEX: Aqueous solutions of 2mmol pyH (0.41g) and 1mmol metal salt (0.1622g of ferric chloride; 0.0989g of cuprous chloride) were mixed and stirred. The mixture was then heated at 45-50°C for three hours with continuous stirring. The colored compounds formed on cooling was filtered, washed with methanol-water solvent and dried over silica gel in a vacuum desiccator.

Antioxidant activity investigation: *In vitro* antioxidant activity evaluation was carried out using the following assays:

Ferric ion reducing power assay; total antioxidant capacity assay; hydroxyl radical scavenging assay, superoxide radical scavenging assay and nitric oxide radical scavenging assay.

1. Reducing power assay: Ferric ion reducing power of the sample was determined by method of Oyaizu (1986) [10] with slight modifications. The solution of the metal-vitamin complex (0.75 ml) at various concentrations(10-100µg) was mixed with 0.75 ml of phosphate buffer (0.2M, pH 6.6) and 0.75 ml $K_3Fe(CN)_6$ (1% w/v), followed by incubating at 50°C in a water bath for 20 min. The reaction was stopped by adding 0.75 ml of trichloroacetic acid (10%) and then centrifuged at 800 rpm for 10 min. One and a half ml of the supernatant was mixed with 1.5 ml of water and 0.1 ml of $FeCl_3$ (0.1% w/v). The absorbance at 700nm was measured as reducing power. Higher absorbance of the reaction mixture indicated greater reducing power.

2. Total antioxidant capacity assay: The method described by Prieto *et al* [11] was used to determine the total antioxidant capacity of the metal-vitamin complexes. The tubes containing 0.2 ml of metal-vitamin complex (100-500 µg/ml), 1.8 ml of distilled water and 2 ml of phosphomolybdenum reagent solution (0.6 M sulfuric acid, 28 mM sodium phosphate and 4 mM ammonium molybdate) were incubated at 95°C for 90 min. After the mixture had cooled to room temperature, the absorbance of each solution was measured at 695nm using an UV-Vis spectrophotometer.

3. Hydroxyl radical scavenging assay: The method of Halliwell, *et al.* (1987) [12] was followed for the hydroxyl radicals scavenging activity of metal-vitamin complex fractions. This non-site specific assay involved the addition in sequence, 0.1 ml of EDTA, 0.01 ml of $FeCl_3$, 0.1 ml of H_2O_2, 0.3 ml of deoxyribose, 1 ml of metal-vitamin complex concentrations (100-500µg/ml), 0.33 ml of phosphate buffer (50 mM, pH7.4) and 0.1 ml of ascorbic acid. After the mixture was incubated at 37°C for 1 hour, 1 ml of the incubated mixture was mixed with 1 ml of 10 % trichloroacetic acid and 1 ml of 1% thiobarbutaric acid (in 0.025M NaOH) and heated for 1 hour in a waterbath at 80°C leading to the formation of a pink chromogen, the absorbance of which was measured at 532nm.

4. Superoxide radical scavenging assay: The superoxide radicals (O_2^{-}°) were generated *in vitro* by non-enzymatic system and determined spectrophotometrically by nitro blue tetrazolium (NBT) photoreduction method with a little modification in the method adopted elsewhere [2]. The amount of O_2^{-}° and suppression ratio for O_2^{-}° can be calculated by measuring the absorbance at 560nm. Solution of methionine (MET), $VitB_2$ and NBT were prepared by avoiding light. The assay mixture, in a total volume of 5ml, contained MET (10mM), NBT (46µM), $VitB_2$ (3.3 µM), the methonolic solutions of metal-vitamin complexes (100-500 µg) and a phosphate buffer (67mM, pH 7.8). After illuminating with a fluorescent lamp at 30°C for 10min, the absorbance of the samples was measured at 560nm.

5. Nitric oxide radical scavenging assay: Sodium nitroprusside (5mM) in phosphate buffer saline was mixed with different concentrations of metal-vitamin complexes (100-500 µg/ml) dissolved in methanol and incubated at 25 °C for 30 min. After 30 min, 1.5 ml of the incubated solution were removed and diluted with 1.5 ml of Griess reagent (1% Sulphanilamide, 2% phosphoric acid, and 0.1% naphthyl ethylene diamine dihydrochloride). The absorbance of the chromophore formed during diazotization of the nitrite with sulphanilamide and subsequent coupling with naphthylethylene diamine was measured at 546nm along with a control [13]. BHA was used as the standard in all the above mentioned assays.

RESULTS AND DISCUSSION: The metal-pyridoxine complexes were synthesized and characterized based on their melting points, molar conductances, UV-Visible, IR, mass spectrometry and magnetic moment data.

Melting points of Fe-py and Cu-pyH complexes were found to be 166°C and 165°C, respectively.

The molar conductances were measured for the complexes in MeOH solutions (1mg/ml). The conductance for Fe(III)-py was in the range 15.62-29.31 $\Omega^{-1}cm^{-1}mol^{-1}$, suggesting it to be non-electrolytes in nature [14, 15, 16], where as for the Cu(I)-

pyH complex in methanol solution showed conductance at 98.66 $\Omega^{-1}cm^{-1}mol^{-1}$ suggesting it to be electrolyte in nature [18].

The absorption band at 290nm for free pyridoxine is assigned to π-π^* electronic transition. This band is shifted to 350nm for Fe-py complex and 330nm for Cu-pyH complex. The π-π^* band undergoes a bathochromic shift [17] confirming metal-pyridoxine complexation.

The essential infrared data are summarized in Table 1.

Table 1. IR absorption bands (cm^{-1}) of pyridoxine and its metal complexes

Assignment	Pyridoxine (pyH)	Fe-py complex	Cu-pyH complex
ν(O-H)	3326.6	3478.95	3731.58 3624.55
ν(CH_3)	2724.45	2724.92	2725.89
ν(C=N)	1543.74	-	-
Water of	3234.04	3181.01	3180.09
crystallization	-	3181.01	3142.00
Intramolecular	2360.44	2360.44	2542.1
H-bond	3234.04	2956	2848.9
ν(M-N)	-	551.542	
ν(M-O)	-	512.973 400.157	595.86
		373.159	382.80
ν(M-Cl)	-	362.552	361.58

The presence of O-H, C=C, M-O, M-N and M-Cl stretching bands and O-H deformation bands are strong evidences for the formation of complexes [17]. Pyridoxine exhibits a very strong absorption band at 1543.74 cm^{-1} due to ν(C=N) [18-25] of the pyridine ring nitrogen. This is absent in Fe-py and Cu-pyH complexes because of the M-N bonding. The 3234 cm^{-1} band in pyH attributable to the ν(C=N) stretching mode has shifted to 3181 cm^{-1} in Fe-py and 3180 cm^{-1} in Cu-pyH indicating the involvement of the N atom in coordination. Free pyridoxine exhibits a band at 2360.44 cm^{-1} which is assigned to intramolecular hydrogen bonding between 3' OH and 4' CH_2OH groups; this is retained in the complexes. The hypsochromic shift of O-H deformation band strongly suggests that pyridoxine is a bidentate in its mode of complexation. Pyridoxine binds to metal ion through nitrogen of pyridine ring and oxygen of 5' CH_2OH (373-420cm^{-1}) group. The observed trend in the mode of complexation of pyridoxine is in good agreement with that found for many coordinating ligands, containing coordination sites of oxygen and nitrogen atoms such as substituted acetamidophenols, orotic acid and aroylhydrazoneoximes. The sharp absorption bands observed around 500-300 cm^{-1} which could not be traced to free pyridoxine have been tentatively assigned to M-O [17, 19-23], M-N [18-23, 26], and M-Cl[18] bond stretching modes for most metal complexes. The bands 900-600cm^{-1} in pyridoxine could be assigned to the stretching frequencies of the substituents in the ligand. In metal complexes, these stretching frequencies are shifted to lower frequencies. In the complexes there occurs a new broad band for water of crystallization at 3181.01 cm^{-1} for Fe-py complex and 3180.09 cm^{-1} for Cu-pyH complex. The positive ion fast atom bombardment (FAB) mass spectra show parent molecular ion peaks at m/z 447.10 (calcd. 447.1) for the Fe(III)-py complex and at 447.1 (calcd. 453.34) for the Cu(I)-pyH complex (Table 2). These data suggest the formulations of the complexes as $Fe(py)_2Cl.H_2O$ and $Cu(py)_2Cl.0.5H_2O$.

Complex	m/z (RI %)	Assignment	m/z calculated
Fe-pyridoxine	239.1(2.6)	$Fe(py^-).H_2O$	242.1189
	273.0(4.3)	$Fe(py^-)Cl.H_2O$	277.5719
	306.1(6.4)	$Fe(py^-)Cl_2.0.5\,H_2O$	304.0249
	329.0(2.2)	$Fe(py^-)Cl_2.2.0\,H_2O$	331.0249
	447.1(1.8)	$Fe(py^-)_2Cl.H_2O$	445.7468
Cu-pyridoxine	228.2(7.2)	Cu(pyH)	231.7179
	257.0(3.8)	Cu(pyH) $.1.5H_2O$	258.7179
	275.0(4.4)	Cu(pyH)Cl	276.1709
	309.0(14.9)	$Cu(pyH)Cl_2$	311.6239
	329.0(2.1)	$Cu(pyH)Cl_2.H_2O$	329.6239
	345.0(1.7)	$Cu(pyH)Cl_2.2.0H_2O$	347.6239
	447.1(2.6)	$Cu(pyH)_2Cl0.5H_2O$	453.3429

[a]Here the pyridoxine ligand is in both the Py^- anionic form due to the ionization of one of the alcohol groups and the PyH molecular form.

The effective magnetic moments found for Fe-py and Cu-pyH complexes are 1.73 and 0.00 BM, respectively corresponding to one and zero unpaired electrons. These values indicate an approximately paramagnetic Fe(III) complex and a diamagnetic Cu(I) complex. These values are approximate to that found in the literature for complexes of these metal ions. The paramagnetic Fe(III) (d^5) ion in $[FeCl(py^-)_2].H_2O$ complex has a square pyramidal or trigonal bipyramidal environment with d^2sp^2 configuration (Figure 1a). In $[Cu(pyH)_2].Cl\ 0.5\ H_2O$ complex, Cu(I) (d^{10}) ion has a four coordinate square planar (d^2sp^2) environment around it (Figure 1b).Therefore, the possible structures of the complexes are:

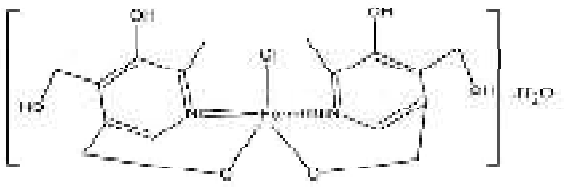


Figure 1a: Molecular structure of Fe-pyridoxine complex

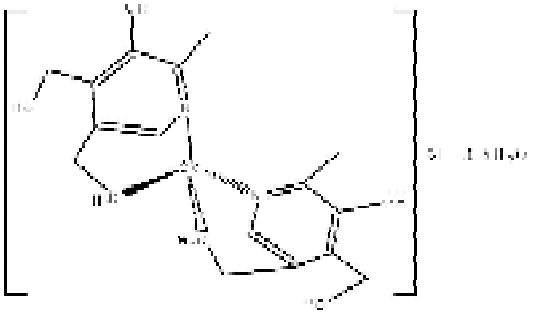


Figure 1b: Molecular structure of Cu-pyridoxine complex

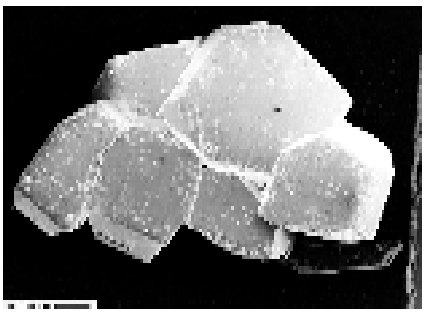


Figure 1c: SEM image of Fe-pyridoxine complex

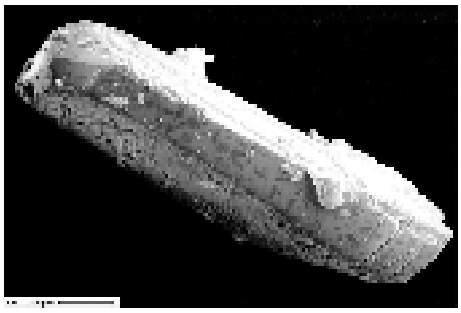


Figure 1d: SEM image of Cu-pyridoxine complex

Antioxidant activity:

1. Reductive ability: The antioxidant activity has been reported to be concomitant with the development of reducing power. The reducing power of metal–vitamin complexes might be due to the hydrogen donating ability, as described by Shimada *et al* [27]. The reducing power of complexes and the standard butylated hydroxyanisole (BHA) is as shown in Figure 2a, 2b. The reducing power increased as the concentration of the metal-vitamin complex increased. For the measurements of the reductive ability, the Fe^{3+}- Fe^{2+} transformation in the presence of metal-pyridoxine complexes was investigated using the method Oyaizu [10]. All the amounts of metal-pyridoxine complexes showed higher activities than the control and these differences are statistically significant.

2. Total antioxidant capacity assay: Phosphomolybdenum assay used to determine the total antioxidant capacity is based on the reduction of Mo(VI) to Mo(V) by the metal-vitamin complexes and subsequent formation of a green phosphate-Mo(V) complex at acid pH[11]. Figure 3a, 3b illustrates the antioxidative capacities of various concentrations of metal-vitamin complexes (100-500 μg).

3. Hydroxyl radical scavenging assay: Hydroxyl radicals are the major reactive species causing lipid peroxidation and enormous biological damage. The deoxyribose method is a simple assay to determine the rate constants for reactions of hydroxyl radicals [28]. Ferric-EDTA was incubated with H_2O_2 and ascorbic acid at pH 7.4. Hydroxyl radicals formed in free solution were detected by their ability to degrade 2-deoxy-2-ribose into fragments that on heating with thiobarbutaric acid at pH 3.0-3.5 formed a pink chromogen [30]. Any hydroxyl radical scavenger added to the reaction would compete with deoxyribose for the availability of hydroxyl radicals. The tested scavenging activities of the metal-pyridoxine complexes are concentration dependent. The complexes are either comparable to or close to the effect of BHA (Figure 4a, 4b). They are also better than the free pyHCl in their effects. The antioxidant activities of these compounds are expressed as 50% inhibitory concentration (IC_{50} in μg) [2]. Among these compounds, the order of hydroxyl radical scavenging activity is BHA>Cu-pyH>Fe-py>py.

4. Superoxide radical scavenging assay: Superoxides are produced from molecular oxygen due to oxidative enzymes of body as well as via non-enzymatic reaction such as autooxidation by catecholamines. In the present study, superoxide radical reduces NBT to a blue colored formazan that is measured at 560nm [29]. Figure 5a, 5b shows the superoxide scavenging effect of metal-vitamin complexes and BHA on the MET/$VitB_2$-NBT system. The decrease of absorbance at 560nm with antioxidants thus indicates the consumption of superoxide anion in the reaction mixture [2]. Among these compounds, the order of superoxide radical scavenging activity is BHA>Cu-pyH>Fe-py>py.

5. Nitric oxide radical scavenging assay: Nitric oxide is an important chemical mediator generated by endothelial cells, macrophages, neurons, etc. and is involved in the regulation of various physiological processes [13]. Excess concentration of nitric oxide is associated with several diseases. Oxygen reacts with the excess nitric oxide to generate nitrite and peroxynitrite anions, which act as free radicals [2]. In the present study, the metal-vitamin complex competes with oxygen to react with nitric oxide and thus inhibits generation of the anions. Figure 6a, 6b illustrates the percentage inhibition of nitric oxide generation by the metal-vitamin complexes. Among these compounds, the order of nitricoxide radical scavenging activity is BHA>Cu-pyH>Fe-py>py.

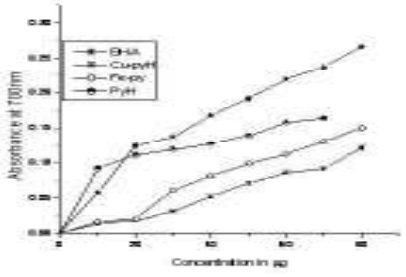
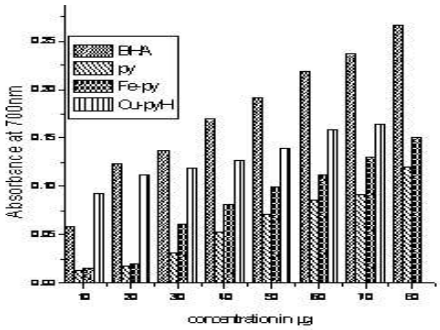


Figure 2a, 2b: Reducing power assay



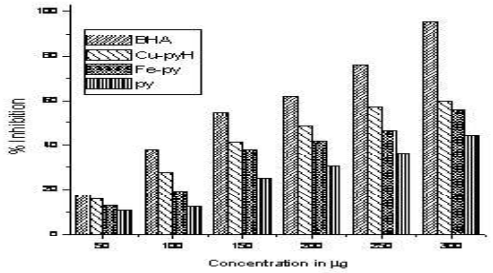
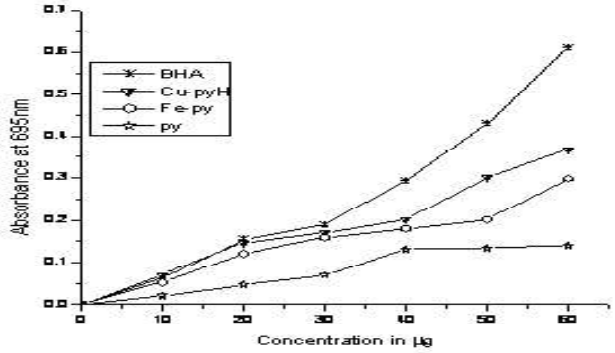
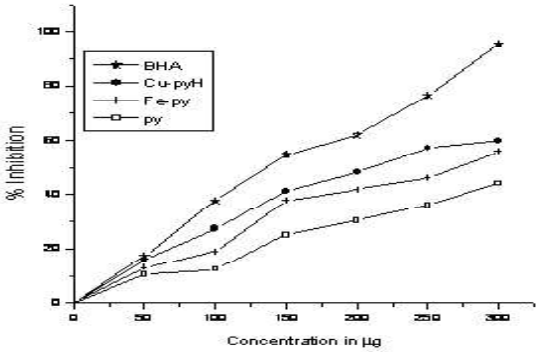


Figure 4a, 4b: Hydroxyl radical scavenging activity





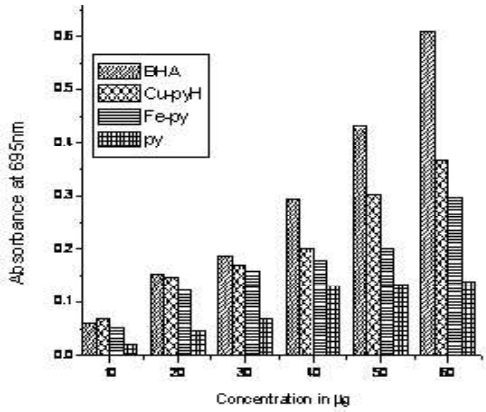


Figure 3a, 3b: Total antioxidant capacity

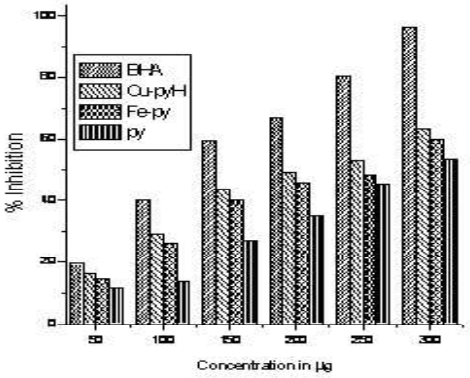
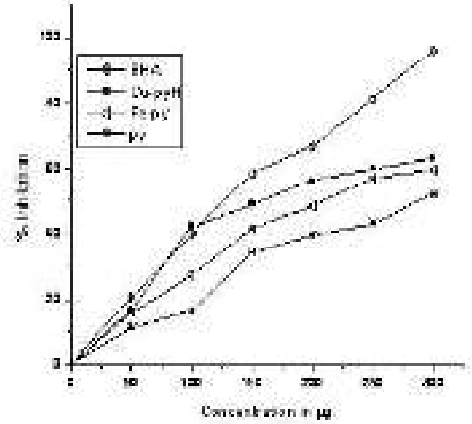
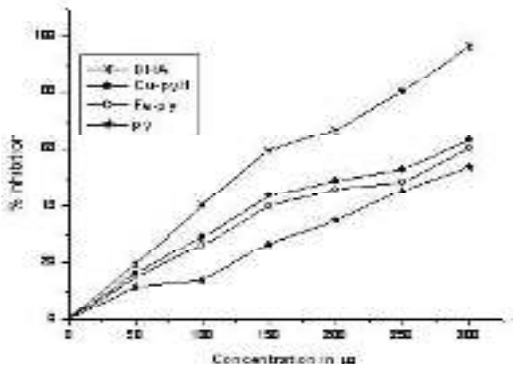


Figure 5a, 5b: Superoxide radical scavenging activity





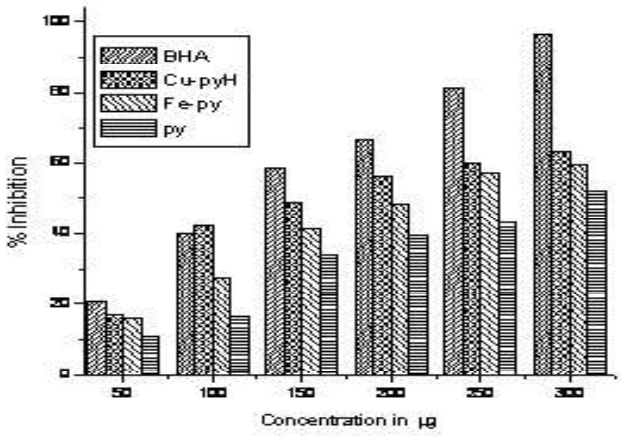


Figure 6a, 6b: Nitricoxide radical scavenging activity

ACKNOWLEDGEMENT:

One of the authors, Chaitanya Lakshmi. G, acknowledges University of Mysore for the award of University Grants Commission meritorious fellowship.

REFERENCES:

1. Thummaruk Suksrichavalit; Supaluk Prachayasittikul; Chanin Nantasenamat. Copper complexes of pyridine derivatives with superoxide scavenging and antimicrobial activities. *Eurp. J. Med. Chem*. **2009**, *44*, 3259-3265

2. Tian Rong Li; Zheng-Yin Yang; Bao-Dui Wang. Synthesis, characterization and antioxidant activity of Naringenin Schiff base and its Cu(II), Ni(II) and Zn(II) complexes. *Chem. Pharm. Bull*. **2007**, 55(1), 26-28

3. Stephen Hartman, J; Kelusky, C. A ^{13}C nmr study of metal ion binding pyridoxine. *Can. J. Chem*. **1979**, *57*, 2118-2122

4. Fernando Back, D; G. M de Oliveira; Lang, E.S; Vargas, J.P; Tabarelli, G. Chelation of UO_2^{2+} and Th^{IV} by N,N$^{\times}$-bis-(pyridoxylideneiminato)R (R=n-propyl, diethylamine), new dianionic Schiff bases derived from vitamin B_6: Synthesis and structural features of $[Th(pyr_2pen)_2]$(pen=1,3-propylendiamine), $[UO_2(pyr_2pen)(CH_3OH)]$ and $[UO_2(pyr_2dien)].2H_2O$ (dien =diethylamine). Searching further for heavy metals damage inhibition in living beings. *J. inorg. Biochem*. **2008**, *102*, 666-672

5. Metzler,D.E; Ikawa,M; Snell,E.E. A general mechanism for Vitamin B_6 catalyzed reactions. *J. Am. Chem. Soc*. **1954**, *76*, 648-652

6. Villa, F; Zyzyck, A; Electronic studies of copper(II) complexes of amino acids. EPR spectra of some vitamin B_6 Schiff base analogs. *Spec. Lett*. **1972**, *5(10)*, 371-376

7. Franklin,J; Richardson. Reactions of metal ions with vitamins, crystal structures of copper complexes with anionic and neutral pyridoxamine. *Inorg. Chem*. **1980**, *19*, 2107-2113

8. Kose, D.A; Zumreoglu-Karan, B; Unaleroglu; Sahin, C; Orhan, O. Synthesis and characterization of transition metal-vitamin B_{13} complexes mixed with a co-vitamin. *J. Coord. Chem*. **2006**, *59(18)*, 2125-2133

9. Casas,J.S; Castineiras,A; Condori,F; Couce,M.D; Russo,U; Sanchez,A; Sordo,J; Varela,J.M; Lopez,M. Diorganotin(IV) complexes of dideprotonated pyridoxine (PN, vitamin B_6). The crystal structures of $[SnEt_2(PN\text{-}2H)].CH_3OH$, $[SnEt_2(PN\text{-}2H)(DMSO)$ and $[SnBu_2(PN\text{-}2H)]$.*J. Org-met. Chem*. **2004**, *689*, 620-626

10. Oyaizu, M. Studies on product of browning reaction prepared from glucose amine. *Japanese J. Nut*. **1986**, *44*, 307-315

11. Prieto, P; Pineda, M; Aguilar, M. Spectrophotometric quantification of antioxidant capacity through the formation of a phosphomolybdenum complex: Specific application of Vitamin E. *Anal.Biochem*. **1999**, *269*, 337-341

12. Halliwell, B. The deoxyribose method: a simple test tube assay for the determination of rate constants for reaction of hydroxyl groups. *Anal. Biochem*. **1987**, *165*, 215-219

13. A, Kumaran ; R, Joel karunakaran. Antioxidant and free radical scavenging activity of an aqueous extract of Coleus aromaticus. *Food Chemistry,* **2006,** *97*,109–114

14. Mane,V.G; Pantage,V.N; Arbad,B.R. Synthesis, structural and thermal characterization and antifungal study of manganese, iron, cobalt and copper complexes of N,O donor ligands. *J. Indian. Chem. Soc*.**2007**, *84*, 1086-1091

15. Pantage, V.N; Arbad, B.R. Transition metal complexes of dehydroacetic acid chalcone: synthesis, spectral, thermal and fungicidal study. *J. Indian. Chem. Soc*. **2007**, *84*, 1096-1103

16. Obaleye,A; Orijiekwe,L. Synthesis and characterization of vitamin C, Ascorbate complexes of Mn(II), Fe(III) and Co(II). *Synth. React .Inorg.Met.Org.Chem*.**1992**, *22(7)*, 1015-1029

17. Adeyemo, A; Akinwumi, F. A zinc (II) complex of vitamin B_1. *J .Coord. Chem*. **1986**, *14*, 231-234

18. Starha, P; Travnicek, Z; Herchel, R; Popa, I; Suchy, P; Vanco, J. Dinuclear copper(II) complexes containing 6-(benzylamino)purines as bridging ligands: Synthesis, characterization, and in vitro and in vivo antioxidant activities. *J. inorg. Biochem*. **2008**, *103*, 432-440

19. Chohan,H; Rauf; Noreen; Scozzafava; Supuran,T. Antibacterial Cobalt(II), Nickel(II) and Zinc(II) complexes of nicotinic acid derived Schiff-bases.*J. Enzym. Inhibit. Med. Chem.* **2002**, *17(2)*, 101-106

20. Selma, Y; Ucan; Mustafa Ucan. Synthesis and characterization of new Schiff bases and their Cobalt, Nickel, Copper, Zinc, Cadmium and Mercury complexes. *Synth. React. Inorg. Met. Org. Chem*. **2005**, *35*, 417-421

21. Mohamed, G.G; Zayed, M.A; El-Gamel, E.A. preparation, chemical characterization and electronic spectra of 6-(2-pyridylazo)-3-acetamidophenol and its metal complexes. *Spec. Lett.* **2000**, *33(6)*, 821-832

22. Kolawole, G.A; Adeyemo, O. Iron(III) complexes of vitamin B_1 and those of bromo, iodo, perchlorato, and thiocyanato analogues. *Synth. React. Inorg. Met. Org. Chem*. **1995**, *25(10)*, 1597-1619

23. Chohan, H.; Shad, A. Structural elucidation and biological significance of 2-hydroxy-1-naphthaldehyde derived sulfonamides and their first row d-transition metal chelates. *J.*

Enzym. Inhibit. Med. Chem. **2008**, *23(3)*, 369-379
24. Salem,J; Laila El Sayed; Wolfgang Haase; Iskander,F. Metal complexes derived from hydrazoneoxime ligands, synthesis, electrospray mass spectra and magnetochemical studies of some copper(II) complexes derived from p-substituted aroylhydrazoneoximes. *J. Coord. Chem*. **2005**, *58(15)*, 1327-1343
25. Vanco, J; Marek, J; Travnicek, Z; Racanska, E; Muselik, J; Ol' ga Svajlenova. Synthesis, structural characterization, antiradical and antidiabetic activities of copper(II) and Zinc(II) Schiff base complexes derived from salicylaldehyde and β-alanine. *J. inorg. Biochem*. **2008**, *102*, 595-605
26. Rogado, M; Zahinos, V. Nickel (II) and Zinc(II) complexes withN-(5,6-dihydro-4H-1,3-thiazin-2-yl)-2-aminobenzimidazole : Synthesis, spectral and structural characterization. *Polyhedron*. **2007**, *26*, 3112-3120
27. Shimada, K; Fujukawa, K; Yahara, K; Nakamara, T. Antioxidative properties of xanthan on the autooxidation of soybean oil in cyclodextrin emulsion. *J.Agric.Food.Chem*. **1992**, *40*, 945-948
28. Gupta, M; Mazumder, U.K; Gomathi, P. In vitro antioxidant and free radical scavenging activities of Galega purpurea root. *Pharmacognosy Magazine*.**2007**, *3(12)*, 219-225
29. Wang, Q; Yang, Z. Y; Fao-Fei Qi; Qin, D.D. Synthesis, crystal structure, antioxidant activities and DNA- binding studies of the Ln(III) complexes with 7-methoxychromone-3-carbaldehyde-(4'-hydroxy) benzoyl hydrazone. *Eurp. J. Med. Chem*. **2009**, *44*, 2425-2433

C.B.M.Sc:-4

EVALUATION OF PLANT GROWTH PROMOTING PROPERTIES OF RHIZOBIUM AND EFFECT OF SOIL PATHOGENS METABOLITES ON RHIZOBIUM GROWTH

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Rhizobium is known to survive in soil and rhizospheres of legumes as well as non-legumes. There is evidence that bacterium thrives on root excretions although no single component in the root exudates has any special role in stimulating its growth. *Rhizobium* secretes extra cellular polysaccharides, which may help in binding soil particles.

The communication that occurs between the plant and the *Rhizobia* during nodule formation and maintenance constitutes a novel opportunity to study signal transduction in plant system. The expression of nodulation genes in the bacteria is activated by signals from plant roots and as a result the bacteria synthesize signals that induce a nodule meristem and enable the bacteria to enter this meristem via plant made infection thread. The chemical signals synthesized by the bacteria are based on a modified amino acid carrying a variable acy1 chain substituent and are called acy1 homoserine lactones.

There is no simple physiological or biochemical tests to distinguish between effective strain and ineffective strains of Rhizobium (Gupta and Sen, 1963). Different strains of Rhizobia also showed a tendency to consume glucose to different degrees, characteristic which would be used to distinguish strain (Gupta and Sen,1963).

Mycorrhizal fungi and root nodule bacteria from symbiotic relationship with roots of plants in acquiring mineral nutrients from soil such as phosphorus, zinc, nitrogen and bromine etc (Tinker, 1984). The saline soil may adversely affect the plant growth and microbial population. The osmotolerant bacteria accumulate some substances called compatible solutes either by absorption or by synthesis. It is assumed that these substances confer protection against the destabilizing effect of salt (Csonka and Hanson, 1991). Compatible solutes identified so far include amino acid (glutamate and proline), Amino acid derivatives (betains and analogous molecule) and carbohyradrates (Kemp f and Bremer, 1998).
Interaction studies of Rhizobium with Trichoderma showed that when culture filtrate was incorporated into the medium, growth and population of Rhizobium were significantly inhibited (Jayaraj and Ramabadran, 1999).

Rhziobium is classified based on cross inoculation grouping which is based on the ability of a limited genera or species capable of nodulating groups of legumes related to one another. All *Rhizobia* that could form nodules on roots of certain legumes have been collectively taken as a species. Example: *Rhizobium leguminosarum* nodulates the pea group consisting of Pisum vicia and R. phaseoli infects the bean group and R. trifolii infects the clover group. Recent version of Rhizobia has decided that *Rhizobium* will have three recognized species *Rhizobium leguminosarum*, R. meliloti and R. loti.

Hence with this background, present work was undertaken to fulfill the following objectives.

- To isolate *Rhizobium* from different sources from Coorg region.
- To study salt tolerance and antibiotic resistance of the isolates.
- To study growth promoting properties of the isolate.
- To study the effect of soil organisms with Rhizobium spp.

MATERIALS AND METHODS

1) COLLECTION OR SAMPLES:

COLLECTION OF SOIL SAPLES:

Soil sample was collected from paddy field near college road Madikeri, Coorg district.

COLLECTION OF ROOT NODULES:

The root nodules of Mimosa pudica, Crotalaria juncea were collected near college campus Madikeri.

2) ISOLATION OF RHIZOBIUM:

Exactly 1g of soil was weighed and serially diluted up to 10^4.

The root nodules of M. pudica and C. juncea were collected and washed with plenty of water

The nodules then surface sterilized with 1.0% NaOCI solution for five minutes, and washed thoroughly with sterile distilled water.

10^{-4} dilutions of each sample were spread on yeast extract mannitol agar (YEMA).

And the plates were incubated at 37°C for 48 hrs and observed.

COMPOSITION OF *YEMA* MEDIUM:

K^2HPO^4——————————————0.5g

$MgSO_4$. $7H_2O$——————————————0.2g

NaCI——————————————0.1g

Mannitol——————————————10g

Yeast extract——————————————01g

Agar——————————————15g

Distilled water——————————1000ml

Congo red (1% solution)———2.5ml (only during isolation)

3) IDENTIFICATION OF *RHIZOBIUM*:

Rhizobium was identified by colony morphology, Gram staining, nitrate reduction test, motility, and sugar utilization test by using Bergy's manual of Bacteriology (1994)

4) SALINITY TOLERANCE:

YEM broth was prepared with different concertration of NaCI (1,2,3, 4 and 5%) ranges from 1% to 5% separately. And sterilized by autoclaved.

The broth was inoculated with each of the isolates.

Incubated at 37^0 C for 3 days.

OD was measured at 594 nm using UV Spectrophotometer.

ANTIBIOTIC RESSTANCE STUDY:

YEMA medium was prepared and sterilized by autoclaved.

The media was plated using sterile Petri plates. The different isolates were inoculated by pour plate method.

The Antibiotic discs of Strephomycin, and Ampicillin (Hi Media) were placed on the medium and the plates were incubated at 37°C for 2 days.

The plates were observed for the inhibition zones.

8) STUDIES ON GROWTH PROMOTING PROPERTY:

The soil was collected and was double autoclaved and soil was weighed and filled into plastic cups (150). Then the cups divided into 6 groups with each of 25 cups.

Each three sets were inoculated with soil isolates, C.*juncea* isolates and M. *pudica* isolates respectively and remaining three sets were maintained as controls.

Healthy green gram seeds were surface sterilized with 0.1% Na OCI (fro 5 min) and washed with sterile distilled water.

The seeds were then sown in both inoculated and non-inoculated soils in the cups.

The cups were kept near the window and watered regularly. And vigour index of the seedlings was recorded after 25 days.

9) TO STUDY EFFECT OF SOIL ORGANISMS WITH *PHIZOBIUM*:

The soil bacteria and fungi were isolated using NA and PDA, from the respective region where *Rhizobium* was isolated.

The soil bacteria were identified by biochemical tests using Bergy's Manual (1994). The fungi were identified Barnett Manual (1972)

The isolated and identified bacteria was grown in NB for 4 days at 37°C, and the fungi were grown in PDB at room temperature for 7 days on rotary shaker.

The metabolites of bacteria and fungi were obtained by centrifuging the broth at 4500 rpm and 10000 rpm for 30 min respectively.

YEMA me medium was prepared and sterilized by autoclaving. The media was plated using Sterile Petri plates.

Four peripheral and a central wells were made on the solidified medium using (5mm diameter) cork borer.

The wells were loaded with varied concentrations of bacterial and fungal metabolities (50 ul, 100 ul, 150 ul, 200 ul). Appropriate control was maintained in the central well. The plates were incubated at 37°C for 2 days.

Plates were observed for the inhibition zones after incubation

RESULTS AND DISCUSSION

The *Rhizobium* isolated from the soil showed brownish white coloured colony when compared other two isolates. But all the three isolates found to be Gram-negative bacilli motile reduced nitrate to nitrite and utilizes carbon sources such as mannitol, fructose and sucrose.

Biochemical and morphological characters of Rhizobium Isolated from different sources

Source	Gram Staining	Colony Morphology	Motility	Nitrate Reduction	Carbohydrate utilization		
					Mannitol	Fructose	glucoe
Soil	-ve bacilli	Brownish white, circular, Mucilaginous, raised	Motile	$+^{ve}$	$+^{ve}$	$+^{ve}$	$+^{ve}$
C.juncea	-ve bacilli	Whitish, semi translucent, mucilaginous, raised	Motile	$+^{ve}$	$+^{ve}$	$+^{ve}$	$+^{ve}$
M.pudica	-ve bacilli	Whitish, semi translucent, mucilaginous, raised	Motile	$+^{ve}$	$+^{ve}$	$+^{ve}$	$+^{ve}$

Effect of salt concentration of the growth of the organism

Source	Salt Concentration	OD at594nm
Soil	1%	0.590
	3%	0.225
	5%	0.272
C.juncea	1%	0.365
	3%	0.210
	5%	0.138
M.pudica	1%	0.483
	3%	0.422
	5%	0.244

Effect of antibiotics on growth of *Rhizobium* isolates

Isolates	Diameter of inhibition zone in cm	
	Streptomycin	Ampicillin
Soil	2.4	3.0
Crotalaria juncea	2.5	2.5
Mimosa pudica	6.0	2.5

In growth promoting property study the Rhizobium inoculated seedlings showed improved vigour index over control. However, Rhizobium Isolated from soil showed maximum vigour index over other two isolates.

Vigour index of green gram seedling inoculated with different isolates.

Source	Vigour index of the inoculated seeds	Vigour index of the control
Soil	1.94	1.20
	1.69	1.58
	1.93	1.53
	2.17	0.71
	2.56	1.80
C. juncea	1.34	1.33
	1.64	1.36
	1.35	1.25
	1.53	1.44
	1.22	1.34
M. pudica	1.57	1.20
	1.42	1.28
	1.26	1.20
	1.69	0.71
	1.54	1.43

Only *Aspergillus* metabolite has shown the inhibition against the isolates tested except *C.juncea* isolate. However, *Penicillium* and *Fusarium* metabolites have no effect on the growth of the isolates.

Effect of fungal metabolites on the growth of the isolates.

Source	Aspergillus metabolite					Penicillium metabolite					Fusarium metabolite				
	50ul	100ul	150ul	200ul	C	50ul	100ul	150ul	200ul	C	50ul	100ul	150ul	200ul	C
Soil	0.6	1.2	1.7	2.0	-	-	-	-	-	-	-	-	-	-	
M.pudica	0.7	1.0	0.9	1.0	-	-	-	-	-	-	-	-	-	-	-
C.juncea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

The association of *Rhizobium* with crop plants is very important in agricultural practices and yield improvement. The present study provided important characters of *Rhizobium* isolated from different sources of Coorg region. They have showed varied morphological characters, which might be specific species characters of the isolates.

The results of salinity tolerance showed that (Table 3) salt concentration may have detrimental effect on soil microbial population as a result of direct toxicity or through osmotic stress, there by decreases the growth of the organism. The results also showed variation in growth of the three isolates in increased salt concentration. This confirms the findings of Jamilia Mathallah et al, 2002.

All the 3 isolates found to be inhibited by the antibiotics such as streptomycin and ampicillin similar results were reported by Nut man (1965). The results of vigour index indicated that all the three isolates have PGPR property. They increased the growth of the inoculated seedlings, when compared to control (Ramesh, 2004)

In the salt tolerance study all the three isolates showed maximum growth at 1% salt concentration. The 37°C temperature was found to be ideal for the growth of all the three isolates. At 25°C temperature, *M.Pudica* isolate showed maximum growth when compared to other two isolates. But the soil isolate could tolerate high temperature. All the three isolates significantly increased the vigour index of the green gram seedlings. *Pseudomonas* metabolite has effect on growth of these isolates among the bacteria isolated from soil. Where as *A.niger* inhibited the growth of soil and *M.Pudica* isolates, but not of the *C.juncea* isolate.

The *Rhizobium* soil isolate is salt tolerant is salt tolerant and can tolerate salt concentration up to 5%. All the three isolates can grow only in alkaline pH. The soil *Rhizobium* isolate significantly increases the plant growth promoting property of the green gram seedlings. All the three isolates are sensitive for the antibiotic and the soil isolate was strongly inhibited by Ampicillin (3.0cm). The fungal and bacterial metabolites have adverse effect on growth of the *Rhizobium.*

C.B.M.Sc:-5

AN ASSESMENT OF PERSPECTIVES AND ATTITUDES TOWARDS LABORATORY SAFETY: A STUDY ON URBAN INDIAN STUDENTS.

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INTRODUCTION: Education, in its broadest sense, refers to the ways in which people learn skills and gain knowledge and understanding about the world and about themselves. Education includes a variety of learning experiences.

Science is a subject which needs practical experience. It cannot be understood just by classroom training. Students will understand the important concepts in science only if they can apply the knowledge gained in the classrooms during practicals. As a result, labs of science for subjects like Physics, Chemistry, Electronics, Biology, and Biochemistry are present from high schools to senior college. The science laboratory is an enjoyable~ exciting place to work and learn. It must also be a safe place. To ensure the safety of everyone, proper conduct safety rules and teacher instructions must be followed at all times.

Science laboratories are well equipped with all modem amenities. A typical Physics laboratory contains instruments like calorimeter, galvanometer, circuit boards, voltmeter, ammeter and materials like connecting wires, experimental boards, scientific scales etc. A Chemistry laboratory will ideally have burette, pipette, titration apparatus, many concentrated and dilute acids, " compounds, chemicals, thermometers and other items. Biology laboratories have instruments to prepare slides, microscopes, collected specimens of plants and animals etc. Students perform the experiments and complete their journals with the guidance of teachers in these laboratories. Science laboratory safety is important and supervisors should ensure that the science laboratory safety rules are followed by all.

During any scientific work undertaken in a laboratory the decisions you make concerning the use of chemicals in the laboratory should be based on an objective analysis of the hazards, rather than merely the perception of the risks involved. Once this has been accomplished, a reasonable means of controlling the hazards through experimental protocol, work practices, ventilation, use of protective clothing, etc., can be determined. It is important to realize that irresponsible prospective in laboratory work are extremely dangerous to self and surrounding.

In order to assess the hazards of a particular chemical, both the physical and health hazards of the chemical must be considered.

Before using any chemical, the material safety data sheet (MSDS) or other appropriate resource should be reviewed to determine what conditions of use might pose a hazard. Accidents with hazardous chemicals can happen quickly and may be quite severe. The key to prevention of these accidents is awareness. Once the hazards are known, the risk of an accident may"be reduced significantly by using safe work practices.

OBJECTIVES: It is well understood that in order to undergo holistic development as a student of science, laboratory safety has to be inculcated in the native approach to experimentation. Hence taking into consideration the importance

of laboratory safety as our topic of research rationale. Our main aim is to lay down general safety specifications and requirements and to provide primary inf()rmation for various safety issues and to promo~e awareness on safety.

Awareness: The following aspects are required to be considered regarding awareness of laboratory safety.
* Be alert to unsafe conditions and actions, and call attention to them so that corrections can be made as soon as possible.
* Label all storage areas, refrigerators, etc., appropriately, and keep all chemicals in
properly labeled containers.
* Date all bottles when received and when opened.
* Note expiration dates on chemicals.
* Note special storage conditions.

Be familiar with the appropriate protective measures to take when exposed to the following classes of hazardous materials like flammables, radioactive compounds, corrosives, biohazards, toxic, carcinogens, reactives and compressed gasses.
* Segregate chemicals by compatibility groups for storage.
* Be aware of the potential interactions of laboratory furniture and equipment with
chemicals used or stored in the lab. (e.g., are oxidizers stored directly on wooden shelving?)
* Post warning signs for unusual hazards such as flammable materials, biohazards or other special problems.
* Pour more concentrated solutions into less concentrated solutions to avoid violent reactions (Le., Always add acid to water; not water to acid).
* Avoid distracting any other worker. Practical jokes or horseplay have no place in the
laboratory.
* Use equipment only for its designated purpose.
* Position and secure apparatus used for hazardous reactions in order to permit manipulation
without moving the apparatus until the entire reaction is complete.

GENERAL GUIDELINES FOR PERSONAL SAFETY: The following guidelines are conductive for personal safety in the laboratory.

1. Conduct yourself in a responsible manner at all times in the laboratory.

2. Follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, ASK YOUR TEACHER BEFORE PROCEEDING WITH THE ACTIVITY.

3. Never work alone ih the laboratory. No student may work in the science classroom without the presence of the teacher.

4. When first entering a science room, do not touch any equipment, chemicals, or other materials in the laboratory area until you are instructed to do so.

5. Perfonn only those experiments authorized by your. teacher. Carefully follow all instruct.ions, both written' and oral. Unauthorized experiments are not allowed.

6. Do not eat food, drink beverages, or chew gum in the laboratory. Do not use laboratory glassware as containers for food or beverages.

7. Be prepared for your work in the laboratory. Read all procedures thoroughly before entering the laboratory. Never fool around in the laboratory. Horseplay, practical jokes, and pranks are dangerous and prohibited.

8. Always work in a well-ventilated area.

9. Observe good housekeeping practices. Work areas should be kept clean and tidy at all times.

10. Be alert and proceed with caution at all times in the laboratory. Notify the teacher immediately of any unsafe conditions you observe.

11. Dispose of all chemical waste properly. Never mix chemicals in sink drains. Sinks are to be used only for water. Check with your teacher for disposal of chemicals and solutions. 12. Labels and equipment instructions must be read carefully before use. Set up and use the equipment as directed by your teacher.

13. Keep hands away from face, eyes, mouth, and body while using chemicals or laboratory equipment. Wash your hands with soap and water after perfonning all experiments.

14. Experiments must be personally monitored at all times. Do not wander around the room, distract other students, startle other students or interfere with the laboratory experiments of others.

15. Know the locations and operating procedures of all safety equipment including: first aid kites), and fire extinguisher. Know where the fire alann and the exits are located.

16. Know what to do if there is a fire drill during a laboratory period; containers must be closed, and any electrical equipment turned off.

CLOTIDNG: The following are guidelines for appropriate clothing in a laboratory.

1. Any time chemicals, heat, or glassware are used, students will wear safety goggles. NO EXCEPTIONS TO THIS RULE!

2. Contact lenses may be not be worn in the laboratory.

3. Dress properly during a laboratory activity. Long hair, dangling jewelry, and loose or baggy, clothing are a hazard in the laboratory. Long hair must be tied back, and dangling jewelry and baggy clothing must be secured. Shoes must completely cover the foot. No sandals allowed on lab days.

4. A lab coat or smock should be worn during laboratory experiments.

ACCIDENTS AND INJURIES: The following measures should be undertaken in case of any accidents or injuries occurring in a laboratory.

1. Report any accident (spill, breakage, etc.) or injury (cut, bum, etc.) to the teacher immediately, no matter how trivial it seems. Do not panic.

2. If you or your laboratory partner is hurt, immediately (and loudly) yell out the teacher's name to get the teacher's attention. Do not panic.

3. If a chemical should splash in your eye(s) or on your skin, immediately flush with running water for at least 20 minutes. Immediately (and loudly) yell out the teacher's name to get the teacher's attention.

HANDLING CHEMICALS: The following guidelines are conductive while handling chemicals in a laboratory.

1. All chemicals in the laboratory are to be considered dangerous. Avoid handling chemicals with fingers. Always use a tweezer. When making an observation, keep at least 1 foot away from the specimen. Do not taste, or smell any chemicals.

2. Check the label on all chemical bottles twice before removing any of the contents. Take only as much chemical as you need.

3. Never return unused chemicals to their original container.

4. Never remove chemicals or other materials from the laboratory area.

HANDLING GLASSWARE AND EQUIPMENT: The following guidelines are conductive while handling glassware and equipments in a laboratory.

1. Never handle broken glass with Your bare hands. Use a brush and dustpan to clean up broken glass. Place broken glass in the designated glass disposal container.

2. Examine glassware before each use. Never use chipped, cracked, or dirty glassware.

3. If you do not understand how to use a piece of equIpment, ASK THE TEACHER FOR HELP!

4. Do not immerse hot glassware in cold water. The glassware may shatter.

HEATING SUBSTANCES: The following are guidelines for handling hot substances.

1. Do not operate a hot plate by yourself. Take care that hair, clothing, and hands are a safe distance from the hot plate at all times. Use of hot plate is only allowed in the presence of the teacher.

2. Heated glassware remains very hot for a long time. They should be set aside in a designated place to cool, and picked up with caution. Use tongs or heat protective gloves if necessary.

3. Never look into a container that is being heated.

4. Do not place hot apparatus directly on the laboratory desk. Always use an insulated pad. Allow plenty of time for hot apparatus to cool before touching it.

Hence summing it up, it has been comprehended by us that," An Assessment of Perspectives and Attitudes Towards Laboratory Safety" is imperative in studies of academic attitudes in urban Indian students. Hence this research endeavor was actualized.

MATERIALS AND METHODS:

A carefully structured questionnaire comprising of a series of questions regarding laboratory safety awareness, knowledge of laboratory safety symbols, recognition of laboratory safety as a mandatory module in scientific education, personal preferences and logistics. The questionnaire was divided into four sections, the first being based on exposure of the individual to laboratory regimen. The second set of questions was based on the education and awareness of the individual about laboratory safety. The third set of questions was based on laboratory safety practices carried out by the individual while working in the laboratory and the fourth set of questions was based on nodal attitude, which gave us the idea about the importance given to laboratory safety by the individual and the departmental laboratories which they are part off.

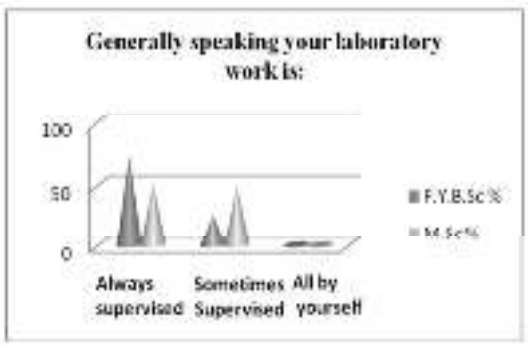
METHOD OF ADMINISTRATION:

Self administration of the questionnaire was carried out to the students of different urban colleges. The panelists were grouped on the basis of their educational qualification. The panelists where divided as undergraduates and postgraduates i.e. the F.Y.B.Sc's and the M.Sc's of a particular subject. The students had subjects like Microbiology, Biotechnology, Biochemistry, Chemistry and Physics as one of their academic subjects or their major subject. The panelists were briefed about the questionnaire and the reason of the survey. A "spontaneous response" of the panelists helped in giving us remarkable results. The results were analyzed and graphs were plotted for each question. The results were obtained in terms of percentages.

RESULTS AND DISCUSSION:

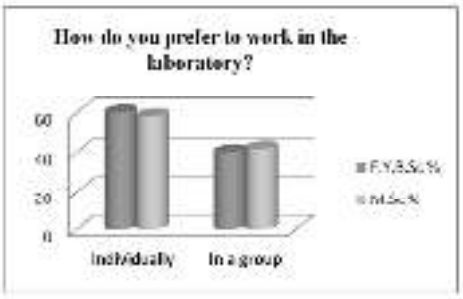
The results obtained from our survey were collated and analyzed. We prepared graphs to illustrate the responses we received.

A comparative study of the science students from different colleges in Mumbai studying at undergraduate level and post graduate students was done.



From the survey it was observed that 73% of the undergraduate students agreed that their laboratory was always supervised. However, in case of M.Sc students it was not always supervised. They had to do some laboratory work by themselves. About 60% of both the undergraduates and post-

graduates preferred to work individually. It was also seen that 95% of students from both levels followed a proper experimental manual / protocol

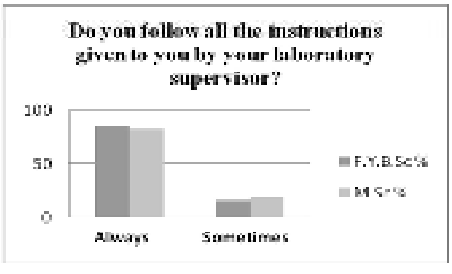


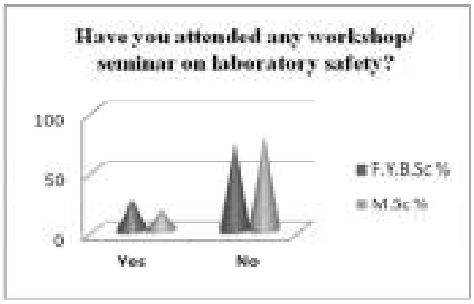




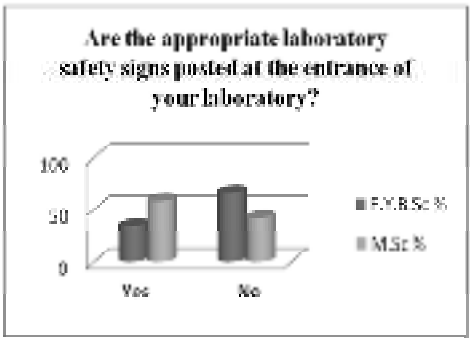
It was also seen that the students handling electrically operated instrunments at undergraduate level was 45% where as 95% of the posygradua tes use it very often. As compared to undergraduates (79.39%) the post graduate students(91 %) were more careful while handling glasswares. This may be since they are aware ofthe problems that can arise due to improper handling of glasswares

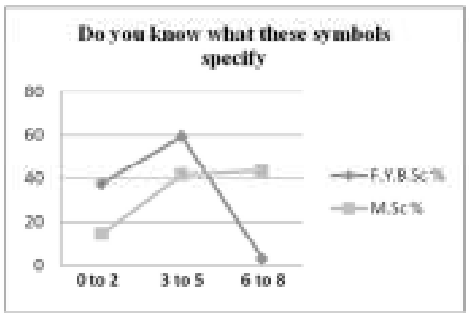
About 85% of the undergraduates and 82% of the post graduates said that they follow all the rules and regulations given to them by their laboratory supervisor. However, the percentage should increase in order to avoid any kind of accidents in future. It was very sad to see that only 20-30% of the students have attended an workshop on laboratory safety. A workshop is necessary so that the students become aware of the importance of laboratory safety.

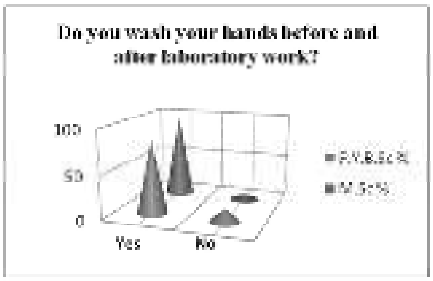




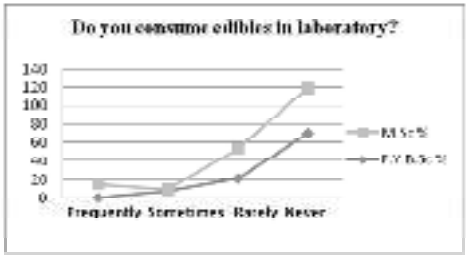
Also 30-50% of the students said that there are no laboratory safety signs posted at the entrance of their laboratory. When the students were told to identify some of the safety signs,such as medical aid, flammable, oxidising, recycle etc. only 3% of the undergraduates and 44% of the post graduates could answer more than 6 symbols out of eight.



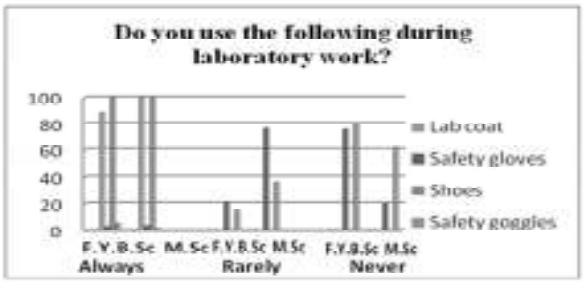




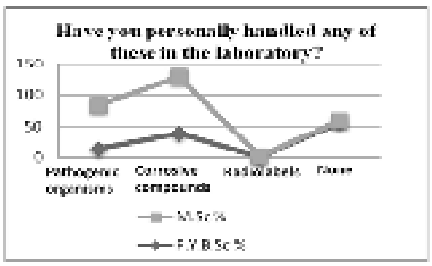
As for personal hygeine 85% of the undergraduates and 96% of the post graduates wash their hands properly before and after laboratory work.

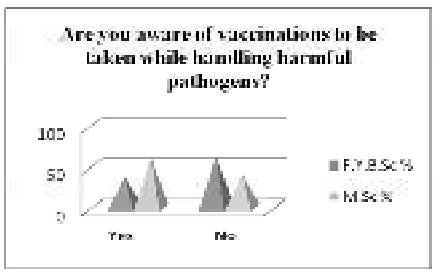


Also 70% of the undergraduates and 50% of the post graduates said that they do not consume edibles in the laboratory. It was also seen that both the students used labcoats during their work. Also most of the students used proper shoes. However, the use of safety gloves and safety goggles even at post graduate level was only upto 3%

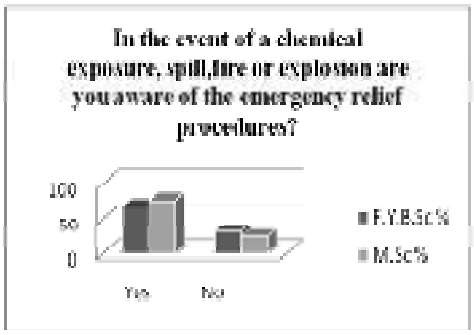


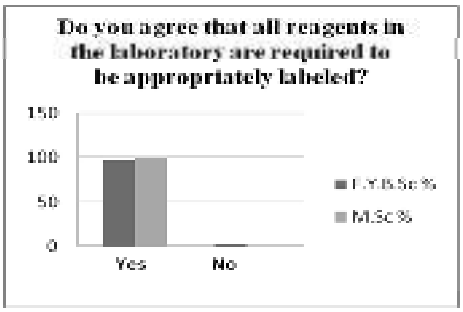
As compared to undergraduates(15-30%) most of the post graduates handle pathogenic organisms(71 %), corrosive compounds(91 %) etc. About 60% of the post graduates and 37% of the undergraduates are aware of the vaccinations to be taken while handling harmful pathogens.

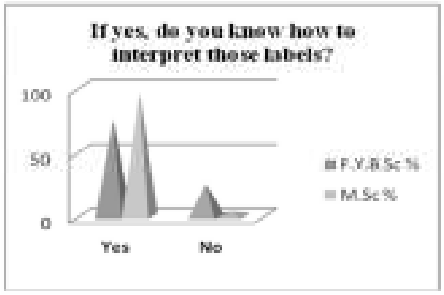


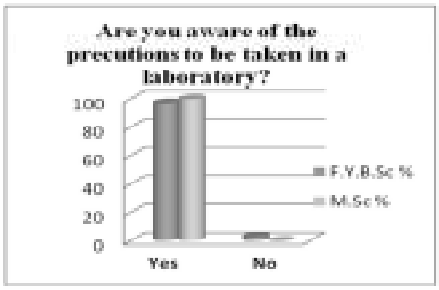


75% of the post graduates and 69% of the undergraduates were aware of the emergency relief procedures . Boh the postgraduates and the undergraduates believe that all reagents should be appropriately labelled. However most of the postgraduates and only 75% of the undergraduates could interpret the properly.

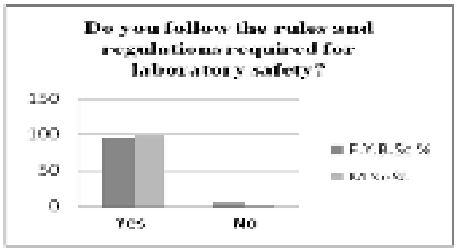


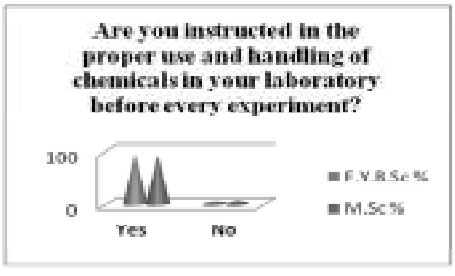




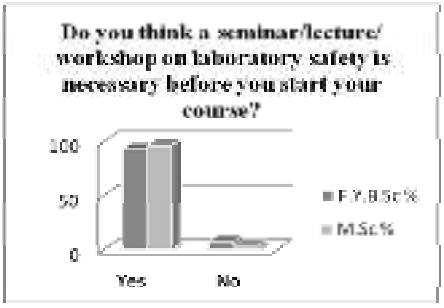


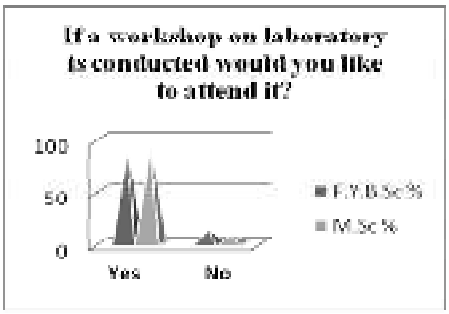
The students of both the levels said that they were aware of precautions to be taken in a laboratory and 96% of the undergraduates and99% of the postgraduates followed all the rules which are necessary in a laboratory.Beforestarting any laboratory experiment it is very necessary that the students are instructed in proper use of all the reagents and are familiar with the protocol. From our survey it was seen that 94% of undergraduates and 93% of the postgraduates were instructed properly.





When the students were asked if a seminar/ workshop is necessary before starting any course 93% of the undergraduates and 96 % of the post graduates said that it is necessary. However, when they were asked if they would like to attend it only 85% of the under graduates and 91 % of the post graduates said they would like to attend it.





These were some ofthe opinions that we collated.

REMEDIAL MEASURES AND CONCLUSION:

The results obtained by us have indicated that there is a serious lack of awareness amongst students in the area oflaboratory safety and students must be made more aware of the importance of laboratory safety.

Regular seminars/ workshops should be conducted for the students.

The students should be familiar with the location, use and limitations of the safety devices such as safety shower, spill cleanup materials, first aid kit, fire alarm and fire extinguisher.

As a result of this result research endeavor, we have visualized a laboratory safety workshop for the panelists as a token service from our end to the understanding of science.

Lastly, it can be said Better safe than Sorry.

Some rules are NOT made to be broken. That is true of the rules used in a science laboratory. They are really, truly for our safety and not our humiliation.

REFERENCES:

* Flinn Fax safety notice, 1987 by Flinn Scientific, Batavia, IL.
* Chemical Technicians' Ready Reference Handbook, G. Shugar, R. Shugar, L. Bauman, R.
Bauman, McGraw-Hill Book Co., 1981.
* Handbook ofChemistrv and Physics, 65th Edition, CRC Press, 1985.
* The Laboratory Safety workshop: http://www.1absafety.org/
* United States. OSHA. 1991. OSHA Laboratory Standard. U.S. Regulation 29 CFR 1910.1450 Implementation guide. Lewis Publishers, New York
* Armour, M.A. 1991. Hazardous Laboratory Chemicals Disposal Guide. CRC Press, Boston, MA. .
* National Research Council. 1981. Prudent Practices for Handling Hazardous Chemicals in Laboratories. National Academy Press, Washington, D.C.
* Journal of Chemical Health and Safety Volume 14, Issue 3, May-June 2007, Pages 14-19 .
* 1984. *Safety and Science Teaching.* 64p. Virginia State Dept. of Education, Richmond. Div. of Sciences and Elementary Administration.
* 1988. *Safety First in Science Teaching.* North Caroline State Dept. of Public Instruction, Raleigh. Div. of Science
* Garner, G.J., et al. 1987. *Science Safety Handbookfor California High Schools.* California State Dept. of Education, Sacramento.
* Bereano, P.L. 1984. Institutional Biosafety Committees and the Inadequacies of Risk Regulation. *Science Technology and Human Values* 9: 16-34. .
* Purvis, J., et al. 1986. Liability in the Laboratory. *Science Teacher* 53: 38-41 (April).
* Fisher, T.M. 1987. Allergens in the Lab. *Science Teacher* 54: 40-43 (Apr.).

THEME 2

PHYSICAL AND MATHEMATICAL SCIENCES (BHASKARIYAM)

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P.M.Sc:-1

Measurement of Kα and Kβ XRF Cross Sections for the elements Ag, Cd, In, Sn and Te excited by 122 keV photons

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[b] Department of Studies in Physics, University of Mysore, Manasagangothri, Mysore

1. Introduction: The characteristic x-rays form an important tool in the study of materials especially in atomic structure investigations. The x-ray fluorescence (XRF) cross section is the measure of the probability of emission of characteristic x-rays from the target. The number of x-rays emitted and primary vacancies produced are related by the fluorescence yield. The primary vacancies can be created through photoeffect. The XRF cross sections can be evaluated by measuring the x-ray intensities produced through photon interaction. Accurate data on *K*-shell XRF cross sections for different elements at various photoionization energies are required in a variety of applications including atomic, molecular and radiation physics studies, x-ray fluorescence surface chemical analysis, dosimetric computations for health physics, cancer therapy and industrial irradiation processing.

There are some measurements on *K*-shell XRF cross sections by using different photon sources by different methods (Bahn et al 1981, Garg et al 1985, Saleh et al 1987, Al-Nasr et al 1987, Casnati et al 1991, Budak et al 1999, Karabulut et al 1999, Durak 1998a, Durak et al 1998b, Durak et al 2001, Özdemir et al 2002, Baydas et al 2003, Gudennavar et al 2003, Sahin et al 2005, Han et al 2007, Cevik et al 2007).

The values of K XRF cross sections at all energies for different elements are very much needed in order to know the trend of variation of cross section with different energies. Therefore, we felt it worthwhile to measure Kα and Kβ XRF cross sections emitted as a result of the photoeffect interaction of 122 keV photons from ^{57}Co with the K shell electrons of the experimental target elements Ag, Cd, In, Sn and Te using a high resolution Si-PIN diode detector

2. Experimental details

The experimental set up used for the measurement of ***Kα*** and **K**β x-rays is depicted in Fig. 1.

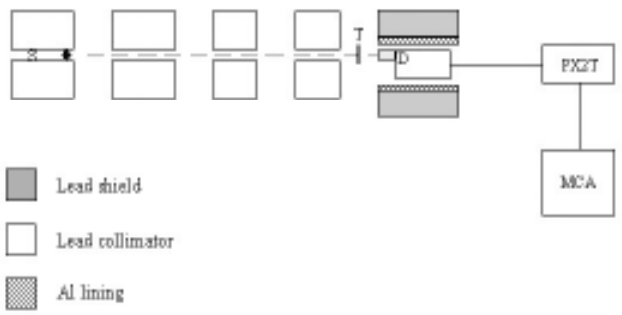


Fig. 1: Experimental setup: S - Source, T - Target, D - Detector, PX2T – Power supply and Spectroscopy amplifier, MCA-PC based multichannel analyzer

The geometry used in the present study satisfies good geometry condition. In this geometry photons emitted from 10 mCi ^{57}Co radioisotope are collimated using collimators and a well-collimated beam of photons is made to incident on the targets of thickness ranging from 20 to 55 mg/cm^2. The apertures of the collimating system, source and the detector are all adjusted to be in the same coaxial line for obtaining good geometry condition thereby avoiding the external secondary radiation from nearby objects and the interfering effects. Each target was exposed to collimated beam of photons and the emitted x-rays were detected using a thermoelectrically cooled XR-100T Silicon-PIN diode detector with an area 13 mm^2 and thickness 500 μm. Power to the detector was provided by the PX2T power supply. Si-PIN diode detector has a very high resolution and high efficiency for photons below 30 keV. The measured energy resolution of the detector system was 300eV FWHM at 6.4 keV. An aluminum filter of thickness 0.25mm was used with the ^{57}Co radioisotope to suppress the low energy photons emitted from the source. Also using an aluminum filter of suitable thickness 14.4 keV photons emitted from the source were absorbed. The target K x-ray spectra were recorded for sufficient long time to achieve the statistical accuracy. The pulses from the detector are fed to the preamplifier and the output pulses are fed to the spectroscopic amplifier for pulse shaping. The spectrum was acquired in a PC based 4K -multichannel analyzer for pulse height analysis. The K x-ray spectrum of Ag obtained is shown in Fig.2. A clear separation of Kα and Kβ peaks can be observed from the spectrum. The number of Kα and Kβ x-rays for different elements were estimated by fitting a Gaussian to the respective peak in the spectrum. The number of x-rays so obtained was corrected for target self-absorption and efficiency of the detector. The corrected number was then used to calculate the XRF cross-sections for different targets by estimating the incident number of photons and the number of atoms exposed to the gamma ray beam in the target.

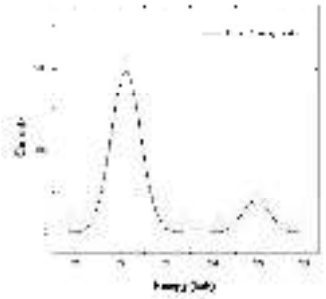


Fig. 2: Resolved *K* x-ray spectrum of Ag

3. Results and discussion

The experimental K XRP cross-sections $\sigma_{K_i}^{X}$ r a given element at energy E were calculated using the relation,

$$\sigma_{K_i}^{X} = \frac{N_{K_i}}{NSG} \qquad (1)$$

where, $N_{K_i}(i = \alpha, \beta)$ is the number of K x-rays emitted in the interaction per unit area in unit time, N is the number of atoms present per unit area in the target, SG is the number of photons incident on the converter foil per unit area in unit time. S is the source strength and G is the geometry factor between the target and detector.

The K XRF cross sections can be theoretically estimated using the relation

$$\sigma_{K_i}^{x} = \sigma_K^P \omega_K F_{K_i} \ (i = \alpha, \beta)$$

where, σ_K^P is the *K*-shell photoeffect cross section for the given element, ω_K the *K*-shell fluorescence yield. The fractional emission rates F_{K_i} for K_i (i = α, β) group of x-rays were calculated using the relations

$$F_{K_\alpha} = \left[1 + \left(\frac{I_{K_\beta}}{I_{K_\alpha}}\right)\right]^{-1} \text{ and } F_{K_\beta} = \left[1 - F_{K_\alpha}\right]$$

where $\frac{I_{K_\beta}}{I_{K_\alpha}}$ s the intensity ratio of **K**β and **K**α x-rays.

Using the K-shell photoeffect cross sections from Scofield (1973), intensity ratios from Scofield (1974a and 1974b) and K-shell fluorescence yields from Krause (1979) the **K**α and **K**β XRF cross sections were calculated.

The experimental and theoretically calculated **K**α and **K**β XRF cross sections using intensity ratios based on DHS and DHF models are tabulated (Table 1, 2) along with the measured values of Durak et al (1998). These values are also shown graphically (Fig.3)

The present ***K**α* XRF cross sections show agreement with the theoretical and Durak (1998a) and Durak et al (1998b) values within the range of experimental uncertainty. The ***K**β* x-ray production cross sections show good agreement in the case Ag and Sn with the cross sections using the intensity ratios based on DHF model with in the experimental uncertainties. However the deviation of about 11% was found with the values using on DHS model for elements Sn and Te.

Estimation of errors: The error due to counting statistics was kept below 0.3 % by accumulating 10^5-10^6 counts within the photo peak. Apart from the counting statistics, the other possible sources of error in the present method are sample impurity, non-uniformity of the sample material and the dead time of the counting instrument. The target used was 99.9% pure and made from thin uniform sheets. Therefore the error due to sample impurity and non-uniformity of the sample material was considered negligible. In the multichannel analyzer used in the present study, there was a built-in provision for dead time correction. The percentage dead time correction was always kept below 2%. Thus, the overall error in the present measurements was about 3% to 4%.

Table 1: **K**α x-ray production cross sections (b/atom) at 122 keV (errors up to 4%)

Z	Element	Experimental		Theoretical (Scofield)	
		Present	*Others*	*DHF*	*DHS*
47	Ag	75.85	+76.24	75.72	76.77
48	Cd	83.87			84.48
49	In	92.08	*95.20		92.51
50	Sn	101.47	*105.23	99.61	101.00
52	Te	114.17			119.20

+Durak (1998a), *Durak et al (1998b)

Table 2: **K**β x-ray production cross sections (b/atom) at 122 keV (errors up to 4%)

Z	Element	Experimental		Theoretical (Scofield)	
		Present	Others	DHF	DHS
47	Ag	14.90	*17.22	16.13	15.08
48	Cd	16.73			16.85
49	In	18.66	*24.40		18.75
50	Sn	20.91	*23.01	22.21	20.82
52	Te	24.34			25.41

*Durak et al (1998b)

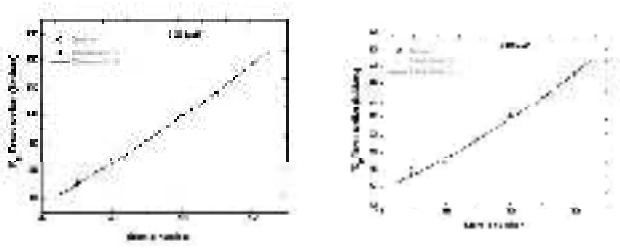


Fig. 3: *Plots of* ***K**α and **K**β*** x-ray production cross section as a function of atomic number

References

Al-Nasr I A, Jabr I J, Al-Saleh K A and Saleh N S (1987) Appl. Phys. **A43**, 71.

Bahn C, Chaturvedi S N and Nath N (1981) X-Ray Spectrom. **10**, 128.

Baydas E, Sahin Y and Büyükkasap E (2003) J. Quant. Spect. and Radiat. Trans. **77**, 87.

Budak G, Karabulat A, Demir L, and Sahin Y (1999) Phys. Rev. **A60**, 2015.

Casnati E, Baraldi C and Tartari A (1991) Phys. Rev. **A44**, 1699

Cevik U, Kaya S,Ertugral B, Baltas H and Karbidak Karadeniz S M (2007) Nucl. Instrum. Meth. B **262**, 165.
Durak R (1998a) Physica Scripta **58**, 111.
Durak R, Erzeneoðlu S, Kurucu Y and Sahin Y (1998b) Radiat. Phys. Chem. **51**, 45.
Durak R, Özdemir Y (2001a) Radiat. Phys. Chem. **61**, 19.
Garg M L, Mehta D, Kumar S, Mangal P C and Trehen P N (1985) X-Ray Spectrom., **14**, 165.
Gudennavar S B, Badiger N M, Thontadarya S R, Hanumaiah B (2003) Rad. Phy. and Chem. **68**, 721.
Han I, Sahin M, Demir L and Sahin Y (2007) App. Rad. and Isotopes **65(6)**, 669.
Karabulat A, Budak G, Demir L, and Sahin Y (1999) Nucl. Instrum. Meth **B155**, 369.
Krause M O (1979), J. Phys. Chem. Ref. Data **8**, 307.
Krause M O, Nestor C W, Sparks C J and Ricci E (1978) Oak Ridge National Laboratory Report ORNL-5399.
Özdemir Y, Durak R, Elif Ö Z (2002) Rad. Phy. and Chem. **65**, 199.
Sahin M, Demir L and Budak G (2005) Appl. Radiat. Isot **63**, 141.
Saleh N S, Al-Saleh K A (1987) Appl. Radiat. Isot **11**, 975.
Scofield J H (1973) UCRL, Report 51326, Lawrence Livermore Lab., Livermore, CA (unpublished).
Scofield J H (1974a) Phys. Rev. **A9**, 1041.
Scofield J H (1974b) At. and Nucl. Data tables **14**, 121.

P.M.Sc:-2

THE CONCEPT OF MIND IN VEDIC SCIENCES – AS A RULER AND AN ARCHITECT OF HUMAN LIFE

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Introduction: मन एव कारणं मनुष्याणां केवलं बन्धमोक्षयोः
For the human life mind is the means for controlling all the attachments and detachments of life.

It is well established that no other organ can either dominate or supersede the mind. While analysing one's role in his life in a wide spectrum such as a master, servant, engineer, sculptor, scientist, teacher, politician, enemy, friend and so on, in the society, one would be surprised to see a man violently reacting at one instance and behaving himself pretty soft in another moment. We encounter situations many times where a person draped in immense sorrow would be putting up a mask of cheer with grinning, though it finds itself in a conflict. It is possible to attribute these observations, by a tracing them in the mirror of wisdom, to the results of activities and characteristics of the mind that can be analyzed by scientific approaches.

The practical and philosophical experiences are the two ways for the 'search of the truth'. The skill adopted in seeking a goal is referred to as the technology. The practical adaptation of science and technology is termed as Engineering. Day-by-day this field has tremendously stretching its span, making revolutionary paths in the social life.

It is narrated in the Vedic Sciences that proper application of philosophical experience can be had through super sensual perspectives like emotional restrain दम, knowledge विद्या, internal power – अन्त ाक्ति, intelligence – धीः, Non-aggressiveness अक्रोध, and wisdom बुद्धि. By incorporating these aspects appropriately and effectively one can build a healthy and stable mind and thereby a good personality that lays the foundation to a good society which is the most essential part of the global peace.

Taking these view points to consideration, the analysis and the concept of mind turns out to be a significant factor. It is intended in this paper to bring out aspects related to these points with logical and substantiating facts.

The Aspects Concerning the Concepts and Behaviour of the Mind

1. Recognition of Mind and Its Role in Vedic Sciences

Kathopanishad says –

आत्मानंरथिनं विद्धि ारीरं रथमेव तु ।
बुद्धिं तु सारथिं विद्धि मनः प्रग्रहमेव च ।। (कठ. उ. 3,3)

With the Soul as the owner of the chariot, body as the chariot, wisdom as the charioteer, mind is the rein. The body that can be considered as a natural machine is referred to as a chariot. Under the control of the mind, wisdom and soul are the core and powerful inner elements of this chariot and mind keeps its special characteristics in tuning up the wisdom and manages the lifestyle on the whole. In this sequence of descriptions one can bring out the feature of the mind that uses its technique of casting the human behaviour. Mind being the interpreter as well as controller of external senses, the senses would be wandering out anywhere if the mind loses its grip on them and the results would be the root cause for the imbalances of the social activities.

2. Significance of the Mind in Psychology

The body and mind are inter-influential elements of the human system. A physical decease could affect mind's health and a mental disorder or excitement could cause physical uneasiness. One can recall what happened to Arjuna, the great warrior when he sees his relatives destined to be killed by him in the battle? He declared it himself as Adharma, a sinful act. But Sri Krishna narrated him on the finer aspects of his duty and motivated him with the Bhagavat-Gita that changed Arjuna's attitude allowed to have the same situations to be interpreted as a Dharmic or religiously accepted path, and redeemed himself to proceed as his duty. One can clearly note here that in this entire episode how the training of the mind had played the role in the changing the actions of extreme natures. In this state of mind, it is said to have attained the discriminative stage that leads for the right deci

sions to be made. This transformation is possible by adapting the crucial technique of invoking the special characteristics of the mind. While psychology is the style of functioning of mind, the approach and control of mind therefore is self descriptive in one's behaviour and thereby becomes the integral and significant part of one's psychology.

3. Analysis of the Mind and its Adaptation

It is a general experience for all that inverting or conflicting the opinions at almost all situations, like – 'shall I do it or not, shall I speak it or not' - a confusing and uncertain feeling that roams in the mind, as a natural phenomenon . Why should it happen like that? When scientifically analyzed and classified broadly on its behaviour the mind has a twin-hold characteristic – a noble or 'clean' mind and another perverted or 'dirty' mind. Technically it leads to say that mind sets in two ways – i) one by self behaviour that functions in a 'free zone' and another by imposed behaviour that is result of pressurized or 'confined zone'.

4. Clean or Noble Mind ुद्ध मनः

In Kathopanishad it is said that –

यस्तु विज्ञानवान् भवति युक्तेन मनसा सदा ।
तस्येन्द्रियाणि व यानि सदश्वा इव सारथेः ॥ (3 –6)

One who makes use of the logical and discriminative power for becoming scholar, he would have his senses under control like the good horses for a charioteer.

Bhagavadgita provides a clarification on the noble mind like this –

अहिंसा सत्यमक्रोधस्त्यागः ान्तिरपै ुनं । दया भूतेष्वलोलुप्त्वं
मार्दवं ह्रीरचापलं ॥
तेजः क्षमा धृतिः ौचमद्रोहो नातिमानिता । भवन्ति सम्पदं
दैवीमभिजातस्य भारत ॥ (16 2,3)

Non-violence, truthfulness, non-aggressiveness, dedication, peacefulness, kindness towards all creatures, modest behaviour, shyness, non-desire, courageousness, forgiveness, braveness, cleanliness, softness, devoid of egoism are considered as the heavenly wealth for a human mind. If a mind has acquired and practices these aspects, that state of mind is maintained for ever, it is considered as noble mind or clean mind.

5. Unclean Mind – अ ुद्ध मनः

दम्भो दर्पो अ्रभमानश्च क्रोधः पारुष्यमज्ञानं सम्पदमासुरीम् ।
न ौचं नापि चाचारं न सत्यं तेषु विद्यते ॥ (भगवद्गीता 6,7)

For such minds that is occupied with improper or perverted knowledge, it gets reflected with ego, arrogance and temperaments that form the basis of wild behaviour and in such a state of mind one would not respect proper code of conduct and would not truthful in his attitudes. Such a perverse status is considered as unclean mind, a demon's mind. One who processes these virtues is considered to be uncultured and could be attributed surely to be harmful for the society.

One important aspect of studies of psychology indicates that the elements of above categories of clean and unclean minds will be present in every person. The dominating category decides the overall state of the mind and behaviour is the resultant of the two components. Mind would control the senses on the preferences derived from the culture built into the individual. It amounts to state that based on the culture one has, the man can either becomes noble, gentle, eccentric, rude or cruel. He can turn out to be a sculptor of a beautiful society making the world to be heavenly or can turn out to be a destroyer of it spoiling it and rendering it to a hell. These are the possible states or positions of the mind is described as the मनोसंकल्प the theme of the mind.

6. Unsound Mind अस्वस्थ मनः ।

Roguishness विकृतमनः and madness उन्माद are two types of unsound mind.

i) Roguishness – क्रोध or anger. By making use of all means of tricks and deceptions to fulfil some desire and considering it as more comfortable. In this path, one would indulge in activities that could result in harmful or un-realizable end points and such failures would further reduce the mind to get induced to overcome the failure from all possible ways. When such efforts fail consistently, his mental state would turn into a rogue position that cannot be easily controlled. The result would be a dangerous to all, including to the self in the long run and more surely devastating to the society. Such living becomes heavy to the society. In this state of mind, it would be obsessive and fails to recognize the need for logical and introspective analysis leading to making his approach more erroneous. This condition is not easy to be cured by external medicines or other advices.

ii) Madness of the mind उन्माद Further a step ahead of the roguishness and associate with depression or frustration is considered as madness. The incidence of some deep instance that shocks and spoils the balance in the state of mind would result in madness. Influence by any instance of severe nature, could it be instances like – enjoying or 'sinking' in that feeling only, crying for a loss or non-having, or failure from a roguishness or cheating, illusion by accepting a false instance as true, extreme expressions for no specific cause like laughing or crying are known to be the typical characteristics of the madness. Restoring from the state of madness to a normal condition is the prime and possibly risky activity of a psychiatrist and is generally attempted by external medicines that bring down activities of mind and allows itself to 'forget' the severities of 'wrong' thinking.

क्षणे तुष्टाः क्षणे रुष्टाः तुष्टाः रुष्टाः क्षणे क्षणे । अव्यवस्थितचित्तस्य
प्रसादोपि भयंकरः ॥

In this Subhashita, it describes the excited mind as – one whose mind is oscillating in its behaviour from pleasing to aggressing frequently, it is too dangerous to be associated even in his pleasing state.

7. Control over the Mind मनोनिग्रह

ातपथब्राह्मण ळज्न्त्र – कामः संकल्पो विचिकित्सा श्रद्धा अश्रद्धा धृतिः अधृतिः ह्रीर्धीर्भीरित्येतत् सर्वं मन एव । तस्मादपि उपत्स्पृष्टा

विजानाति ॥

Obsessive desire, ability to build themes, logical inference, ability to focus interest with tolerance, negligence, courageousness with boldness, cowardice, shyness, intelligence and fright are categorised to be different states of mind. The mind has the ability to bear all these features are therefore turn out to be components of every human being. If the mind attains the state of depressed state – that leads to a moody and unrealistic thinking mode, then the person feels as if the society is disgraceful and will not recognize him even though he has done a noble job. He gets such a feel possibly due to the jealousy treatment from others or when others tease his deeds. This would result in inertness and inactivity. Duryodhana's character is a good example to represent this. Taking these points in lead, it is inferred that only the holding a mental restraint over senses would prevent reaching such disastrous conditions. It is much like the well known statement – prevention is better than a cure. It is makes to point that all categories of the mind should be kept in control and balance, since they are inherent to the mind, by 'training' it with the different concepts like well accepted and good practices of culture, religion and duties. This is much like a warrior or an athlete would practice when he is not in the field and can only make use of such practices for his success. It is imperative that practicing the control of mind is the best solution for creating a healthy atmosphere in the society. This is the unique characteristic only the mind can exhibit and is termed as mental power मन ाक्ति ।

8. Mean As of Developing the Mental Power

a) Concentration – This is the unique capability that only mind can have. This state can be attained through consistent practices like Yoga therapy that brings in the required balance. Pathanjali interprets Yoga as चित्तवृत्तिनिरोध – restraint over the mental aberrations or control over the mental activities. Bhagavadgita clarifies this aspect as xÉqÉÎxjÉÌiÉ – a state of balance or stability in emotional or depressed conditions. Kathopanishad clarifies तां योगमिति मन्यन्ते स्थिरामिन्द्रियधारणाम् । अप्रमत्तस्तदा भवति योगो हि प्रभवाप्ययौ ॥ (6 11). Attaining the stability or the ability to restrain over senses is named as Yoga. When this is adapted, the mental state would make it to be in विज्ञानमयको ा discriminative cell – as stated in Taittariyopanishad. Patanjali has described that the path to attain the Yogic state as अभ्यासवैराग्याभ्यां तन्निरोधः amounting to mean that Yoga can be accomplished through regular practice and imposing of a sense of non-attachment. These are the instruments human mind can adapt with which the ability for concentration can be developed.

b) By implementing good habits, mind can be kept in a sound and healthy state. It is a well known statement – "idle mind is a devil's workshop". With lack of work assigned to the mind, it would create a complicated situation, generally a loss in concentration and unhealthy thinking. This happens because of biologically intrinsic considerations the mind cannot be kept 'jobless' at any cost.

c) Non-excitement on the exclamations - such as an over-joy or an over-agony is one of the most essential features to keep the mind in the sound health. In a good example for this in Ramayana, while hearing the imposition of exile to forest, considered equivalent to a death sentence, Rama did not get agonised एतदप्रियममित्रघ्नो वचनं मरणोपमं श्रुत्वा न विव्यथे रामः–(2–19–1). His behaviour here stands out as one of the reference marks for the balance of mind for the mankind.

d) Establishing good humanitarian relation, dedication, non-cruelty, non-theft behaviour, control over senses, truth, non-aggressiveness are known to be the best techniques to enhance the mental power.

e) In the background of honest duty, prompting the mind with great enthusiasm is considered as an essential and successful exercise for healthy mind. In this situation, to uphold the social norms, as a cause for benefit of the large, even an act of aggressiveness will not forfeit the nobility of the act. In Ramayana, we see many instances of such acts, when Bharata's shows up disobedience to Kaikeyi, when Lakshmana becomes aggressive before Bharata's arrival in the forest, when Rama loses his temperament anguished towards Samudra Raja that shows each of the acts were emotionally strong but did not deviate any code of conduct thereby displaying a good balance of mind.

उत्तिष्ठत जाग्रत प्राप्य व्रान् निबोधत । क्षुरस्य धारा नि ाता दुरत्यया दुर्गं पथस्तत् कवयो वदन्ति॥

A scholarly statement that tells that though the path appears to be tough enough to cross, the approach for mind should be to arise, awake, acquire the knowledge through great preceptors which is comparable for walking on a knife edge.

By adapting the above techniques on the mind, and deploying it properly, it is well inferable that there is no doubt that the human atmosphere of the whole world can face less or no problems. But on the contrary in today's world, what is happening in this context is something a strong deviation leading to the troubles we are encountering that the mankind should possibly feel ashamed of. A few recent instances of activities with such uncontrolled minds, if we glance:

i. A teacher, who is not at all fit to name his profession, did not hesitate to kill more than 20 young women for the fulfilment of his sexual pleasure – a terrible example of loss of mental balance on obsessive desire.

ii. A taxi driver who was previously a trusted office-boy killed all the three family members – example of greed.

iii. Politicians, MLAs, Ministers sitting on the ruling seats are quarrelling, abusing, corrupting and cheating, sowing the immortality in public, at the cost of public. Their struggle is to hold the seats rather than to solve the problems – an example of shamelessness and greed.

iv. Naxalite terrorists do not hesitate to smash off not only the human lives, but also the natural and wealthy treasures – an act of roguishness.

v. Unabated Corruption we encounter daily. We see that the so called noble profession of educational field itself is turn

ing into a business, most often prejudices dominate the decision making, and have improper assignments. The other areas possibly find no bounds in these aspects. The greediness is possibly is ever increasing to the extent that we may need to search for acts of morality, honesty and acts of nobility.

In this situation it is one of the most important factors that we can observe is that there is a huge value addition for the mankind in establishing the global peace and one of its best approaches would be by tuning the mind set-up.

Conclusion

विज्ञान सारथिर्यस्तु मनः प्रग्रहवान् नरः। सो ध्वनः
पारमाप्नोति तद्विष्णोः परमं पदम्।। (कठ 3–4)

In the Kathopanishad it is stated clearly that – one who is having the knowledge as a charioteer, mind as the rein he will certainly cross the worldly worries that is considered as the Lord Vishnu's abode, one of the highest esteems one could think of.

Day-by-day In today's competitive world, the imbalance in the state of mind is spoiling the global peace possibly in an arithmetic progression, and is enhanced possibly exponentially due to the spread of Information Technology and Bio-Technology. Vedic sciences give immense solutions for the stability of mind that are known to be universal and valid for all time. It is observed that the scientific technologies change quite frequently, the concept of mind derived from the Vedic Sciences has remained unaltered and valid even from the age of the traces of biological life. By a tactical training of the mind, man can re-build an excellent world. In this aspect one can infer the significance of the concept of the mind, its role as Ruler and Architect of the human life. Mind is a good Engineer and a wise technologist in framing the noble and cultured society in the world.

ॐ वाङ मे मनसि प्रथिष्ठिता मनो मे वाचि प्रथिष्ठितम् । आविरावीर्मा एधि । वेदस्य म आणीस्थः श्रुतं मे माप्रहासीः अनेनाधीतेन अहोरात्रान् सन्दधामि । ऋतं वदिष्यामि । सत्यं वदिष्यामि । तन्मामवतु । तद्वक्तारमवतु । अवतु मां, अवतु वक्तारं ।
ॐ शान्तिः शान्तिः शान्तिः ॥

O Almighty! Let my speaking organ lay in mind, and the mind in the tongue. O! The speach and mind, the personifications of the God, bless me with knowledge. With a great Asheervadams, let me not forget the knowledge that I have acquired so for. Really I am telling you the truth! Let that truth save me and the narrator. Let the peace spread all over the world.

THEME 3

AGRICULRURE HORTICULTURAL FISHERY & VETERINARY SCIENCES (PARASHARIYAM)

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A.H.F.V.Sc:-1

EMPOWERMENT OF RURAL WOMEN THROUGH INCOME GENERATING ACTIVITIES

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Abstract : The study was conducted in Bidar district of North Eastern Karnataka to know the extent of empowerment of rural women through income generating activity. The extent of gain in empowerment through income generating activity was 24.6 percent. Education, land holding, income of the family and social participation and mass media participation showed highly significant association with empowerment whereas, age, marital status, caste, family type and family size had no association with empowerment of rural women.

Introduction : Women constitute half of the humanity, even contributing two thirds of worlds work hours. She earns only one-tenth of the total income and owns less than one-tenth of the worlds resources. This shows that the economic status of women is in pathetic condition and this is more so in a country like India. Empowerment is a multi dimensional process, which should enable women or group of women to realize their full identity and power in all spheres of life (Sureharao and Rajamanamma, 1999).

Economic indepedance is one of the means to empower the women. Enhancing womens economic productivity is an important strategy for improving the welfare of 60 million Indian households living below the poverty line (Dwarkanath, 1999). The existence of women in a state of economic, political , social and knowledge disempowerment is known to be a major hindrance to economic development. Income generating activities are considered as those initiatives that affect the economic aspects of people's lives through the use of economic tools such as credit. The self-help group provides an appropriate platform for initiating and sustaining income generating activities for the rural women. There is a need assess the extent of empowerment of rural women through income generating activities and to study the relationship between empowerment and personal characteristics of rural women.
Empowerment can give power to women to have control over resources and ideology, greater self-confidence and an inner transformation of one's consciousness that enables one to overcome external affairs. Empowerment of women is critical not only for their own welfare but also for the development of the country.

India envisions a future in which Indian womens are independent and self-reliant. In various national policies and developmental programmes, emphasis has been given on organizing women in Self Help Groups and thus, marks the beginning of a major process of empowering women. It is also felt to equip the the women with necessary skills in the modern trades, which could make them economically self-reliant. Women must be empowered by enhancing their awareness, knowledge, skills and technology use efficiency, thereby, facilitating overall development of the society. The concept of Self Help Groups (SHG's) is proving to be helpful instrument for the empowerment of women. SHG is an organization of rural poor, particularly of women that deliver micro credit to undertake the entrepreneurial activity.

Material and methods: Bidar district of North Eastern Karnataka was selected purposefully for the study. Ex-post facto research design was used for conducting the study. The district consists of five talukas, among these, three talukas were selected for the study based on highest numbers of self-help groups. From each taluka, four villages were selected by using the same criterion.

From each selected village, two self-help groups were selected and from each self-help group, five rural women who are involved in income generating activity were selected. Thus, the total sample size was one hundred twenty. An empowerment index was developed for the study by taking into account, the dimensions of empowerment. Data was collected personally by administering the standardize interview schedule and analyzed by using mean, standard deviation, 't' test and chi-square test. The empowerment index was used to know the extent of empowerment before and after taking up income generating before and after taking up income generating activity.

Results and Discussion :A glance of Table-1 highlights the extent of empowerment in Bidar district through income generating activities. There was 25.7 percent gain in empowerment in Bidar taluk, it was 25.0 and 23.1 percent in Aurad and Humnabad taluks, respectively. The overall gain in empowerment in Bidar district was 24.6 percent. The 't' values revealed the significant difference in mean values of empowerment of rural women before and after taking up income generating activity. This clearly revealed the fact that, income generating activity significantly contributed for empowerment of rural women. Further, the data also revealed that there was 24.6 percent gain in empowerment after taking income generating activity. Through analysis of components of empowerment revealed that considerable percentage of rural women became functionally literate and owner of house for being beneficiary of Government programmes which initiated income generating activity. Apart from this, women were able to earn money through income generating activity which facilitated them to control money earned by them independently. It also enhanced saving contributed significantly for gain in empowerment.

In addition, the accessibility of rural women to formal financial credit institutions was also enhanced due to taking up of income generating activity. Being a member of SHG, respondents participated in various extension activities like trainings, meetings, educational tours, demonstrations, exhibition and Krishimela.

Among the respondents of the Bidar district, the gain in empowerment of the respondents of Bidar taluk was slightly higher. Rural women of Bidar taluk have easy access to information on income generating activities and other enterprises since the Krishi Vigyan Kendra, Bidar is situated near Janawad.

The table-2 highlighted that education showed highly significant association with empowerment. Women with better education improves awareness, decision making power, understanding skill and knowledge involved in the income generating activities, marketing behavior and also self confidence

The data presented in table-2 indicated highly significant association between the land holding possessed by the family of respondents and empowerment. It is a fact that individuals with big land holding have better socio-economic status, opportunity for formal education and exposure to mass media leading to acquisition of knowledge and skill involved in different income generating activities, which will encourage saving habits and control the money earned by her. Income of the family had highly significant association with empowerment. When the family income is more, women can invest in different income generating activity and can earn more and become economically independent.

The results highly significant association between social participation of rural women and their empowerment. It is because of increased general exposure due to their social participation and the awareness of women rights. Social urge of women has been satisfied and their self-confidence has naturally improved. These are the major contributing factors for the empowerment of women. Women participation in mass media had highly significant association with their empowerment. It was very true that Television and radio are important source of information at the awareness stage influencing even on uneducated rural women. With the increased mass media usage women will be aware of so many important things, which ultimately lead attitude change and empowerment. It may be because of their improved skill to take up independent income generating activity, which may further lead her to control the income earned by her, enhance the saving habit, social participation and communication skill. However, age, marital status, caste, family type, family size and material possession had no association with empowerment of rural women. It was evident from the study that income generating activity significantly contributed for gain in empowerment of rural women. Income generating activity is an important tool for empowerment of rural women. The socio-economic characteristics like education, land holding, income of the family, social participation, mass media participation and number of trainings have significant influence on empowerment of rural women.

References :

PREETI SHARMA AND SHASHI KANTA VARMA, 2008, Women Empowerment through Entreprenerial Activities of self help groups. Indian Research Journal Extension Education. 8(1) : 46-51

DWARAKANATH, H D., 1999, DWCRA in Andhra Pradesh. Kurukshetra, 47(12) : 14-18

Table 1.Extent of empowerment of rural women through income generating activities

Taluks	Index Value (Before)	Index Value (After)	Gain in empowerment	't' value
Bidar	15.70	41.40	25.7	17.66**
Aurad	19.80	44.80	25.0	28.41**
Humnabad	17.10	40.20	23.1	25.66**
Total (combined)	17.53	42.13	24.6	38.14**

** : Significant at 1% level of probability.

Table 2. Relation between empowerment and socio-economic characteristics of rural women.

Sl No.	Socio-economic characteristics	X^2 values
	Age	2.20^{NS}
	Education	72.46**
	Marital status	6.81^{NS}
	Family type	0.87^{NS}
	Caste	5.64^{NS}
	Land holding	24.43**
	Family size	1.22^{NS}
	Income of the Family	25.46**
	Social participation	29.96**
	Mass media participation	13.46**
	Trainings undergone	24.83**

A.H.F.V.Sc:-2

RESPONSE OF VIGNA RADIATA AND VIGNA UNGUICULATA SEEDLINGS TO DISTILLERY EFFLUENT.

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INTRODUCTION: Distilleries are one of the major agro based revenue earning industries that produce ethyl alcohol. Presently there are 319 distilleries in India producing 3.25 billion litres of alcohol annually (Uppal, 2004). These industries use sugarcane molasses as a raw material for the production of alcohol by fermentation. The amount of waste generated from distilleries is nearly 15 times the total production of alcohol. There are 39 distilleries in the state of Karnataka with an installed capacity of 282.5 million litres of alcohol production generating 3672.5 million litres of spent wash (Sugar India, 2005). The state earns more than 3000 crores by way of excise duty annually. Studies have been shown that distillery effluent contains large quantities of plant nutrients in addition to high organic load and dissolved organic matter.

The practice of applying PME in agricultural fields either as pre or post sown has found to be beneficial. Most field crops have shown positive response to PME effluent application with irrigation water (Chhonkar et al., 2000).

The research efforts are geared towards assessing the agricultural potential of treated distillery spentwash. Using industrial effluent for irrigation purpose is a beneficial proposition. Non judicious use of spent wash has shown to adversely affect the growth of the crop and soil properties by increasing the salinity of the soil (Jagdale and Savanth, 1979).Considering this a study was undertaken to know the effect of distillery effluent on *Vigna radiata* and *Vigna unguiculata*

MATERIALS AND METHODS : The effluent samples were collected from the Chamundi Distilleries located at Maliyur, T. Narasipur Taluk. Mysore District. The physico-chemical characteristics of the effluent were analyzed by adopting the methods prescribed by the American Public Health Association (APHA, 1985).

Germination studies: The germination studies were carried out in the laboratory at Department of Studies in Botany, Manasagangotri, University of Mysore, Mysore, according to the standard methods recommended by International Seed Testing Association (ISTA, 1985). The seed samples of certified varieties of V. radiata var (Pusa baisaki) and V. unguiculata var (CS1) were procured from The Regional Agricultural Institute University, V.C. Farm, Mandya, Karnataka.Ten healthy seeds of the test crops were kept in sterilsed petridishes in replicates containing equal amount of sterilized soil.10 ml of different concentrations 25,50,75,100%v/v, symbolically represented as T_2, T_3, T_4.and T_5 and tap water served as control (T_1). Germination percentage was recorded on 15th day of germination. The root and shoot length was measured. Vigour index of the seedlings were calculated as per the method of Abdul Baki and Anderson (1973).

RESULTS

The characteristics of untreated, treated spentwash were analysed and the results are given in Table –1.

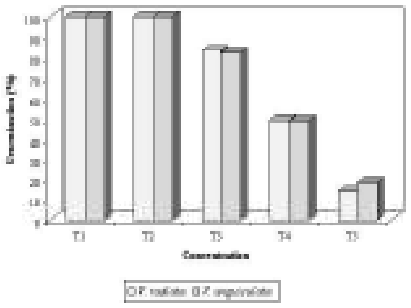
Table – 1 : Physico-chemical parameters of distillery effluent in comparison with ISI limits

Parameter	Untreated	Final Treated	ISI limits for discharge of industrial effluents on land for irrigation
Colour	Dark Brown	Reddish dark brown	-
Odour	Burnt sugar odour	Unpleasant	-
Turbidity	High	High	-
Temperature (°C)	75°C	32°C	-
Ph	3.90	8.41	5.5-9.0
EC(ds/m)	46.8	31.6	-
BOD (mg/lt)	37,500	2100	100
COD (mg/lt)	96,556	9561	-
Suspended solids (mg/lt)	7,988	2,800	200
Total solids (mg/lt)	88532	21566	-
Total dissolved solids (mg/lt)	84976	22560	2100
Sulphate as SO_4	3600	280	1000
Chloride mg/lt	5150	3700	-
Sodium mg/lt	400	400	-
Potassium mg/lt	12,000	8,000	-
Calcium mg/lt	3400	1500	-
Phosphorus mg/lt	480	260	-
Nitrogen mg/lt	904	464	-

Seedling growth: Figure 2, 2a, 2b and 2c represents the data on germination percentage and seedling growth parameters of *V.radiata* and *V.unguiculata* .The analysis of variance performed for these values revealed a significant difference be

tween concentrations and plants. Germination percentage in both *V.radiata* and *V.unguiculata* was on par with that of control at T_2 effluent concentration (25%), while percent germination was significantly reduced at T_5 effluent concentrations in both the plants (14 and 18 % respectively).

Fig. 2a. –Effect of different concentrations of distillery effluent on seed germination of V.radiata and V. unguiculata.



The seedling growth of *V. radiata* and *V.unguiculata.* root length and shoot length values followed the same trend as in the case of percent germination in both the plants. The maximum root length and shoot length were recorded at T_2 effluent concentrations (11.43 and 12.93 cms) in *V.radiata* and (7.86 and 16.40cms) in *V.unguiculata* respectively. At T_5 effluent concentration no growth occurred in both the plants. With regard to vigour index, maximum values were recorded at T_2 effluent concentrations in *V.radiata (*2481.00) and in V.*unguiculata* (2428.33). Vigour index reduced with increase in effluent concentrations and was absent at T_4 effluent concentrations in both the plants.

Fig. 2.b –Effect of different concentrations of distillery effluent on seedling growth of V.radiata and V. unguiculata.

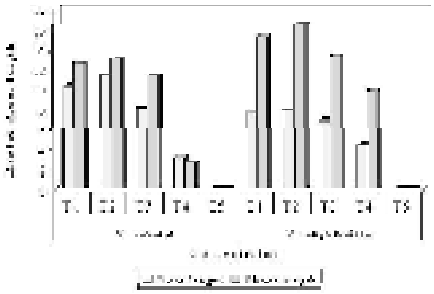
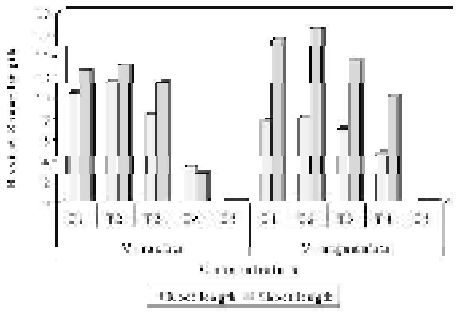


Fig. 2c. Effect of different concentrations of distillery effluent on vigour index of V.radiata and V. unguiculata.



Discussion

Physico chemical parameters

The pH of the untreated effluent was acidic, while the treated effluent was alkaline in nature. This is in confirmation with the earlier reports of Sahai and Srivastava (1986). The total solid content of the untreated, and treated effluent was 88532, and 21,566 mgl^{-1} respectively. Suspended solids as well as total dissolved solids have exceeded the ISI limits of 200 mg / l^{-1} and 2100 mg/l^{-1} respectively. This is in accordance with the findings on distillery effluent by Vijayakumari and Kumudha (1990) The Biochemical oxygen demand of the untreated and secondary treated spentwash was 37500 and 2100 mg l^{-1} respectively. The chemical oxygen demand (COD) of the raw and treated spentwash was 96,556 and 9561 mg l^{-1} respectively. The high COD of the raw effluent might be due to the presence of large quantities of chemicals in the raw effluent. This is in confirmation with earlier report of Blackwell et al., (1979). The nitrogen, phosphorus and potassium content of the treated distillery effluent was 464, 260 and 8000 mg/L respectively. Similar results have also been observed by Jabeen and Saxena (1990); Kannan (2002) and Suthar et al., (2005). From the present investigation, it is evident that some of the parameters have exceeded the ISI limits (1977) for discharge of industrial effluent on land for irrigation.

Germination and Seedling growth parameters: The ability of a crop to germinate and establish under environmental stress is an early indication of tolerance. During germination any disturbance in the environment in which the seed occurs ultimately affects the growth and yield of crop (Dixit et al., 1986). In the present study, seed germination percentage was found to decrease gradually in *V. radiata* and *V. unguiculata* with increase in concentrations of distillery effluent. Both *V. radiata* and *V. unguiculata* recorded the highest germination percentage (100%) up to T_2 (25%) effluent concentration, and gradually declined above T_3 (50%) effluent concentration. Lower concentration of the effluent increased the germination percentage. The results were in conformity with findings of Balashouri and Pramiladevi (1990) in *V. radiata* and *Cajanus cajan*, Madhappan (1993) in *P. mungo* and *P. aureus*, Kumar et al (1997) in *P. aureus* and *P. mungo,* Tamizhiniyan et al., (1998), in cowpea ; and Pragasam and Kannabiran (2001) in *V. mungo*. There was significant reduction in the percent germination at T_4 (75%) and T_5 (100%) effluent concentrations in both the crops studied. Similar reduction in percent germination due to high amount of total dissolved solids that disturbed the osmotic relations & other metabolic constituents in the crop plants were also expressed by Sahai and Srivastava (1986), Srivastava and Sahai (1987), Rajaram and Janardhanan (1988) and Ramana et al., (2001). The root and shoot length were found to be highest in *V. radiata* and *V. unguiculata* at T_2 (25%) effluent concentration while the lowest was at T_5 (100%)effluent concentra

tion. Inhibition of seedling growth at higher concentration (100%) have also been observed in Paddy by Behera and Mishra (1982) and Sahai et al., (1983)., in Pennisetum typhoides, P. mungo, Mung bean, Urd bean, in Soyabean by Rajaram and Janardhanan (1988)., in *V. radiata* by Vijayakumari and Kumudha (1990), in *P. aureus* by Kannan (2001) in treated with distillery effluent.

The promotion of seedling growth at the lower concentration of the effluent treatment may be due to the presence of optimum levels of plants nutrients in the effluent (Sahai et al., 1983 and Rajaram and Janardhanan, 1988, or due to enhanced plant nutrients such as N, P, K, Ca present in effluent (Rajannan et. al., 1998). Root and shoot length in the present investigation was completely inhibited at T_5 (100%) effluent concentration. At higher concentration of the effluent, N, P, K, chlorides, sulphates and organic pollutants inhibit seedling growth by altering the osmotic relations (Sahai and Srivastava, 1986).

Seedling vigour index in the present study showed a gradual decline with the progressive increase in effluent concentration. *V. radiata* showed a higher degree of decline when compared to *V. unguiculata*. The decline in seedling vigour index was similar to the earlier findings of Salunke and Karande (1999) in *Vigna radiata* and Kannan (2001) in *Pennisetum typhoides*.

On the basis of this preliminary work, it can be suggested that the distillery effluent can be used for irrigational purpose after proper dilution with water, which will be one of the solutions for combating environmental pollution problems. Further studies on growth performance and yield properties of soil are needed to corroborate the present findings.

REFERENCES

A.P.H.A., 1985. Standard methods for the examination of water and waste water. American Public Health Association, New York.

Abdul Baki, A., and Anderson, J.D., 1973. Vigour index determination of Soybean seed by multiple criteria. *Crop Sci*., **3**:630-633.

Balashouri and Pramiladevi, 1994. Effect of tannery effluent on germination and growth of selected pulse and cereal crop plants. J. Ecotoxicol. Environ. Monit. 4(2); 115-120.

Behera, B.K., and Misra, B.N., 1982. Analysis of the effect of industrial effluent on growth and development of rice seedlings, *Environ., Res*. **28**:10-20.

Blackwell, B.R., Malkay, W.B., Murray, F.E. and Oldium, N.K., 1979. Review of craft foul condensate: Sources, quantities, chemical composition and environmental effects. *Tappi,* **62**: 33-37.

Chhonkar, P.K., Datta, S.P., Joshi, H.C., and Pathak, H., 2000. Impact of Industrial effects on soil Health and Agriculture – Indian Experience : Part I – Distillery and Paper Mill Effluents. JCSIR. 59 : 350-361.

Dixit A., Lakshman, M., and Srivastava S.K., 1986. Effect of cardboard factory effluent on seed germination and early seedling growth of rice (*Oryza sativa*) seeds. *Seed. Res.* **14(1):** 66-71.

Indian standard Institution, 1977. Tolerance limits for discharge of industrial effluents on land for irrigation. No. 3307.

ISTA. 1985. International rules for seed testing. Seed Sci. and Tech. 13 : 421-463

Jabeen, S., and Saxena. P.K., 1990. Effect of Industrial effluent on growth behaviour of *Pisum sativum*. *Geobios.,* **17** : 197-201.

Jagdale, H.N., and Savant, N.K., 1979. Influence of spentwash (distillery waste) on growth and chemical composition of immature sugarcane (*Saccharum officinarum L.*) cultivar CO 740. Indian Sugar, 29 : 433-440.

Kannan, J., 2001. Effect of distillery effluent on crop plants. *Adv. Plant. Sci.,* **14(1)** : 127-132.

Kannan, J., 2002. Effect of distillery effluent irrigation on soil biological properties on which ground crops were raised. *Adv. Plant. Sci.,* **15(11)** : 439-443.

Pragasam, A., and Kannabiran, B., 2001. Effect of distillery effluent on the morphology, biochemistry, and yield of *Vigna mungo*. *Adv. plt. Sci.* **14 (2)** 547-552.

Rajannan, G., Devarajan, L., and Oblisami, G., 1998. Impact of distillery effluent irrigation on growth of banana crop. In : National seminar on application of treated effluent for irrigation held at REC, Tiruchirapalli, March 23, pp – 56.

Rajaram, N., and Janardhanan, K., 1988. Effect of distillery effluent on seed germination and early seedling growth of soybean, cowpea, rice and sorghum. *Seed Res*. **16(2)** : 173-177.

Ramana, S., Biswas, A.K., Kundu, S., Saha, J.K., and Yadava, R.B.R., 2001. Efficacy of distillery effluent on seed germination and seedling growth in mustard, cauliflower and radish. *Proc. Nat. Acad. Sci., India.* **71 : B(III)** 129-135.

Sahai, R., Jabeen, S., and Saxena, P.K., 1983. Effect of distillery effluent on seed germination, seedling growth and pigment content of rice. *Ind. J. Ecol.,* **10** : 7-10.

Sahai, R., and Neelam., 1987. Effect of fertilizer factory and distillery effluent on seed germination, seedling growth, pigment content and biomass of *Phaseolus radiatus* Linn. *Indian, J. Ecol.* **14** L 21-25.

Sahai, R., and Srivastava, V., 1986. Effect of distillery waste on the seed germination, seedling growth and pigment content of *Cajanus cajan* L. *Indian Bot. Soc*., **65** : 206-211.

Salunke, K.J., and Karande, S.M., 1999. Effect of pulp and paper mill effluent on the seed germination and early seedling and growth in Mung bean. Proc. Nat. Conference on Industry and Environment, Karad. Dec. 28-30, Ed. Trivedi, R.K, Publ. Daya Publishing house Delhi.

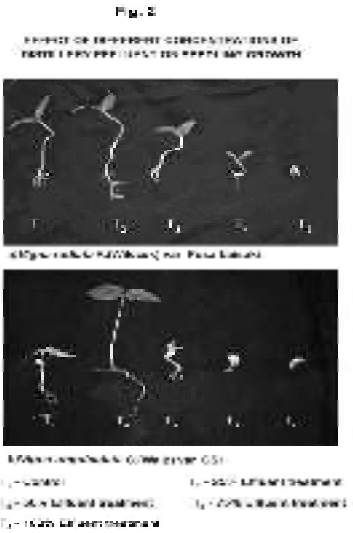
Sugar India., 2005. Anekant Prakashan, Jayaringapur, Kolhapur.

Suthar, S.S., Sharma, S., Verma, P., Suthar, S., and Pareek, G., 2005. Impact of distillery effluent on seed germination and seedling growth of some plants. *Nature Environ. and Poll. Tech* **4(3)**: 413-418.

Thamizhiniyan, P., Sundaramoorthy, P., and Lakshmanachary, A.S., 2000. Effect of sugar mill effluent on germination, growth and pigment contents of ground nut (*Arachis hypogea* L.) and Paddy (*Oryza sativa* L.) *Indian J. Applied and Pure Bio.,* **15(27):** 151-155.

Uppal, J., 2004. Water utilization and effluent treatment in the Indian alcohol industry – an overview. In Indo workshop and promoting efficient waster in Agro based industries, New Delhi, 15-16.

Vijayakumari, K., and Kumudha, P., 1990. Effect of distillery effluent on seed germination and early seedling growth in some crop plants. *Geobios.,* **17:** 206-211.



A.H.F.V.Sc:-3

OPTIMISING RESOURCE USE IN PADDY CULTIVATION THROUGH WOMEN'S PARTICIPATION

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Introduction: Irrigation projects of Kerala cater mostly to the needs of paddy irrigation. The paddy area in Kerala is drastically getting reduced due to multiple reasons of which the comparatively low profit share is a major factor. Due to the problems associated with paddy cultivation and the low benefit - cost ratio in the sector, farmers leave the paddy fields fallow and shift to other income generating activities. It is in this context that a pilot study was conducted in the command area of Ichannur sub distributory of the Kuttiyadi Irrigation Project of Kerala with the objective to optimise resource use in paddy cultivation. The Systems in Rice Intensification Technology (SIRI) was compared with conventional method of paddy cultivation and both the methods were compared and evaluated. The study was undertaken through the participation of women in the command area, and this was done with the purpose of empowering women on paddy farming. Due to the limitations such as small holding size and low benefit cost ratio, male farmers of the area migrate to other areas in search of job to meet their livelihood needs. In such circumstances, women empowerment has added advantage.

Methodology: The study was undertaken through women groups in the study area. The usual participation of women in paddy farming is only as labourers, but in this study the entire activities starting from planning to marketing was undertaken by women group. There were twenty members in the group and the total experimental area was 0.5 hectare. This was a pilot attempt on the technology and hence there were doubts about its success in the area. The SIRI requires less water and hence is reported elsewhere that is a water efficient cropping system.

At the outset, women were given training on the different aspects of the new method of cultivation and they were addressed by the scientists who had already successfully conducted the programme in the research stations. The necessary inputs and technical support were given to the participants and the crop management was undertaken by the women participants.

Nursery management

The seed rate in conventional system was 80 kg/ha, but in SIRI method, seed rate is only 5 kg/ha and the nursery area is only $1/10^{th}$ of that of the conventional method. Paddy variety *Jyothi* was used for the study. Nursey management is different in both the methods. In SIRI method, the sprouted seeds were planted in a thin layer sand-cowdung (dry) mixture spread on a plastic sheet and made wet. Water was sprinkled just to wet the nursery crop. Nine days old seedlings were uprooted carefully without breakage of roots/ causing minimum trauma to roots. At the time of uprooting, the seedlings had only 2 small leaves. In the conventional method, sprouted seeds were planted in well puddled nursery, thin film of standing water maintained and were uprooted at 18 days when there were 3-4 leaves.

Main field preparation

Land preparation was almost the same for both the systems of cultivation. Land was puddled well taking care to have perfect leveling. For ensuring efficient water management, channels were taken at 2 metre intervals. Organic matter @ 5T/ha and basal fertiliser application of N P K @ 45:45:45 was given. The plot was well puddled and only a thin film of water was retained in the field.

Transplanting

In SIRI, seedlings were transplanted @one seedling per hill and was planted in a rectangular grid pattern 40 cm X 25 cm. In the conventional method, 3-4 seedlings were planted at a spacing of 20 cm X 20 cm.

Water management

Water management calls utmost attention in the wetland paddy cultivation. In the conventional system 5 cm standing water was maintained throughout the vegetative phase up to 50% maturity. In SIRI method, it was ensured that the field was always kept moist up to panicle initiation phase and a thin film of water was retained afterwards up to 50% maturity.

Cultural operations

Because of the wide spacing and no standing water, weed infestation was more under SIRI than under conventional cultivation. Weeding was done only once in the conventional system, whereas in the SIRI, weeding was necessary five times starting on the 12th day after transplanting. A cono weeder was used to remove the weeds and it had the additional advantage of aerating the soil. Top dressing was done with urea and Muriate of potash one month after transplanting in both the cases.

Harvesting and post harvest operations

The harvesting and post harvest operations were similar in both the methods of rice cultivation. The harvest observations in both the conventional plot and the SIRI plot were analysed and the results of comparative analysis are given below. The following observations are taken from the sample plot of 5 sq.m area.

Plant height

The data on plant height revealed that there was no significant difference in plant height between the two methods of cultivation.

Table 1 Effect of cultivation methods on the plant height (cm)

Observation plots	SRI plot	Control plot
1	94	86
2	89	88
3	86	94
Average	90	89.3

Number of tillers

The results revealed that tillers count in the SIRI plot was considerably more than that of the control plot ie three times that of the tiller count in the control plot.

Table 2 Effect of cultivation methods on the total number of tillers

Observation plots	SRI plot	Control plot
1	21	10
2	23	9
3	25	8
Average	23	9

Productive tillers /hill

The number of productive tillers per hill was almost three times in the SIRI plot when compared to the conventional paddy cultivation.

Table 3 Effect of cultivation methods on the number of productive tillers

Observation plots	SRI plot (No/plant)	Control plot (No/ plant)
1	19	7
2	18	6
3	19	6
Average	18.7	6.3

Yield

The results revealed that grain and straw yield were higher in the SIRI method when compared to the conventional method of cultivation. Grain yield was almost three times in the SIRI method of cultivation. Similar was the case with straw yield also. This is a very favourable result and shows that the resources are very effectively utilised with respect to productivity. Because plant populations were greatly reduced with SIRI, seed costs were cut by 80-90%, and because paddy fields were not kept continuously flooded, there was water savings of about 30%, a major benefit at times of water scarcity.

Table 4 Yield of grain and straw from the sample plots

Yield particulars	SRI plot	Control plot
Grain yield	19 (Ton/ha)	7 (Ton/ha)
Straw yield (Ton/ha)	18 (Ton/ha)	6 (Ton/ha)
Water use	115 cm	80 cm

Conclusion

SIRI is a good method of paddy cultivation and women can possibly opt for leasing paddy fallows and go for SIRI method of paddy cultivation. Since the water demand and seed requirement are lower than that of the conventional method, the benefit cost ratio is higher. SIRI also has the benefit of being particularly accessible for small landholders. Ultimately, the crop yield and water use efficiency was more in this practice when compared to the conventional transplanted technology.

The pilot study helped the women to gain confidence to adopt this efficient rice production technology in future and to transfer the know-how to the nearby areas.

THEME 4

HEALTH AND MEDICAL SCIENCES INCLUDING AYURVEDA (DHANVANTARIYAM)

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H.Ms.A:-1

ANTIBACTERIAL ACTIVITY OF ROOTS OF ARISTOLOCHIA INDICA ON BACILLUS SUBTILIS

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ABSTRCT: Aristolochiales have several medicinal uses. *Aristolochia indica* being one among them is a well known medicinal plant in India. It is reported to be a stimulant, tonic, and febrifuge. It is also used for treatment of snakebites, diarrhea and intermittent fever. *Aristolochia indica* was collected near by Bangalore city. Roots were sun dried, oven dried and ground to fine powder. Solvents such as Acetone, Butanol, DMF, Distilled water and Ether were used for extraction. Different concentration of each was prepared as per standard method. *Bacillus subtilis* culture was obtained from stock culture. Standard antibiotic discs like Ciprofloxacin, Nitrofurantoin, Ofloxacin, Pefloxacin and Sparfloxacin were used for the comparative study. Standard antibiotics, solvents and plant extracts were individually tested for antibacterial activity against *Bacillus subtilis*. The data obtained was subjected to Scheffe Post Hoc one way test.

Of all the 5 solvents tested on *Bacillus subtilis* highest activity was seen in Butanol followed by Ether, DMF, Acetone and least in Distilled water. Each Standard antibiotic on comparison with all 5 solvents against *Bacillus subtilis:* Ciprofloxacin had the most significant activity, Distilled water the least, and the activity of other solvents did not differ much. Nitrofurantoin and Butanol showed highest activity and other solvents had uniform impact. Ofloxacin, Pefloxacin, Sparfloxacin with Butanol showed high activity and other solvents exhibited similar activity. Plant extracts on comparison with standard antibiotics against *Bacillus subtilis*: Ciprofloxacin, Butanol extract showed highest activity followed by Ether. DMF, Distilled water had same impact and Acetone extracts the least. Nitrofurantoin exhibited varied activity, Butanol extract had maximum activity, antibiotic Nitrofurantoin, Distilled water, DMF and Acetone extract had similar activity. Ofloxacin, Pefloxacin and Sparfloxacin against plant extracts using various solvents showed similar activity and did not differ much. Among the various solvents tested Butanol showed higher activity, this with plant extract exhibited significant activity compared to rest. On comparison with 5 standard antibiotics, the extract found to have more activity than Nitrofurantoin. Natural plant extract exhibiting antibacterial property promises the generation with less or no side effects when used for treatment.

Introduction: Anti-infectious agents have gained lot of importance in the field of ethnopharmacology. The use of angiosperm plant parts and their extracts to treat infections is an age old practice. Contrary to the synthetic drugs, antimicrobials of plant origin are not associated with many side effects and have enormous therapeutic potential to heal many infectious diseases.

Aristolochiales have several medicinal uses as per the survey of literature. Aristolochia indica contains beta-caryophyllene and alpha-humulene which show antibacterial activity, (Bhattacharya and Sarkar, K. 1986). Camporese et al., (2003) have screened many plants as antibacterial agents, Che et al., (1984) have isolated many antibacterial compounds from Aristolochia species. Reports on the study of medicinal properties of Aristolochia include Kumar et al., (2006), Manikandar et al., 2006 and Negi et al., (2003). Antibacterial activity of Aristolochia indica has been studied by Shafi et al., (2002, 2006) and Sarma et al., 2003.

A preliminary study of the extracts of *Aristolochia indica* as antibacterial agent against *Bacillus subtilis* has been conducted.

Materials and Methods: *Aristolochia indica* Linn plants were collected from near by scrubby forest of Bangalore. *Bacillus subtilis* stock culture was obtained from the Department of Microbiology, University of Mysore, Mysore and sub cultured. The standard antibiotic discs were obtained from HI media (Ciprofloxacin 30 mcg/disc, Nitrofurantoin 300 mcg/disc Ofloxacin 5 mcg/disc, Pefloxacin 5mcg/disc and Sparfloxacin 5 mcg/disc). 10 grams of thoroughly washed, sun dried roots were homogenized in solvents of Acetone, Butanol, DMF, Distilled water and Ether. Preliminary screening was done by Disc diffusion method (Bauer *et al.,* 1996).The culture was inoculated by cotton swab method (0.5ml).The standard discs, the discs soaked in solvents and extracts; to be tested were placed (2 in a plate) on cultured plate, and incubated at 37^0c for 24hrs (Patel *et al.,* 2007).The zone of inhibition was measured and the data obtained were subjected to Scheffe Post Hoc one way test .The results are tabulated.

Results and Discussion: Standard antibiotics, solvents and plant extracts were tested against *Bacillus subtilis* and presented in Table 1.1, 1.2 and 1.3. The standard antibiotics test against *Bacillus subtilis* (Table. 1.1) indicates that Ciprofloxacin has the highest activity followed by Sparfloxacin, Ofloxacin and Pefloxacin. Nitrofurantoin shows least activity compared to other four. Among all the 5 solvents tested on *Bacillus subtilis* (Table. 1.2) highest activity was seen in Butanol followed by Ether, DMF, Acetone and least in Distilled water. Of all the plant extracts Butanol-plant

extract showed maximum activity.

Comparative standard antibiotic test against various solvents is described in Table 2.Comparing the activity of Ciprofloxacin it is observed that among the solvents Butanol has higher activity than other solvents. All solvents have lower activity, with Distilled water being least when compared to the activity of Nitrofurantoin. Similarly the activity of solvent Butanol is slightly high and Distilled water the least when compared to the standard antibiotic Ofloxacin. The activity of Pefloxacin and Sparfloxacin is similar to Ofloxacin antibiotic. Therefore the standard antibiotics on comparison with 5 solvents showed that the solvent Butanol has higher activity in retarding the growth of *Bacillus subtilis.*

Comparing the standard antibiotic test against plant extracts on *Bacillus subtilis* (Table 3) it is observed that Ciprofloxacin exhibits highest activity, and plant extract-Butanol higher than other extracts. However the standard Nitrofurantoin activity is low towards the bacterium than plant extracts of Butanol and Ether. Ofloxacin activity is very high against the bacterium and only the plant extract in Butanol is almost closer to it. Similar is the activity of antibiotic Pefloxacin and Sparfloxacin when compared to various solvents. In all cases the plant extract in Butanol has the closer and slightly higher activity compared to all the 5 antibiotics tested.

Conclusion : Preliminary level of screening showed roots of *Aristolochia indica* exhibiting antibacterial activity towards *Bacillus subtilis* and its extraction with Butanol had little higher significance. Therefore on standardization and purification the field promises to use Butanol extracts as a suitable antibacterial agent *Bacillus subtilis* for treatment.

References

- Bauer A W, Kirby W M ,Sheris J C and Truck M (1966), "Antibiotic Susceptibility Testing by a standardized Single disc Method" , Am. J. Clin.Pathol., Vol. 45,pp. 149 – 158.
- Bhattacharya, and Sarkar, K. 1986. Impact of the threatened plant *Aristolochia indica* L., on the conservation of swallowtail buterfly, *Tros aristolochae*, in Burdwan. Burdwan University Science Journal 3: 123-126
- Camporese, A. Balick, M. J., Arvigo, R., Esposito, R. G., Morsellino, N., De Simone and Tubaro, F. 2003. Screening of anti-bacterial activity of medicinal plants from Belize (Central America).
- Che, C.T., Ahmed, M.S., Kang, S.S., Waller, D.P., Bingel, A.S., Martin, A. and Rajamahendran, P. 1984. Studies on *Aristolochia* III. Isolation and biological evaluation of constituents of *Aristolochia*. Journal of National Proceedings 47: 331-341.
- Kumar, P., Neelam, V., Chauhan, S., Padh, H. and Rajani,M. 2006. Search for antibacterial and antifungal agents from selected Indian medicinal plants. Journal of Ethnopharmacology.
- Manikandar, R. V., Selvamani, P. and Latha, S. 2006. Antibacterial activity of leaf extracts of *Aristolochia bracteate* Retz. 68: 509-510.
- Negi, P.S, Anandharamakrishnan, C. and Jayaprakasha, G.K. 2003. Antibacterial activity of *Aristolochia bracteata* root extract. Journal of Medicinal Food 6: 401-403.
- Patel, S.J., Venugopalan, S.N.N. and Pradeep. 2007. Screening for antimicrobial activity of weeds. The International Journal of Microbiology 4.
- Sarma, P. C., Kanjilal, P. B. and Kotoky, R. 2003. Studies on floral biology of *Aristolochia indica* (L.) used in Indian system of medicine. Plant Archives 3: 203-206.
- Shafi, P.M., Rosamma, M.K., Jamil, K. and Reddy, P.S. 2002. Antibacterial activity of the essential oil from *Aristolochia indica*. Fitoterapia 73: 439-41.
- Shafi, P. M., Rosamma, M. K., Jamil, K. and Reddy, P.S. 2006. Antibacterial activity of the essential oil from *Aristolochia indica.* Journal of Ethnopharmacology 107:182-188.

Table 1.1: Standard antibiotics tested for antibacterial activity -*Bacillus subtilis*

Sl. No.	Name	Measurement of inhibition zone in cms			
		I	II	III	IV
1	**Ciprofloxacin**	**5.3**	**5.2**	**5.5**	**5.3**
2	**Nitrofurantoin**	**1.2**	**1.3**	**1.3**	**1.4**
3	**Ofloxacin**	**3.9**	**4.0**	**4.2**	**4.1**
4	**Pefloxacin**	**3.5**	**3.4**	**3.6**	**3.7**
5	**Sparfloxacin**	**4.7**	**4.6**	**4.4**	**4.4**

Table 1.2: Solvents tested for antibacterial activity - *Bacillus subtilis*

Sl. No.	Name	Measurement of inhibition zone in cms			
		I	II	III	IV
1	Acetone	1.0	1.0	0.0	0.0
2	Butanol	0.9	1.0	1.1	1.0
3	DMF	1.1	1.0	0.0	0.0
4	Distilled water	0.0	0.0	0.0	0.0
5	Ether	0.7	0.6	0.6	0.6

Table 1.3: Plant extract tested for antibacterial activity - *Bacillus subtilis*

Sl. No.	Name	Measurement of inhibition zone in cms			
		I	II	III	IV
1	Acetone	1.0	1.2	1.4	1.4
2	Butanol	2.4	2.5	2.2	2.4
3	DMF	1.2	1.3	1.3	1.3
4	Distilled water	1.3	1.5	1.5	2.0
5	Ether	2.2	2.3	1.6	1.8

Table 2: One way test for comparative standard antibiotic test against solvent - *Bacillus subtilis*

	N	Mean	Subsets	Std.Deviation	Std.Error
Ciprofloxacin	4	5.3250	c	.1258	6.292E-02
Acetone	4	.5000	ab	.5744	.2887
Butanol	4	1.0000	b	8.165E-02	4.082E-02
DMF	4	.5250	ab	.6076	.3038
Distilled water	4	.0000	a	.0000	.0000
Ether	4	.6250	ab	5.000E-02	2500E-02
Nitrofurantoin	4	1.3000	b	8.165E-02	4.082E-02
Acetone	4	.5000	ab	.5744	.2887
Butanol	4	1.0000	b	8.165E-02	4.082E-02
DMF	4	.5250	ab	.6076	.3038
Distilled water	4	.0000	a	.0000	.0000
Ether	4	.6250	ab	5.000E-02	2500E-02
Ofloxacin	4	4.0500	c	.1291	6.455E-02
Acetone	4	.5000	ab	.5744	.2887
Butanol	4	1.0000	b	8.165E-02	4.082E-02
DMF	4	.5250	ab	.6076	.3038
Distilled water	4	.0000	a	.0000	.0000
Ether	4	.6250	ab	5.000E-02	2500E-02
Pefloxacin	4	3.5500	c	.1291	6.455E-02
Acetone	4	.5000	ab	.5744	.2887
Butanol	4	1.0000	b	8.165E-02	4.082E-02
DMF	4	.5250	ab	.6076	.3038
Distilled water	4	.0000	a	.0000	.0000
Ether	4	.6250	ab	5.000E-02	2500E-02
Sparfloxacin	4	4.5250	c	.1500	7.500E-02
Acetone	4	.5000	ab	.5744	.2887
Butanol	4	1.0000	b	8.165E-02	4.082E-02
DMF	4	.5250	ab	.6076	.3038
Distilled water	4	.0000	a	.0000	.0000
Ether	4	.6250	ab	5.000E-02	2500E-02

Table 3: One way test for comparative standard antibiotic test against plant extract - *Bacillus subtilis*

	N	Mean	Subsets	Std.Deviation	Std.Error
Ciprofloxacin	4	5.3250	a	.1258	6.292E-02
Plant extract-Acetone	4	1.2500	a	0.1915	9.574E-02
Plant extract-Butanol	4	2.3750	c	0.1258	6.292E-02
Plant extract-DMF	4	1.2750	b	5.000E-02	2.500E-02
Plant extract-Distilled water	4	1.5750	ab	.2986	.1493
Plant extract-Ether	4	1.9750	bc	.3304	.1652
Nitrofurantoin	4	1.3000	a	8.165E-02	4.082E-02
Plant extract-Acetone	4	1.2500	a	.1915	9.574E-02
Plant extract-Butanol	4	2.3750	c	.1258	6.292E-02

Plant extract-DMF	4	1.2750	a	5.000E-02	2.500E-02
Plant extract-Distilled water	4	1.5750	ab	.2986	.1493
Plant extract-Ether	4	1.9750	bc	.3304	.1652
Ofloxacin	4	4.0500	a	.1291	6.455E-02
Plant extract-Acetone	4	1.2500	a	.1915	9.574E-02
Plant extract-Butanol	4	2.3750	c	.1258	6.292E-02
Plant extract-DMF	4	1.2750	a	5.000E-02	2.500E-02
Plant extract-Distilled water	4	1.5750	ab	.2986	.1493
Plant extract-Ether	4	1.9750	bc	.3304	.1652
Pefloxacin	4	3.5500	a	.1291	6.455E-02
Plant extract-Acetone	4	1.2500	a	.1915	9.574E-02
Plant extract-Butanol	4	2.3750	c	.1258	6.292E-02
Plant extract-DMF	4	1.2750	a	5.000E-02	2.500E-02
Plant extract-Distilled water	4	1.5750	ab	.2986	.1493
Plant extract-Ether	4	1.9750	bc	.3304	.1652
Sparfloxacin	4	4.5250	a	.1500	7.500E-02
Plant extract-Acetone	4	1.2500	a	.1915	9.574E-02
Plant extract-Butanol	4	2.3750	c	.1258	6.292E-02
Plant extract-DMF	4	1.2750	a	5.000E-02	2.500E-02
Plant extract-Distilled water	4	1.5750	ab	.2986	.1493
Plant extract-Ether	4	1.9750	bc	.3304	.1652

H.Ms.A:-2

HEALTH PROBLEMS OF ADOLESCENT MOTHERS RELATED TO MATERNITY

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Introduction: Health status of adolescent mothers has an important impact on health of children, the family, the community and the society at large. Despite these assertions and the rapid technological advances that have been made in a number of fields many women / adolescent girls still suffer from many general and reproductive health problems (WHO, 1992). In India adolescent girls account for a little more than one-fifth of the population (21.4%). Out of an estimated 200 million adolescents, girls account for slightly less than 100 million due to disproportionate sex ratio (Census, 2001). In our country 31 per cent of the girls aged between 15 and 19 years were married. Large numbers of girls from poor households are pushed into early marriage, which is consummated almost immediately after menarche. Of the 4.5 million marriages that take place in India every year, three million marriages involve girls in the age range of 15-19 years (Census, 1991).

Teenage pregnancy is a fairly common occurrence in India, due to many factors such as early marriages and consummation of marriage on reaching puberty. Adolescent motherhood adversely affects the child survival and maternal life because of the high incidence of fetal wastage. Adolescent girls are at a risk of having anemia in pregnancy which is considered to be mainly responsible for prevailing high maternal mortality and high incidence of Low-birth-weight deliveries in India. it is estimated that about 437 women for every 1, 00,000 women die every year in India due to pregnancy and its related causes (NFHS 1992-93). In the Indian context adolescent girls enter into reproductive life, with the early marriages, pregnancies and child bearing resulting in damaging effects to their general and reproductive health especially obstetric problems. Majority of the obstetric problems are resulting from the traditionally early marriage of girls that still prevails especially in rural areas of the developing world. Where early marriage is prevalent, resultant early child bearing is associated with serious health problems to adolescent mothers and their offspring. The health related experiences of adolescent girls and their attitudes are intimately linked to their social, educational and economic status.

Maternal age plays an important role during pregnancy that influences the outcome of the delivery and health of the adolescent girl after the delivery. Adolescent girls are at risk for complications during all these three periods. Only the degree of complications varies from one adolescent girl to other adolescent girl. Failure to meet the nutritional requirements during pregnancy may also pose an additional risk to the adolescent mothers.

Thus the present study focuses on maternal problems of adolescent mothers with objectives

1. To study the prevalence, causes and types of maternity problems
2. Relation between nutritional status and maternity problems.

Methodology: This study was conducted during 2004-05 in Ranebennur taluk of Haveri district. The sample was selected from 14 villages, out of 106 villages. Multistage technique was used to collect the respondents. In each selected villages the total number of married adolescent from low income group families in their reproductive years who are staying with their husband were listed to form sampling frame. Thus a total of 150 adolescents were selected as the final sample. Data was collected with the help of pre-tested schedule. In-depth interview method was used for gathering information.

Results and Discussion: From the table 1, results revealed that, more than half (55.3%) of the respondents who experienced pregnancy were found to be below 18 years of age. Nearly 45 per cent of the respondents experienced pregnancies when they were in the age group of 18-20 years. Sooner the adolescent become pregnant, higher the complications she has to face during pregnancy and delivery. The results of Pandse and Giri's (1989) study inline with the present study that, majority (54.5%) of the married adolescent respondents experienced the first birth within one to three years of menarche i.e. between 15 to 17 years.

Table 2 presents prenatal problems faced by the respondents. The results of same table revealed that majority (57.3%) of the respondents suffered many problems during prenatal period. Among them, the common problems reported by the respondents were lower abdominal pain, vomiting and fever, cough and cold, slight bleeding and severe bleeding (59.3, 58.1, 48.8, 48.8 and 34.8%). The problems faced during pre-natal period were found to be high among adolescent mothers. This indicates the high prevalence of maternal morbidity. It may be due to lack of education and marginal health seeking behaviour of adolescent mothers. Some times they may not understand the problems they had during pregnancy which leads to complications further. Hence these mothers require immediate treatment to overcome these problems. These results are inline with the study conducted by Dhak (2003) on complications of pregnancy among teenagers.

The problems faced by respondents during peri natal period (table 3) revealed that, 48 per cent of the respondents faced and reported one or the other problems. Majority of the respondents reported problem of vomiting before delivery followed by fever and swelling in feet (70.8, 54.2, and 52.8 % respectively). 43 per cent of respondents reported lower abdominal pain and prolonged labor. Nearly 42 per cent of the respondents reported problem of heavy bleeding after delivery. During peri-natal period proper care is absolutely necessary. In this study, the respondents did not receive proper antenatal care services and most of them were delivered at home with the assistance of those persons who were not able to identify the high-risk deliveries. Due to these reasons many of them were unaware of the dangers of pregnancy complications. As such these problems carried to the peri and postnatal periods also. The same result was found out from the NFHS (1992-93) report.

Table 4 depicts the problems faced by respondents during postnatal period. Results revealed that, 3.3 per cent of the respondents had problems during postnatal period. Majority of the problems reported by the respondents were lower abdominal pain (70.8%), followed by excessive bleeding (66.1%) and cough and cold (47.7%). Nerve pain (10.8%) and pain in operated area (7.7%) were the other problems reported by the respondents. Child bearing exerts heavy toll on adolescent girls. The NFHS (1992-93) data, reported that births to mothers less than 20 years of age at the time of delivery are more likely to result in complications than among mothers belonging to higher age group. It may be noted that as already mentioned in the previous section that all the respondents selected were below 20 years of age. Hence this child bearing at an early age might be the reason for their suffering the observed complications. Similar results were found in the study conducted by Dhak (2003) and Sharma et al (2003).

From the table 5 it was found that, slightly more than half of (52.7%) the respondents height was ranging from 146cms-149cms. Nearly one third (32.7%) of the respondents height was below 145cms and 32 per cent were under weight i.e. below 38Kg. One-fourth (25.5%) of them were found to be suffering from mild to moderate malnourishment. Poor nutritional status among adolescent mothers shows high incidence of complications, which put them under risk.

Influence of body mass index and maternity problems experienced by the respondents were depicted in the table 6. It could be seen from the table that, the nutritional status of the respondents which was calculated by the body mass index was showed positive significant relation with the problems faced during pre and perinatal problems which indicated poor nutritional status of adolescent mothers had an impact on their maternal period. However non-significant relation was found during post natal period.

Conclusion: From these discussions one may infer that, pregnancy complications among teenage mothers in the locale of the study differ from place of residence, education, age at birth of child, antenatal care are also important factors, which influence the health of pregnant teenage mothers. More over maternity problems are highly prevalent among teenage mothers residing in rural areas. This is due to improper facility and freedom to take decision regarding their own reproductive health, which contributed to making these adolescent mothers highly vulnerable. Thus there is a need to educate the adolescent girls and her family if married her in-laws and the community regarding maternal problems and risk factors of pregnancy among adolescent girls.

References:

1. CENSUS, 1991, Distribution of population. Director of Census Operations, Karnataka.
2. CENSUS OF INDIA, 2001, Rural-urban distribution of population, provisional population total. Director of Census Operations, Karnataka.
3. DHAK, B., 2003, Complication in pregnancy among teenage women in India. Seminar paper. International Institute for Population Sciences, Mumbai, pp. 1-17.
4. NATIONAL FAMILY HEALTH SURVEY 1992-93, Maternal and child health and family planning. International Insti

tute for Population Sciences, Bombay.
5. PENDSE, V. AND GIRI, I., 1989, Pregnancy care practices in rural Rajasthan. The Journal of Family Welfare, 35 (6) : 53-57.

Table 1: Number of pregnancies and age of the respondents at pregnancy

Age of the respondents at pregnancy (years)	**No. Of pregnancies**		
	Frequency	**Percent**	
15	12	3.4	**55.3%**
16	58	16.3	
17	127	35.6	
18	100	28.0	**44.7%**
19	49	13.7	
20	11	3.0	
Total	**357**	**100.0**	

Table 2. Prevalence of problems faced during prenatal period

N=86

Sl. No.	**Prevalence of problem**	**Frequency**	**Percentage**
i.	Respondents without problems	64	42.7
ii.	Respondents with problems	86	57.3
	Problems reported		
a.	Lower abdominal pain	51	59.3
b.	Vomiting and fever	50	58.1
c.	Cough and cold	42	48.8
d.	Slight bleeding	42	48.8
e.	Swelling in feet	38	44.9
f.	Severe bleeding	30	34.8
g.	Leg pain, backache	15	17.4

Note: Respondents reported more than one problem

Table 3. Prevalence of problems faced during perinatal period

N = 72

Sl. No.	Prevalence of problems	Frequency	Percentage
i.	Respondents without problems	78	52.0
ii.	Respondents with problems	72	48.0
	Problems reported		
a.	Vomiting before delivery	51	70.8
b.	Fever	39	54.2
c.	Swelling in feet	38	52.8
d.	Lower abdominal pain	31	43.0
e.	Prolonged labor	31	43.0
f.	Heavy bleeding after delivery	30	41.7
g.	Breech presentation	4	5.6
h.	Fits during delivery	2	2.8
i.	Placenta came out first during delivery	1	1.4

Note: Respondents reported more than one problem

Table 4. Prevalence of problems faced during postnatal period

N = 65

Sl. No.	Prevalence of problems	Frequency	Percentage
i.	Respondents without problems	85	56.7
ii.	Respondents with problems	65	43.3
	Problems reported		
a.	Lower abdominal pain	46	70.8
b.	Excessive bleeding	43	66.1
c.	Cough and cold	31	47.7
d.	Nerve pain	7	10.8
e.	Pain in operated area	5	7.7

Note: **Respondents reported more than one problem**

Table 5. Nutritional status of the respondents

N=150

Sl. No.	Variables	Frequency	Percentage
I.	**Height of the respondents**		
	< 145 cms	49	32.7
	146 cms – 149 cms	79	52.7
	>150 cms	22	14.7
II.	**Weight of the respondents**		
	<38 kg	51	32.0
	39kg – 45 kg	30	22.0
	46kg – 55 kg	69	46.0
III.	**BMI of the respondents**		
	<16.0 Severely malnourished	-	-
	16.0-17.0 Moderately		
	malnourished	6	4.2
	17.0-18.5 Mildly		
	malnourished	32	21.3
	18.5-20.0 Low weight normal	51	34.0
	20.0-25.0 Normal	61	40.7

Table 6. Relation between body mass index and maternity problems

Variables	'r' values body mass index
Prenatal problems	0.186*
Perinatal problems	0.171*
Postnatal problems	0.072 NS

Note : * **Significant at 5% level**

NS-Not-significant

H.Ms.A:-3

REPRODUCTIVE HEALTH PROBLEMS OF MARRIED ADOLESCENT GIRLS

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Introduction: Reproductive health is a relatively new concept. It recognizes that, with regard to the reproductive process and functions, a woman has special health needs of men. It recognizes that the reproductive health needs before, during and beyond the child bearing age; it also considers the special needs of men. It recognizes that the reproductive health of present generation has an impact the health of the next generation and that both are of crucial importance for socio-economic development.

World Health Organization (WHO) has defined reproductive health as a "state of complete, physical, mental and social well-being and not merely the absence of disease or infirmity, reproductive health addresses the reproductive processes, functions and system at all the stages of life. Reproductive health, therefore, implies that people are able to have the capacity to reproduce and the freedom to decide if, when and how often to do so. Implicit in this last condition are the right of men and women to be informed of and to have access to safe, effective, affordable and acceptable methods of fertility regulation of their choice and the right of access to appropriate health care services that will enable women to safely go through pregnancy and child birth and provide couples with the best chance of having a healthy infant".

Adolescent reproductive health status is not only influenced by the economic context but also very much by social, cultural, political and individual factors. Reproductive health covers all aspects of adolescent health. It is an umbrella concept, consisting of several distinct, yet related issues such as abortion, child birth, sexuality, contraception and maternal mortality. Biological, social, cultural, economical and behavioral factors play an important role in determination of reproductive health (Singh et al., 1996) among married adolescent girls.

Teenage pregnancy is a fairly common occurrence in India, due to many factors such as early marriages and consummation of marriage on reaching puberty. In the Indian context many adolescent girls enter into reproductive life due to the early marriages. The early child bearing results in damaging effects to their general and reproductive health of adolescent mother. Adolescent motherhood adversely affects child survival and maternal life because of high incidence of fetal wastage.

Maternal mortality among mothers aged 15-19 years is also very high as compared to that among mothers in 20-24 years. Adolescent mother's are at risk of having anaemia in pregnancy, which is considered to be mainly responsible for prevailing high maternal mortality and low birth weight babies in India. Adolescent pregnancies were proved by research to be associated with low birth weight, pre-maturity, birth injury, stillbirths and infant mortality (WHO 1989).

Thus the concept marks the shift towards a more holistic approach. In this respect, the present study investigates with the objective of prevalence of child wastage and its influence on maternal age of rural adolescent mothers.

Material and Methods: The study comprised of 150 married adolescent girls from low income group at Ranebennur taluk of Haveri district by lottery method. Information was collected by interviewing the respondents with the help of pre tested schedule.

Results and discussion: The high prevalence of child wastage among adolescent mothers especially in rural area is a well-established fact (NFHS 1992-93). Due to repeated pregnancy at an early age, the health of adolescent mothers is adversely affected. Such pregnancy also increases the risks of child wastage especially through miscarriage. From the Table 1, it was found that, more than half (55.3%) of the respondents were found to be below 18 years of age. Nearly 45 per cent were in the age group of 18-20 years.

The results of table 2 showed that, the prevalence of child wastage which was found to be more (53.30%) among respondents.

The types of child wastage (Table 3 & 4) revealed that, most of the miscarriages (43.30%) occurred in the first pregnancy and very few (8.20%) in second pregnancy only. Thus results point out that miscarriages were found to occur when respondents were below 18 years of age.

When stillbirths were examined in relation to the ordinal number of pregnancy and the age of respondents it was found that, stillbirths occurred during second and third live births. Out of fifteen stillbirths, fourteen occurred when the respondents were below 18 years of age (Table 3 and 4). Study conducted by Asundi (2000) revealed that, half of the stillbirths occurred to the respondents when they were below 18 years of age. Chatterjee et al. (1991) in their results found that, stillbirths was highest for the mother aged below 18 years of age. Non-utilization of antenatal care services is a

major factor responsible for stillbirths. The same results were observed in Dasgupta's (1997) study. Neonatal deaths were slightly more (2.70%) among the respondents who experienced first pregnancy compared to second (2.40%) and third (1.40%) pregnancies. Infant deaths were more among the respondents who experienced second and third pregnancy.

When the age and number of miscarriages by ordinal number of pregnancy was examined from the Table 5 it was found that, majority of the miscarriages occurred in their first pregnancy when they were below 18 years of age and it was found to be significant at 5% level. Stillbirths were found to be more in third and second order of pregnancy. These stillbirths were also occurred more among the respondents when they were below 18 years of age and it was found to be significant at 5% level. Neonatal deaths were slightly more in first and second order of pregnancy when they were below 18 years of age and infant deaths were more in second order of pregnancy when they were below 18 years of age. Neonatal and infant deaths were found to be non-significant. From this table one can inferred that, most of the child wastages occurred to the respondents when they were below 18 years of age and child wastage was reduced as the age of the respondents increased.

Conclusion: Health status of the adolescent is very important to have a healthy baby. There is higher number of child wastage among adolescents than older women. Thus it can be concluded regarding child wastage that, apart from early pregnancy and malnourishment the high prevalence of child wastage among respondents could be due to various factors such as immaturity of the reproductive organs, lack of decision making power regarding their own health, regarding decision making to seek treatment and pressure to deliver at home and family pressure to bear the child to prove her fertility.

References

1. Asundi, N.R., 2000, Reproductive health of women belonging to rural landless families. M.H.Sc. Thesis, Uni. Agric. Sci., Dharwad (India).

2. Chaterjee, S., Ghosh, K.A. and Piplai, C., 1991, Stillbirths in relation to birth weight and length, birth orders and mother's age. Man in India, 71 (2&3): 475-81.

3. Dasgupta, K.P., Basu, K., Chakraborty, S., Basak, M. and Bhowmik, K.P., 1991, Early neonatal morbidity and mortality in a city based medical college nursery. Ind. J. Pub. Health, 42 : 9-14.

4. National Family Health Survey 1992-93, Maternal and child health and family planning. International Institute for Population Sciences, Bombay.

5. World Health Organization (WHO), 1989, Reproductive Health: Biennial Report.

Table 1: Number of pregnancies and age of the respondents at pregnancy

Age of the respondents at pregnancy (years)	* No. Of pregnancies N(%)	
15	12 (3.4)	**55.3%**
16	58 (16.3)	
17	127 (35.6)	
18	100 (28.0)	**44.7%**
19	49 (13.7)	
20	11 (3.0)	
Total	**357 (100.0)**	

Note: Numbers in the parenthesis indicates percentages
* Respondents experienced more than one pregnancy

Table 2 : Prevalence of child wastage among respondents N=150

Sl.No	Variables	N (%)
I	**Prevalence of child wastage**	
1.	No. of respondents who underwent pregnancy	150 (100.00)
2.	No. of respondents with child wastage	80 (53.30)
II.	**Outcome of total pregnancies**	
	No. of successful pregnancies	247 (69.30)
	No. of child wastage	110 (30.70)
	No. of total pregnancies	357 (100.00)

Note: Numbers in the parenthesis indicates percentages

Table 3: Type of child wastage by ordinal number of pregnancies/live births

Ordinal no. of pregnancy/ live births	Child Wastage				Total number of child wastage	Child survived	Total
	Miscarriage	Still births	Neonatal deaths	Infant deaths			
1st n = 150	66 (43.30)	3 (2.00)	4 (2.70)	2 (1.30)	74 (49.30)	76 (50.70)	150 (100.00)
2nd n = 124	10 (8.20)	6 (4.80)	3 (2.40)	6 (4.80)	25 (20.20)	99 (79.80)	124 (100.00)
3rd n = 70	-	6 (8.60)	1 (1.40)	3 (4.30)	10 (14.30)	60 (85.70)	70 (100.00)
4th n = 14	-	-	-	1 (6.70)	1 (6.50)	12 (80.00)	14 (100.00)

Note : Numbers in the parenthesis indicates percentages

Table 4: Distribution of number and type of child wastage by age at which it occurred

Total child wastage N = 110

	Age groups			Total
	15-16 yrs	17-18 yrs	>18 yrs	
	N(%)	N(%)	N(%)	
Miscarriages	39 (35.50)	36 (32.70)	-	75 (68.20)
Still births	6 (5.50)	8 (7.30)	1 (0.90)	15 (13.70)
Infant deaths	-	12 (10.90)	-	12 (10.90)\
Neonatal deaths	3 (2.70)	5 (4.50)	-	8 (7.20)
Total	48 (43.70)	61 (55.40)	1 (0.90)	110 (100.00)

Note : Numbers in the parenthesis indicates percentages

Table 5: Association between age and child wastage by ordinal position of pregnancy

Type of child wastage	Age	Ordinal Position			Total	χ^2
		1st	2nd	3rd		
Miscarriages	15-17 years	61	8	0	69	28.8*
	18-20 years	4	2	0	6	
	Total	65	10	0	75	
Stillbirths	15-17 years	1	5	5	11	16.4*
	18-20 years	1	1	2	4	
	Total	2	6	7	15	
Neonatal deaths	15-17 years	3	2	1	6	2.00 NS
	18-20 years	1	1	0	2	
	Total	4	3	1	8	
Infant deaths	15-17 years	2	4	1	7	0.34 NS
	18-20 years	2	2	1	5	
	Total	4	6	2	12	

Note : χ^2 0.05 table value 7.815.
NS – Not significant

H.Ms.A:-4

REPRODUCTIVE HEALTH PROBLEMS UNRELATED TO MATERNITY AMONG MARRIED ADOLESCENT GIRLS

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Introduction : Poor nutrition is often mentioned as the major reason for the delay in the onset of menarche among Indian adolescent girls and their inability to reach their genetic potential for height and weight. The poor nutritional status has intergenerational effects. The most visible manifestation of nutritional deficiency is the high prevalence of anaemia and stunted growth among adolescents. The Indian adolescent girls aged 15-19 years were reported to have mild (36.2%) and moderate (17.9%) anaemia (Anonymous, 2001).

In India, reproductive health of young women is affected by a variety of socio-cultural and biological factors. Underlying poor reproductive health among Indian women is their poor overall status on the one hand and an inadequate delivery system to cater to the needs of secluded, shy and devalued women on the other (Jejeeboy, 1997). Reproductive health problems of married women also experience gynecological problems. They do not discuss about their problems with any one due to the fear of social stigma attached to such problems (Sharma, 2004).

Health problems unrelated to maternity form one class of reproductive health problems. The problems, which come under this category, are menstrual, vaginal and uterine problems. Usually married adolescents are shy to discuss these problems with anyone due to social stigma attached to these problems and also due to their powerless position in their marital home. Thus the adolescent girls are at risk when they suffer these problems frequently. Hence an attempt was made in this study to investigate with the objective of prevalence of menstrual and other gynecological problems.

Methodology: This study was conducted during 2004-05 in Ranebennur taluk of Haveri district. The sample was selected from 14 villages, out of 106 villages. Multistage technique was used to collect the respondents. In each selected villages the total number of married adolescent from low income group families in their reproductive years who are staying with their husband were listed to form sampling frame. Thus a total of 150 adolescents were selected as the final sample. Data was collected with the help of pre-tested schedule. In-depth interview method was used for gathering information.

Results and Discussion: Regarding age at menarche, it was observed from the table 1 that, majority of the respondents (57.3%) reached menarche at the age of 13-15 years followed by more than one-third of respondents (37.3%) who reached menarche at the age of 10-12 years. The mean age at menarche for the sample of the study was found to be 13.07 years. Similar results were found in the study conducted by Chaturvedi et al. (1994) who found that mean age at attainment of menarche was 13.54 years.

In this study it has been found that, one fourth of the respondents were having moderate to mild malnourishment (BMI <18.5) as indicated by their body mass index. Further, one third of them were found to be normally nourished but were having low body weight, which could make them likely candidates to suffer from different health problems.

It may be noted from the results (table 2) that, nearly one third (32.7%) of the respondents in the present study were having a height less than 145 Cms and one-third were having a weight less than 38Kg both of which are considered as the risk factors for pregnancy. As a result of combined effects of shorter average maternal height and competition for nutrients between mother's growth needs and growth needs of fetus, the health of the mother and child may be greatly affected. It is estimated that 47 per cent of the adolescent girls in India have body weight less than 38 kg and 39 per cent have height less 145 cm which were known as risk factor for pregnancy (ShivaMeera, 2000; Saroja, 2001 and NFHS 1992-93). However not only does early child bearing further deplete the malnourished adolescent, but it result in severe damage to the reproductive tract which may affect future pregnancy and childbirth.

Results of the present study (Table 3) found that almost all the respondents had one or more reproductive health problems unrelated to maternity. Majority reported problems related to menses followed by vaginal and uterine problems (76.7, 23.3 and 13.3% respectively).

When menstrual problems of the respondents were examined, it was found that, nearly one fourth of the respondents suffered from irregular menses, 18 per cent of them had pain in body and legs. 15.3 per cent had white discharge, 13.32 and 12.7 per cent had excessive bleeding and lower abdominal pain. Similar results were found in Inamati's (2001) study on menstrual problems of school students in rural and urban areas. She reported that 64 per cent of the respondents, who reported problems, were found to be suffering from lower abdominal pain (dysmenhorrea) and 55 per cent of them reported irregular periods (secondary amenorrhea). Nearly 40 per cent of them reported heavy bleeding (menorrhagia). Similar results regarding menstrual disorders and lower abdomi

nal pain were found in Rahman et al's. (1995) study found that, menstrual disorders were reported by nearly 64 per cent. Nearly 60 per cent of the respondents reported problem of lower abdominal pain.

Regarding vaginal problems in the present study most of the respondents complained of burning sensation during urination. The high prevalence of this particular problem could be due to the poor personal hygiene and sanitation among the respondents. Similar problem was reported in the Rahman et al's. (1995) study.

Some respondents in the present study suffered uterine problems. The problems suffered by these respondents were pain in the uterus and swelling of uterus. No studies were available regarding uterus problems among adolescent girls. Hence no comparative discussion could be presented here.

Conclusion: Thus, from the above discussion, it may be concluded that, the prevalence of menstrual problems among adolescent girls was high. The reason could be that, most of the girls were from the low socio-economic status families and found to be malnourished. Moreover when the adolescents attain menarche in their parental home, the mothers of the adolescents who should become a source of knowledge regarding process of menstruation to make their daughters enlightened regarding their menarche were found to be not giving this information to their daughters. With this lack of knowledge about menstruation, process of menstruation, association between menstruation and reproduction along with the necessity of maintaining hygiene, girls get married and were sent to their marital homes. All these factors cumulatively contribute to the high prevalence of menstrual problems among adolescents. Hence, the menses problems like irregular menses, pain in body and legs, white discharge, excessive bleeding, which can lead to anemia, were found to be highly prevalent among the respondents.

References

1. ANONYMOUS, 2001, Women and Men in India. Central Statistical Organization. Ministry of Statistics and Programme Implementation. Government of India, New Delhi.

2. CHATURVEDI, S., KAPI,L, U BHANTHI, T., GNANASEKARAN, N. AND PANDEY, R.M., 1994, Nutritional status of married adolescent girls in rural Rajasthan. Indian Journal of Pediatrics, 61 (6) : 695-701.

3. INAMATI, V., 2001, Menstrual problems of school students in rural and urban areas of Dharwad taluk. MH.Sc. (Thesis), University of Agricultural Sciences, Dharwad.

4. JEJEEBHOY, S.J., 1996, Maternal mortality and morbidity in India, priorities for social science research. The Journal of Family Welfare, 43 (2) : 31-51.

5. NATIONAL FAMILY HEALTH SURVEY 1992-93, Maternal and child health and family planning. International Institute for Population Sciences, Bombay.

6. RAHMAN, M.M., KABIR, M., SHAHIDULLAH, M., 1995, Adolescent self reported reproductive morbidity and health care seeking behaviour. Department of population dynamics, National Institute of Preventive and social medicine. http://www.unfpa.org.

7. SAROJA, K., 2001, Mahile Mattu Arogya (Kannada Language), Kannada University, Hampi Vidyaranya, pp. 65.

8. SHIVAMEERA, 2000, Women and health. In Alok Mukhopadhay. State of India's health, New Delhi Voluntary Health Association of India and WHO, pp. 275-76.

Table 1: Age and time interval variables related to initiation of reproductive life

N=150

Sl. No.	Age Variables	Frequency	Percentage	Mean
I.	Age at menarche			
	10-12 years	56	37.3	13.07
	13-15 years	86	57.3	
	16-18 years	8	5.4	

Table 2: Nutritional status of the respondents N=150

Sl. No.	Variables	Frequency	Percentage
I.	Height of the respondents		
	< 145 cms	49	32.7
	146 cms – 149 cms	79	52.7
	>150 cms	22	14.7
II.	Weight of the respondents		
	<38 kg	51	32.0
	39kg – 45 kg	30	22.0
	46kg – 55 kg	69	46.0
III.	BMI of the respondents		
	<16.0 Severely malnourished	-	-
	16.0-17.0		
	Moderately malnourished	6	4.2
	17.0-18.5 Mildly malnourished	32	21.3
	18.5-20.0 Low weight normal	51	34.0
	20.0-25.0 Normal	61	40.7

Table 3: Prevalence of health problems unrelated to maternity

N = 150

Sl. No.	Types of problems	Frequency	Percentage
I	*Menstrual problems*		
A.	Respondents with problems	115	76.7
	Respondents without problems	35	23.3
a.	Irregular menses	37	24.7
b.	Pain in body and legs	27	18.0
c.	White discharge	23	15.3
d.	Excessive bleeding	20	13.3
e.	Lower abdominal pain	19	12.7
f.	Long period of menses	19	12.7
g.	Back ache	16	10.7
II	Vaginal or Uterine problems		
	Respondents with vaginal or uterine problems	35	23.3
	Respondents without vaginal or uterine problems	115	76.7
A.	Vaginal problems	20	13.3
a.	Burning sensation during urination	17	11.3
b.	Itching	3	2.0
B.	Uterine problems	15	10.0
a.	Pain in uterus	8	5.4
b.	Swelling of the uterus	7	4.6

Note: Respondents reported more than one problem

THEME 5

CIVIL, MECHANICAL, AEROSPACE AND TRANSPORTATION SCIENCES; ALSO IT, BT, NT (BHARADVAJIYAM)

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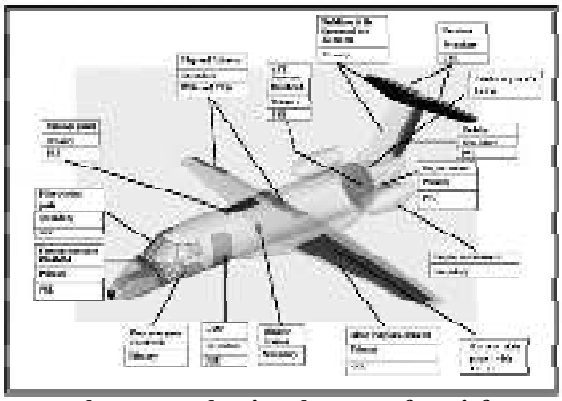
ವಿಮಾನ ಸಂರಚನೆಗಳ ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸ

Kshama,
NAL, Bangalore-560 017

ಪರಿಚಯ : ವಿಮಾನದ ಕಾರ್ಯಾವಧಿಯಲ್ಲಿ ಅದಕ್ಕೆ ಗಂಭೀರ ದಣಿವು, ಕೊರೆತ ಮತ್ತು / ಅಥವಾ ಅಪಘಾತಗಳಿಂದ ಹಾನಿ ಉಂಟಾಗಿದೆಯೇ ಅಥವಾ ಇಲ್ಲವೇ ಎಂಬುದನ್ನು ಖಚಿತಪಡಿಸಿಕೊಳ್ಳಲು ಸಂರಚನೆಯನ್ನು ಪ್ರಮಾಣೀಕರಿಸುವುದನ್ನೇ ಹಾನಿ ಸಹನಾಶಕ್ತಿ ಎನ್ನಬಹುದು. ಅಂದರೆ ವಿಮಾನದ ಒಂದು ಭಾಗ ಹಾನಿಯಾಗಿದ್ದರೂ, ಉಳಿದ ಸಂರಚನಾ ಭಾಗಗಳು ವಿಫಲವಿಲ್ಲದೆ ಅಥವಾ ಹೆಚ್ಚುವರಿ ಸಂರಚನಾ ವಿರೂಪಣವಿಲ್ಲದೆ ಹೊರೆಯನ್ನು ಹೊರಬಲ್ಲ ಶಕ್ತಿಯನ್ನು ಹೊಂದಿದೆಯೇ ಇಲ್ಲವೇ ಎಂಬುದನ್ನು ಪ್ರಮಾಣೀಕರಿಸುವುದೇ ಹಾನಿ ಸಹನಾಶಕ್ತಿಯ ಉದ್ದೇಶವಾಗಿದೆ. ವಿಮಾನದ ವಿನ್ಯಾಸದಲ್ಲಿ ಪರಿಗಣಿಸಬೇಕಾದ ಹಾನಿಯ ಆಕರಗಳೆಂದರೆ – ೧) ದಣಿವು ೨) ಕೊರೆತ ಮತ್ತು ೩) ಅಪಘಾತ. ಸಂರಚನೆಗಳು ಹೊರೆ ಹೊರುವ ಸಾಮರ್ಥ್ಯವನ್ನು ಕಳೆದುಕೊಳ್ಳುವಂತೆ ಗಂಭೀರವಾಗಿರಬೇಕು ಈ ಹಾನಿಗಳು. ಅಲ್ಲದೆ ಇಂತಹ ಹಾನಿಗಳ ಗಂಭೀರತೆಯನ್ನು ತಿಳಿಯಲು, ಸಂರಚನೆಗಳ ಸಂಪೂರ್ಣ ಕಾರ್ಯಾವಧಿಯನ್ನು ಪರಿಗಣಿಸಬೇಕಾಗುತ್ತದೆ. ಹಾನಿಯುಂಟಾದ ಸಂರಚನೆಗಳು ಕನಿಷ್ಠ ಮಟ್ಟದ ಹೊರೆಯನ್ನು ಹೊರಬೇಕಾದ ಅವಶ್ಯಕತೆಯಿದೆ. ಈ ಹಾನಿಗಳನ್ನು ನಿಯಮಕ್ಕನುಸಾರ ವಿಚಾರಣೆಯ ವೇಳೆಯಲ್ಲಿ ಪತ್ತೆ ಮಾಡಬೇಕು ಮತ್ತು ಹಿಂದಿನ ಆರೋಗ್ಯಕರ ಶಕ್ತಿಯನ್ನು ಗಳಿಸಲು ಇವುಗಳನ್ನು ರಿಪೇರಿ ಮಾಡಬೇಕು ಅಥವಾ ಬದಲಿಸಬೇಕು.

ವಿಮಾನವು ಹಾನಿ ಸಹನಾಶಕ್ತಿಯನ್ನು ಹೊಂದಿರುತ್ತದೆ ಎಂದು ಬಯಸಿದರೆ ಸಾಲದು. ಇದನ್ನು ಗಂಭೀರವಾಗಿ ಪರಿಗಣಿಸಬೇಕು; ವಿನ್ಯಾಸ ಹಂತದಲ್ಲಿ ಹಾನಿ ಸಹನಾಶಕ್ತಿಯನ್ನು ಹೊಂದಿರುವಂತೆ ಸಂರಚನೆಯನ್ನು ನಿರ್ಮಿಸಬೇಕು ಮತ್ತು ರಿಪೇರಿ ಅಥವಾ ಬದಲಿಕೆಯ ಮೂಲಕ ವಿಮಾನದ ಸಂಪೂರ್ಣ ಕಾರ್ಯಾವಧಿಯಲ್ಲಿ ವಿಮಾನವು ಹಾನಿ ಸಹನಾಶಕ್ತಿಯನ್ನು ಹೊಂದಿರುವಂತೆ ನೋಡಿಕೊಳ್ಳಬೇಕು.

ವಿಮಾನ ಹಾರಾಟ (Aviation) ನಿಬಂಧನೆಗಳ ಅನುಸಾರ ಹೆಚ್ಚಿನ ವಿಮಾನ ಸಂರಚನಾ ಘಟಕಗಳನ್ನು ಹಾನಿ ಸಹನಾಶಕ್ತಿ ಹೊಂದಿರುವಂತೆ ವಿನ್ಯಾಸಗೊಳಿಸಲಾಗುತ್ತದೆ. ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸವು ಪ್ರಾಯೋಗಿಕವಲ್ಲದ ಸಂರಚನಾ ಘಟಕಗಳಿಗೆ ಈ ನಿಬಂಧನೆಗಳು ಸಂರಕ್ಷಣಾ ಜೀವನ ವಿನ್ಯಾಸದ ಮಾಡಲು ಅವಕಾಶವನ್ನು ನೀಡುತ್ತದೆ.



Damage tolerance evaluation elements of an airframe

ಸಂರಚನೆಗೆ ಹಾನಿ ಸಹನಾಶಕ್ತಿಯ ಅವಶ್ಯಕತೆ

ಸಂರಚನೆಯ ಹಾನಿ ಸಹನಾಶಕ್ತಿಗೆ ಪರಿಗಣಿಸಬೇಕಾದ ಕೆಲವು ಅವಶ್ಯಕತೆಗಳು ಹೀಗಿವೆ :

೧) ಸಂರಕ್ಷಣೆ

ವಿಮಾನದ ಪ್ರಾಥಮಿಕ ಸಂರಚನೆಯು ಸಾಕಷ್ಟು ಹಾನಿ ಸಹನಾಶಕ್ತಿಯನ್ನು ಹೊಂದಿದ್ದು, ಅದರ ಕಾರ್ಯಾವಧಿಯಲ್ಲಿ ಯಾವುದೇ ರೀತಿಯ ಪ್ರಳಯಕಾರಿ ವಿಫಲತೆ ಉಂಟಾಗದಿರುವುದು ಖಚಿತವಾಗಿರಬೇಕು. ಹಾನಿ ಸಹನಾಶಕ್ತಿಯ ಬಗೆಗಿನ ಮೂರು ಮುಖ್ಯ ವಿಷಯಗಳೆಂದರೆ
೧) ಪತ್ತೆ ಮಾಡದಿರುವ ಹಾನಿಯು ವಿಮಾನ ಜೀವನದುದ್ದಕ್ಕೆ ಬದಲಾಗದೆ ಹಾಗೆಯೇ ಇರಬೇಕು.
೨) ಪತ್ತೆ ಮಾಡಲಾದ ಹಾನಿಯು ನಿರ್ದಿಷ್ಟ ಸಮಯದ ಅವಧಿಗೆ ಹಾಗೆಯೇ ಉಳಿಯಬೇಕು.
೩) ವಿಮಾನ ಹಾರುತ್ತಿರುವಾಗ ಉಂಟಾಗುವ ಹಾನಿಯು, ಹಾರಾಟ ಸುರಕ್ಷಿತವಾಗಿ ಮುಗಿಯುವವರೆಗೆ ಅದು ವಿಮಾನವನ್ನು ಬದಲಿಸಬಾರದು.

೨) ಸಂರಚನಾ ದಕ್ಷತೆ

ಮೇಲಿನ ಅವಶ್ಯಕತೆಗಳಿಗೆ ಪೂರ್ವ ತಯಾರಿಯೆಂದರೆ ಸಂರಚನೆಯಲ್ಲಿ ಸಾಮಾನ್ಯ ಕಾರ್ಯ ಶ್ರಮಗಳು ಕಡಿಮೆ ಇರುವಂತೆ ಮಾಡುವುದು. ಈ ದೃಷ್ಟಿಯಿಂದ ತೂಕ ಕಡಿಮೆಗೊಳಿಸುವುದರ ಮೂಲಕ ಕಡಿಮೆ ವಿನ್ಯಾಸ ಶ್ರಮ ಉಂಟಾಗುವಂತೆ ಮಾಡಬಹುದು.

ಆದ್ದರಿಂದಲೇ ಹಾನಿ ಸಹನಾಶಕ್ತಿಯ ಗುರಿ ಎಂದರೆ – ಉಳಿದ ಸಾಮರ್ಥ್ಯ ಅವಶ್ಯಕತೆಗಳೊಂದಿಗೆ ಸಮಂಜಸವಿರುವ ಅತಿ ಹೆಚ್ಚು ಸಾಧ್ಯ ಹಂತದಲ್ಲಿ ವಿನ್ಯಾಸ ಶ್ರಮಗಳನ್ನು ಇಡುವುದು. ಇದರಿಂದ ಕನಿಷ್ಠ ತೂಕ ಸಂರಚನೆಯನ್ನು ಪಡೆಯಬಹುದಾಗಿದೆ.

೩) ಅರ್ಥಶಾಸ್ತ್ರ

೧) ಹಾನಿ – ಸಹನಾಶಕ್ತಿ ಉತ್ಪಾದಕಗಳನ್ನು ತಯಾರಿಸಲು, ಸಂಸ್ಕರಣಾ ತಯಾರಿಕೆ ಮೌಲ್ಯವು ಕಡಿಮೆ ಇರುವಂತೆ, ವಸ್ತು ಮತ್ತು ವಿನ್ಯಾಸ ರಚನೆ ಇರಬೇಕು.
೨) ಲೋಹ ಸಂರಚನೆಗಳಿಗೆ, ಹಾನಿ ಸಹನಾಶಕ್ತಿ, ಸಂರಚನಾ ದಕ್ಷತೆ, ಕಡಿಮೆ – ಖರ್ಚಿನ ತಯಾರಿಕೆ ಮತ್ತು ಸುಸ್ಥಿತಿಯಲ್ಲಿಡುವುದು ಇವುಗಳ ಅಂದಾಜು ಸಮತೋಲನವನ್ನು ಮಾಡಲಾಗುತ್ತದೆ. ಇದರಿಂದ ಉತ್ಕೃಷ್ಟವಾದ ಸಂರಕ್ಷಣೆಯನ್ನು ಪಡೆಯಲು ಸಾಧ್ಯ.

ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸ

ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸದಲ್ಲಿ ಮೂರು ಹಂತಗಳಿವೆ.
೧) ಪೂರ್ವತಯಾರಿಕಾ ಹಂತ
೨) ವಿನ್ಯಾಸ, ವಿಶ್ಲೇಷಣೆ ಮತ್ತು ಪರೀಕ್ಷಾ ಪ್ರಮಾಣೀಕರಣ ಹಂತ
೩) ಪತ್ತೆ ಹಚ್ಚುವುದು, ರಿಪೇರಿ / ಬದಲಿಕಾ ಹಂತ

ಪೂರ್ವತಯಾರಿಕಾ ಹಂತ

ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸವು ಸಾಮಾನ್ಯವಾಗಿ ವಿಮಾನದ ಮುಕ್ಕಾಲುಭಾಗ ಪ್ರಾಥಮಿಕ ಸಂರಚನೆಗಳಿಗೆ ಪ್ರಾಯೋಗಿಕವಾಗಿರುತ್ತದೆ.

ಸಂಪೂರ್ಣ ವಿಮಾನವನ್ನು ಸೂಕ್ಷ್ಮವಾಗಿ ಪರೀಕ್ಷಿಸಿ, ಇವುಗಳನ್ನು ಗುರುತಿಸಲಾಗುತ್ತದೆ.

೧) ಪ್ರಮುಖ ಸಂರಚನಾ ಭಾಗಗಳು (Principal Structural Elements – PSEs)

೨) ಗಂಭೀರ ಸಂರಚನಾ ಭಾಗಗಳು (Critical Structural Elements – CSEs)

ಪ್ರಳಯಕಾರಿ ವಿಫಲತೆಗೆ ಕಾರಣವಾಗುವ ಪತ್ತೆಹಚ್ಚದ ಹಾನಿಯನ್ನು ತಡೆದುಕೊಳ್ಳುವ ಶಕ್ತಿಯು ಈ ಭಾಗಗಳಿಗೆ ಇರುತ್ತದೆ. ಈ ಶಕ್ತಿಗೆ ಕಾರಣವೆಂದರೆ –

ಆ ಭಾಗದಲ್ಲಿರುವ ೧) ಒಟ್ಟು ಶ್ರಮ ಸ್ತರ ೨) ಹೊರೆ ಮಾರ್ಗ ಕಡಿತಗೊಳಿಸುವಿಕೆ ೩) ಕೊರೆತ ತಡೆಯುವ ಶಕ್ತಿ ೪) ಮೂಲ ವಸ್ತುವಿನ ಗಡಸುತನ ೫) ಪತ್ತೆ ಹಚ್ಚುವಿಕೆಗೆ ಈ ಪ್ರದೇಶಗಳ ಲಭ್ಯತೆ. ಚಿತ್ರವು ವಿಮಾನವೊಂದರ ಪ್ರಮುಖ ಸಂರಚನಾ ಭಾಗಗಳು ಮತ್ತು ಗಂಭೀರ ಸಂರಚನಾ ಭಾಗಗಳನ್ನು ತೋರಿಸುತ್ತದೆ.

ಹಾನಿ ಸ್ಥಳಗಳು

ಮುಂದಿನ ಹೆಜ್ಜೆಯೆಂದರೆ ಪ್ರಮುಖ ಸಂರಚನಾ ಭಾಗಗಳು ಮತ್ತು ಗಂಭೀರ ಸಂರಚನಾ ಭಾಗಗಳಲ್ಲಿರುವ ಹಾನಿ ಪ್ರದೇಶಗಳನ್ನು ಗುರುತಿಸುವುದು. ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸದ ಉದ್ದೇಶಕ್ಕಾಗಿ, ಹಾನಿಗಳು ಅನೇಕ ಸಾಧ್ಯವಾದ ಸ್ಥಳಗಳಲ್ಲಿ ಅಸ್ತಿತ್ವದಲ್ಲಿ ಇರಬಹುದು ಎಂದು ನಂಬಬೇಕು. ಇಂತಹ ಸ್ಥಳಗಳು ಕನಿಷ್ಠ ಸಾಧ್ಯವಾಗುವ ಉಳಿದ ಶಕ್ತಿ, ದಣಿವು ಜೀವನ ಮತ್ತು ಇತ್ಯಾದಿಗಳನ್ನು ನೀಡುತ್ತದೆ.

ಹಾನಿ ಸ್ಥಳಗಳನ್ನು ವಿಶ್ಲೇಷಣೆ ಮೂಲಕ ಅಥವಾ ವಿಮಾನದ ಸಂಪೂರ್ಣ ಅಥವಾ ಅದರ ಭಾಗಗಳ ಮೇಲೆ ನಡೆಸುವ ದಣಿವು ಪರೀಕ್ಷೆಯ ಮೂಲಕ ಕಂಡುಹಿಡಿಯಬಹುದು. ಸ್ಥಿರ ವಿಶ್ಲೇಷಣೆಯಿಂದ, ಉಚ್ಚ ಶ್ರಮ ಕೇಂದ್ರೀಕೃತ ಸ್ಥಳಗಳನ್ನು ಗುರುತಿಸಬಹುದು. ಇದೇ ರೀತಿ ದಣಿವು ಹಾನಿ ಲೆಕ್ಕಾಚಾರಗಳು, ಪ್ರಳಯಕಾರಿ ವಿಫಲತೆಗೆ ಕಾರಣವಾಗುವ ದಣಿವು ಒಡೆತ ಪ್ರದೇಶಗಳನ್ನು ಗುರುತಿಸಬಲ್ಲವು. ಗಣನೆಗೆ ತೆಗೆದುಕೊಳ್ಳಬೇಕಾದ ಇತರೆ ಸ್ಥಳಗಳೆಂದರೆ–

೧) ಹಾನಿಯೊಂದಿಗೆ ಗರಿಷ್ಠ ಶ್ರಮವನ್ನು ಹೊಂದಿರುವ ಭಾಗದ ಪಕ್ಕದ ಭಾಗಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಿ.

೨) ಉಚ್ಚ ಶ್ರಮ ಕೇಂದ್ರೀಕೃತ ಭಾಗಗಳ ಅಕ್ಕಪಕ್ಕದ ಭಾಗಗಳಲ್ಲಿನ ಅಲ್ಪ ಮುರಿದಿರುವ ಸ್ಥಳಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಿ.

೩) ಪತ್ತೆ ಹಚ್ಚುವಿಕೆ ಮತ್ತು ಅಥವಾ ಹುಡುಕುವಿಕೆಗೆ ಕಷ್ಟವಾಗಿರುವ ಸ್ಥಳಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಿ. ಹಕ್ಕಿ ಹೊಡೆತದಿಂದ ಹಾನಿಗೊಳಗಾಗುವ ಸಾಧ್ಯತೆಯಿರುವ ಸ್ಥಳಗಳು, ಇಂಜಿನ್‌ನ ವಿಫಲತೆಯಿಂದ ಹಾನಿಗೊಳಗಾಗುವ ಸ್ಥಳಗಳು ಇವುಗಳನ್ನೂ ಗುರುತಿಸಬೇಕಾಗುತ್ತದೆ. ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿಶ್ಲೇಷಣೆಯನ್ನು ಆರಂಭಿಸಲು ಅವಶ್ಯಕವಿರುವ ಎರಡು ಇತರೆ ವಿಷಯಗಳೆಂದರೆ – ೧) ಸಂರಚನೆಯಲ್ಲಿನ ಹೊರೆ ಮಾರ್ಗಗಳ ಏರ್ಪಾಡು ಮತ್ತು ೨) ಸಂರಚನೆಗೆ ವಸ್ತುವಿನ ಆಯ್ಕೆ.

ಹೊರೆ ಮಾರ್ಗ

ಹೊರೆ ಮಾರ್ಗ ಏರ್ಪಾಡು, ಸಂರಚನೆಯನ್ನು ಎರಡು ರೀತಿಯಲ್ಲಿ ನಿರ್ಧರಿಸುತ್ತದೆ.

೧) ಏಕ ಹೊರೆ ಮಾರ್ಗ ಸಂರಚನೆ

೨) ಅನೇಕ ಹೊರೆ ಮಾರ್ಗ ಸಂರಚನೆ

ಏಕ ಹೊರೆ ಮಾರ್ಗ ಸಂರಚನೆಗೆ, ವಿಫಲತೆಯ ಅಪಾಯ ಹೆಚ್ಚು. ಆದರೆ ಅನೇಕ ಹೊರೆ ಮಾರ್ಗ ಸಂರಚನೆಯಲ್ಲಿ, ಪರಿಗಣಿಸಬೇಕಾದ ಹಾನಿಗೊಳಗಾಗುವ ಪ್ರದೇಶಗಳು ಹೆಚ್ಚು. ಏಕ ಹೊರೆ ಮಾರ್ಗ ಸಂರಚನೆಗೆ ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸವು ಮುಂದಿನವುಗಳನ್ನು ಖಚಿತಪಡಿಸಬೇಕು. ಸಂರಚನೆಯು ಒಡೆತ ಮುಕ್ತ ಜೀವನವನ್ನು ಹೊಂದಿರಬೇಕು ಅಥವಾ ಸಂರಚನೆಯ ಸೇವಾ ಜೀವನದಲ್ಲಿ ಉಂಟಾದ ಒಡೆತವು ತೊಂದರೆ ಮಾಡುವಷ್ಟು ಗಾತ್ರಕ್ಕೆ ಬೆಳೆಯಬಾರದು. ಅನೇಕ ಹೊರೆ ಮಾರ್ಗ ಸಂರಚನಾ ಭಾಗಕ್ಕೆ ಮೂರು ವಿಷಯಗಳನ್ನು ಖಚಿತಪಡಿಸಬೇಕು.

೧) ಕನಿಷ್ಠ ಒಡೆತ ಮುಕ್ತ ಜೀವನ (ಆ ಸಮಯದವರೆಗೂ ಪತ್ತೆ ಹಚ್ಚುವ ಅವಶ್ಯಕತೆ ಇಲ್ಲ)

೨) ಮೊದಲ ಪತ್ತೆ ಹಚ್ಚುವಿಕೆಗೆ ಸಮಯ ಮತ್ತು

೩) ಪತ್ತೆ ಹಚ್ಚುವ ಅವಧಿ.

ಆದರೂ ಹಾನಿಯಾಗದ ಸಂರಚನೆಯಲ್ಲಿ ಕೇವಲ ಹೊರೆ ಮಾರ್ಗಗಳನ್ನು ಪರಿಗಣಿಸುವುದು ಮಾತ್ರ ಸಾಲುವುದಿಲ್ಲ. ಸೇವಾ ಜೀವನದಲ್ಲಿ ಹಾನಿಯು ಹೆಚ್ಚಾದಂತೆ, ಸಂರಚನಾ ಭಾಗಗಳ ಪ್ರತಿಕ್ರಿಯೆಗಳು ಬದಲಾಗುತ್ತವೆ ಮತ್ತು ಆದ್ದರಿಂದ ಹೊರೆ ಮಾರ್ಗವು ಬದಲಾಗುತ್ತದೆ. ಅಂದರೆ ಅನೇಕ ಹೊರೆ ಮಾರ್ಗ ಸಂರಚನೆಯು ಏಕ ಹೊರೆ ಮಾರ್ಗ ಸಂರಚನೆಯಾಗಬಹುದು.

ವಸ್ತು ಆಯ್ಕೆ

ವಿನ್ಯಾಸ ಹಂತದಲ್ಲಿ ವಸ್ತು ಆಯ್ಕೆಯು, ಸಂರಚನೆಯ ಹಾನಿ ಸಹನಾಶಕ್ತಿ ಗುಣಮಟ್ಟದಲ್ಲಿ ಪ್ರಮುಖ ಪಾತ್ರವನ್ನು ವಹಿಸುತ್ತದೆ. ವಸ್ತುವನ್ನು ಆಯ್ಕೆ ಮಾಡುವಾಗ ಕೆಳಗೆ ಸೂಚಿಸಿರುವ ಗುಣಗಳನ್ನು ಗಮನಿಸಬೇಕು.

೧) ನಿಯಂತ್ರಣಕ್ಕೊಳಪಟ್ಟ ನಿಧಾನ ಬೆಳೆಯುವ ವೇಗ ಪ್ರಮಾಣ

೨) ಹೆಚ್ಚು ಮುರಿತ ಗಡಸುತನ

೩) ಒಳ್ಳೆಯ ಕೊರೆತ ರೋಧಕತೆ

ಆರಂಭಿಕ ಹಾನಿಯ ಬಗೆ ಮತ್ತು ವಿಸ್ತರಣೆ

ಹಾನಿ ಸಹನಾಶಕ್ತಿಯ ಅಸ್ತಿತ್ವದ ತಯಾರಿಕೆಯಲ್ಲಿನ ಕೊನೆಯ ಹಂತವೆಂದರೆ – ಹಾನಿ ಬಗೆಯ ಆಯ್ಕೆ ಮತ್ತು ವಿಸ್ತರಣೆ. ಆಯ್ಕೆ ಮಾಡಿದ ಹಾನಿ ಸ್ಥಳಗಳಲ್ಲಿ ಹಾನಿ ಬಗೆಯನ್ನು ಮತ್ತು ವಿಸ್ತರಣೆಯನ್ನು ನಿರ್ಧರಿಸಬೇಕು. ಹಾನಿ ಬಗೆಗಳೆಂದರೆ – ೧) ದಣಿವು ಒಡೆತಗೊಳ್ಳುವಿಕೆ ೨) ಕೊರೆತ ಹಾನಿ ಮತ್ತು ೩) ವಿಭಿನ್ನ ಆಕರಗಳಿಂದಾದ ಹಾನಿ. ಹಾನಿಯ ವಿಸ್ತರಣೆಯು ಹಾನಿಯ ಗಾತ್ರ ಮತ್ತು ಆಕಾರಗಳನ್ನು ಪ್ರತಿನಿಧಿಸುತ್ತದೆ.

ಆರಂಭಿಕ ಒಡೆತಗಳ ಶಿಷ್ಟ ಆಕಾರಗಳು ಮತ್ತು ಗಾತ್ರಗಳನ್ನು ಊಹೆ ಮಾಡಲಾಗುತ್ತದೆ. ಇವುಗಳು ಉತ್ಪಾದನಾ ದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ವಿತರಣೆಯ USAF ಅಧ್ಯಯನಗಳನ್ನು ಆಧರಿತವಾಗಿವೆ. ಆರಂಭಿಕ ಒಡೆತಗಳಿಗೆ ಎರಡು ಪ್ರತ್ಯೇಕ ನಿರ್ದಿಷ್ಟತೆಗಳಿವೆ.

೧) ೦.೦೫ ಇಂಚಿನ ಧೂರ್ತ(ಕೆಟ್ಟ) ದೋಷ

ಇದು ಉತ್ಪಾದನಾ ದೋಷವಾಗಿದ್ದು, ಇದನ್ನು ಪತ್ತೆ ಮಾಡಲಾಗುವುದಿಲ್ಲ.

೨) ೦.೦೦೫ ಇಂಚಿನ ಸರಾಸರಿ ದೋಷ

ಇದಕ್ಕೆ ಕಾರಣ ಸಾಮಾನ್ಯ ತಯಾರಿಕಾ ವಿಧಾನಗಳು

ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸದಲ್ಲಿ, ಸಂರಚನೆಯಲ್ಲಿ ಚಿಕ್ಕ ಒಡೆತಗಳಿರುವ ಕಾರಣ, ಅದರ ಪಕ್ಕದಲ್ಲಿ ದೊಡ್ಡ ಒಡೆತವು ವೇಗವಾಗಿ ಬೆಳೆಯಬಹುದೆಂಬ ಪ್ರಮುಖ ಅಂಶವನ್ನು ಪರಿಗಣಿಸಬೇಕಾಗುತ್ತದೆ.

ಅಲ್ಲದೆ ಊಹೆ ಮಾಡಲಾದ ಆರಂಭಿಕ ಒಡೆತದಲ್ಲಿ ಸ್ವಲ್ಪ ಬದಲಾವಣೆ ಇದ್ದರೂ, ಅದು ಒಡೆತ ಬೆಳವಣಿಗೆ ಜೀವನದಲ್ಲಿ ದೊಡ್ಡ ವ್ಯತ್ಯಾಸವನ್ನೇ ಉಂಟುಮಾಡಬಲ್ಲದು.

ಪತ್ತೆ ಮಾಡಬಹುದಾದ ಒಡೆತದ ಗಾತ್ರ

ಆರಂಭಿಕ ಒಡೆತ ಗಾತ್ರದ ಊಹೆಯನ್ನಲ್ಲದೆ, ಒಡೆತಗಳ ಪತ್ತೆಮಾಡಬಹುದಾದ ಗಾತ್ರಗಳನ್ನು ಸಹ ಅಸ್ತಿತ್ವಗೊಳಿಸಬೇಕಾಗುತ್ತದೆ. ಇಂತಹ ಪತ್ತೆಮಾಡಬಹುದಾದ, ಕಾಣುವಂತಹ, ಒಡೆತಗಳ ಗಾತ್ರ ಊಹೆ ಮಾಡಲಾದ ಆರಂಭಿಕ ಒಡೆತ ಗಾತ್ರಕ್ಕಿಂತ ಹೆಚ್ಚಿರುತ್ತದೆ. ಎಷ್ಟು ಹೆಚ್ಚಿರುತ್ತದೆ ಎಂಬುದು ಸಂರಚನೆಯ ಪತ್ತೆ ಹಚ್ಚುವಿಕೆ, ಪ್ರವೇಶ, ಕಾರ್ಯ ವಾತಾವರಣ ಮತ್ತು ರಚನೆಗಳನ್ನು ಆಧರಿಸಿವೆ. ಮೊದಲ ಪರೀಕ್ಷೆಗಾಗಿ ಸಮಯವನ್ನು ನಿರ್ದಿಷ್ಟಗೊಳಿಸಲು ಪ್ರತಿಯೊಂದು ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿಶ್ಲೇಷಣೆಗೆ ಪತ್ತೆ ಮಾಡಬೇಕಾದ, ಸೂಕ್ತ ಗಾತ್ರದ ಒಡೆತವನ್ನು ಊಹಿಸಬೇಕು. ಇದೇ ರೀತಿ ವಿಭಿನ್ನ ಆಕರ ಹಾನಿಗಳಿಗೆ ಗಾತ್ರಗಳನ್ನು ಊಹಿಸಬೇಕು.

ಹೀಗೆ ಹೇಳಿದ ಇಂತಹ ಪೂರ್ವ ತಯಾರಿಕಾ ದತ್ತದ ಮೇಲೆ ಗುಣಮಟ್ಟದ ಹಾಗೂ ಸಂಪೂರ್ಣ ವರದಿಯನ್ನು ತಯಾರಿಸಬೇಕು. ಇದು ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸದ ಮುಂದಿನ ಹಂತಕ್ಕೆ ಮಾರ್ಗದರ್ಶಿಯಾಗುತ್ತದೆ. ಈ ವರದಿಯು ಮಾಡಿದ ಊಹೆಗಳು, ಪ್ರಮುಖ ಸಂರಚನಾ ಭಾಗಗಳು, ಗಂಭೀರ ಸಂರಚನಾ ಭಾಗಗಳನ್ನು ಮತ್ತು ಹಾನಿ ಸ್ಥಳಗಳನ್ನು ಕಂಡು ಹಿಡಿಯಲು ಬಳಸಿದ ವಿಧಾನಗಳು ಇತ್ಯಾದಿ ಎಲ್ಲವನ್ನೂ ಒಳಗೊಳ್ಳಬೇಕು.

ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿಶ್ಲೇಷಣೆ

ಎರಡನೇ ಹಂತವು ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿಶ್ಲೇಷಣೆ ಮತ್ತು ಪರೀಕ್ಷೆ ರುಜುವಾತು ಇವುಗಳನ್ನು ಒಳಗೊಂಡಿದೆ. ಹಿಂದೆ ಹೇಳಿದಂತೆ, ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿಶ್ಲೇಷಣೆಯು ಕೆಳಗಿನವುಗಳನ್ನು ಅಸ್ತಿತ್ವಗೊಳಿಸಬೇಕು.

೧) ಏಕ ಹೊರೆ ಮಾರ್ಗ ಸಂರಚನಾ ಭಾಗಗಳಿಗೆ ಸುರಕ್ಷತಾ ಒಡೆತ ಬೆಳವಣಿಗೆ ಪ್ರಮಾಣ

೨) ಅನೇಕ ಹೊರೆ ಮಾರ್ಗ ಭಾಗಗಳಿಗೆ

- ಮೊದಲ ಪರೀಕ್ಷೆಗೆ ಬೇಕಾದ ಸಮಯ
- ಸುರಕ್ಷತಾ ಪರೀಕ್ಷಾ ಅವಧಿ
- ವಿಫಲ – ಸುರಕ್ಷತಾ ಸಂರಚನೆಗೆ ಪ್ರತ್ಯೇಕ ಭಾಗ ಮುರಿತವನ್ನು ಹಿಡಿಯುವ ಮತ್ತು ಇಟ್ಟುಕೊಳ್ಳುವ ಸಾಮರ್ಥ್ಯ

ವಿಮಾನ ಹಾರಾಟ ನಿಯಮಗಳಲ್ಲಿ ಹಾನಿ ಸಹನಾಶಕ್ತಿ ಅವಶ್ಯಕತೆಗಳನ್ನು ಪರಿಚಯಿಸಿದಾಗಿನಿಂದ, ಸಂರಚನೆಗಳಲ್ಲಿ ಇರುವ ಹಾನಿಗಳಿಂದ ಉಂಟಾಗುವ ಪ್ರಳಯಕಾರಿ ವಿಫಲತೆಗಳನ್ನು ತಡೆಯುವ ನಿಟ್ಟಿನಲ್ಲಿ ಶ್ರಮಿಸಲಾಗುತ್ತಿದೆ. ಅಲ್ಲದೆ ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸದ ಸಂಪೂರ್ಣ ಪ್ರಕ್ರಿಯೆಯಲ್ಲಿ ಹಾನಿ ಪತ್ತೆ ಹಚ್ಚುವಿಕೆಯು ಅತ್ಯಂತ ದುರ್ಬಲವಾದುದು ಎಂಬುದು ಈಗಾಗಲೇ ತಿಳಿದಿರುವ ವಿಷಯ. ಅತ್ಯಂತ ದೊಡ್ಡ ಗಾತ್ರದ ದೋಷದ ಇರುವಿಕೆಯಲ್ಲಿ ಸಂರಚನೆಯ ಸಾಮರ್ಥ್ಯವನ್ನು ಕಂಡುಹಿಡಿಯುವಲ್ಲಿ ಹೆಚ್ಚಿನ ಸಂಶೋಧನೆ ನಡೆದಿದೆ. ಈಗ ವಿಮಾನ ಉದ್ದಿಮೆಗಳು **'೨ – ತುದಿಗಳಲ್ಲಿನ ಒಡೆತ ಕಡಿಮೆ ಮಾಡುವ ಸಾಮರ್ಥ್ಯ'** ಎನ್ನುವ ತತ್ವವನ್ನು ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸದ ಶಿಷ್ಟತೆ ಎಂಬುದಾಗಿ ಒಪ್ಪಿಕೊಂಡಿದೆ. ಇದನ್ನು ದಸ್ತಾವೇಜುಗಳಲ್ಲಿ ನಿರ್ದಿಷ್ಟವಾಗಿ ಹೇಳದಿದ್ದರೂ, ಅಗಲ – ದೇಹ ಸಾರಿಗೆ ವಿಮಾನಗಳ ಅಭಿವೃದ್ಧಿಯಲ್ಲಿ ಪ್ರಮುಖ ವಿಮಾನ ಕಂಪೆನಿಗಳು ಇದನ್ನು ಅಭ್ಯಾಸಗೊಳಿಸಿವೆ.

ದಣಿವು ಹಾನಿಯ ಸಂಗ್ರಹ ವಿಮಾನದಲ್ಲಿ ಅನಿವಾರ್ಯ. ಆದ್ದರಿಂದಲೇ ದಣಿವು ಪ್ರಕ್ರಿಯೆಯ ಬಗ್ಗೆ ಯೋಚಿಸುವ ಬದಲು ದಣಿವಿನಿಂದ ಉಂಟಾಗುವ ಪ್ರಳಯಕಾರಿ ವಿಫಲತೆಯನ್ನು ಹೇಗೆ ತಡೆಯಬಹುದೆಂದು ಯೋಚಿಸಲಾಗುತ್ತಿದೆ. ವಿಮಾನ ಸಂರಚನೆಯು ಅನೇಕ ಹೊರೆ ಮಾರ್ಗಗಳಂತಹ ಗುಣಗಳನ್ನು ಹೊಂದಿರುತ್ತದೆ. ಒಡೆದಿರುವ ಸಂರಚನಾ ಭಾಗದಿಂದ ಹೊರೆಗಳನ್ನು ಅಕ್ಕಪಕ್ಕದ ಸರಿಯಾದ ಭಾಗಕ್ಕೆ ವರ್ಗಾಯಿಸಿ, ಒಡೆತ ತುದಿಯಲ್ಲಿ ಶ್ರಮದ ಶಕ್ತಿಯನ್ನು ಕಡಿಮೆ ಮಾಡಬಹುದು. ಇದರಿಂದ ಒಡೆತವು ಮುಂದೆ ಹೋಗುವುದನ್ನು ತಡೆಗಟ್ಟಲೂಬಹುದು.

ಪರೀಕ್ಷೆಯ ದೃಢೀಕರಣ

ನಿರ್ದಿಷ್ಟ ಒಡೆತ ಬೆಳವಣಿಗೆ ಜೀವನವು ವಿಶ್ಲೇಷಣೆಯನ್ನು ಆಧರಿಸಿದೆ. ಆದ್ದರಿಂದ ಪರೀಕ್ಷಾ ಫಲಿತಾಂಶಗಳೊಂದಿಗೆ ಸಂಬಂಧಿಸಿ, ತಯಾರು ಮಾಡಲಾದ ಮಾದರಿಗಳನ್ನು ಖಚಿತಪಡಿಸಲಾಗುತ್ತದೆ. ಒಡೆತ ಬೆಳವಣಿಗೆಯ ಮಾದರಿಗಳು ಇವುಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುತ್ತವೆ.

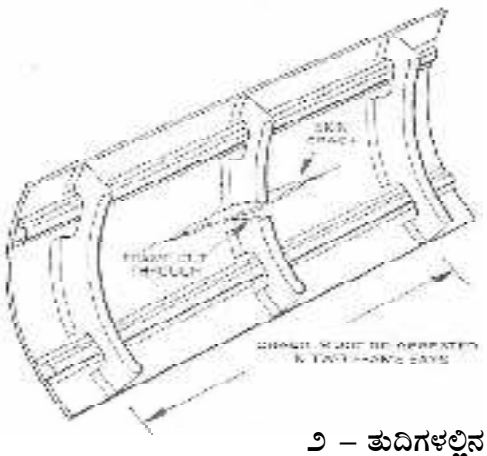
೧) ಒಡೆತ ರಚನೆಗೆ ಶ್ರಮ ತೀವ್ರತೆ ಅಂಶ

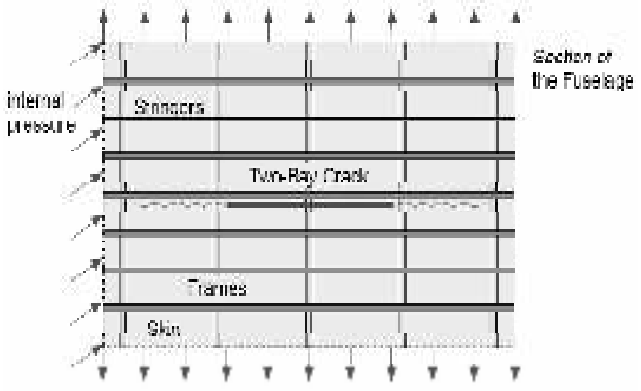
೨) ಸಾಮಾನ್ಯ ಶ್ರಮದ ಅಳತೆಗಳಲ್ಲಿ ವಿಮಾನ ಹಾರಾಟ ಹೊರೆ ರೋಹಿತ

೩) ವಸ್ತುವಿನ ಒಡೆತ ಬೆಳವಣಿಗೆ ಪ್ರಮಾಣ ಸಮೀಕರಣ

೪) ಹೊರೆ ಒಡಂಬಡಿಕೆ ಮಾದರಿ

ಇವೆಲ್ಲವೂ ಒಳಾರ್ಥ – ಹೊರಾರ್ಥ ಊಹೆಗಳನ್ನು ಹೊಂದಿದ್ದು,





೨ – ತುದಿಗಳಲ್ಲಿನ ಒಡೆತ ಕಡಿಮೆ ಮಾಡುವ ಸಾಮರ್ಥ್ಯ

ಇವುಗಳನ್ನು ಖಚಿತಪಡಿಸಬೇಕು. ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿಶ್ಲೇಷಣೆಯಲ್ಲಿ ವಿಶ್ವಾಸವನ್ನು ಅಸ್ತಿತ್ವಗೊಳಿಸಲು, ಜೀವನ ಲೆಕ್ಕಾಚಾರಗಳನ್ನು ಪರೀಕ್ಷಾ ದತ್ತದೊಂದಿಗೆ ಸಂಬಂಧಿಸಬೇಕಾಗುತ್ತದೆ. ಸ್ಥಿರ ಪಾರ ಹೊರೆಯೊಂದಿಗೆ ವಿನ್ಯಾಸ, ಅಭಿವೃದ್ಧಿಪಡಿಸಬೇಕಾದ ವಿಮಾನವನ್ನು ಪರೀಕ್ಷಿಸಲಾಗುತ್ತದೆ. ಇದರಿಂದ ವಿಶ್ಲೇಷಣೆ ಮೂಲಕ ಗಳಿಸಿದ ಶ್ರಮ ತೀವ್ರತೆ ಅಂಶವನ್ನು ಕ್ಯಾಲಿಬ್ರೇಟ್ ಮಾಡಬಹುದು. ರೋಹಿತ ಹೊರೆ ಒಡೆತ ಬೆಳವಣಿಗೆ ಮಾದರಿಯೊಂದಿಗೆ ಸಹಸಂಬಂಧವನ್ನು ಏರ್ಪಡಿಸಲು, ಕ್ಯಾಲಿಬ್ರೇಟ್ ಮಾಡಿದ K – ಕಾರ್ಯಭಾರದೊಂದಿಗೆ ವಿಮಾನ ಒಡೆತಗಳಿಂದ ದೊರೆತ ವಿಮಾನ ಜೀವನ ದತ್ತವನ್ನು ಬಳಸಲಾಗುತ್ತದೆ. ಒಡೆತ ಬೆಳವಣಿಗೆ ಮಾದರಿಯನ್ನು ಖಚಿತಪಡಿಸಲು, ವಿಮಾನದ ಪ್ರಮುಖ ಉಪ–ಸಂಯೋಜಕಗಳಲ್ಲಿ K – ಕ್ಯಾಲಿಬ್ರೇಷನ್ ಪರೀಕ್ಷೆಗಳನ್ನು ಕೈಗೊಳ್ಳಲಾಗುತ್ತದೆ. ನಂತರ ಅದೇ ವಿಮಾನ ಉಪ – ಸಂಯೋಜಕಗಳ ಮೇಲೆ ದಣಿವು ಒಡೆತ ಬೆಳವಣಿಗೆ ಪರೀಕ್ಷೆಯನ್ನು ಕೈಗೊಳ್ಳಲಾಗುತ್ತದೆ.

ತನಿಖೆ ರಿಪೇರಿ ಅಥವಾ ಬದಲಿಕೆ

ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿಮಾನವನ್ನು ಅಭಿವೃದ್ಧಿ ಪಡಿಸುವಲ್ಲಿ NDI ನ ಪ್ರಾಮುಖ್ಯತೆ ಪ್ರಸಿದ್ಧಿಯಾಗಿದೆ.

ಕೆಳಗಿನ ವಿಷಯಗಳನ್ನು ನಿರ್ದಿಷ್ಟಪಡಿಸುವ ಅಗತ್ಯವಿದೆ.

* ದಣಿವು ಮತ್ತು ಕೊರೆತ ಹಾನಿಗಳ ಪತ್ತೆ ಹಚ್ಚುವಿಕೆಗೆ ಬಳಸಬಹುದಾದ ಉಪಕರಣಗಳ ಆಯ್ಕೆ
* ಪತ್ತೆ ಹಚ್ಚುವಿಕೆಯ ಮಿತಿಯ ಸ್ಥಾಪನೆ
* ಪ್ರತಿಯೊಂದು ಗಂಭೀರ ಸ್ಥಳಕ್ಕೆ NDI ವಿಧಾನದ ಅಭಿವೃದ್ಧಿ
* ಸುಸ್ಥಿತಿಯಲ್ಲಿಡಲು ಮತ್ತು ರಿಪೇರಿಯ ಕೈಪಿಡಿಯ ತಯಾರಿಕೆ

ಕೊನೆಯದಾಗಿ, ವಿಫಲತೆಗಳನ್ನು ಒಟ್ಟಿನಲ್ಲಿ ಸಂಪೂರ್ಣವಾಗಿ ತಡೆಗಟ್ಟುವುದು ಅಸಾಧ್ಯ. ವಿನ್ಯಾಸಗಾರರು ವಿಫಲತೆಯ ಸಂಭವತೆಯನ್ನು ಒಪ್ಪಿಗೆಯಾಗುವ ಕೆಳ ಸ್ತರದಲ್ಲಿ ಇರುವಂತೆ ನೋಡಿಕೊಳ್ಳುತ್ತಾರೆ. ಯಾವುದೇ ವಿಮಾನವು ಹಾರಾಟದಲ್ಲಿದ್ದಾಗ ಹೆಚ್ಚು ಹೊರೆಯಿಂದ ಅಪಘಾತಕ್ಕೀಡಾಗಿ ವಿಫಲವಾಗುವುದು ಬಹಳ ಅಪರೂಪ. ಹೆಚ್ಚಿನ ವಿಫಲತೆಗಳು ಕೊರೆತದಿಂದ ಅಧಿಕಗೊಳ್ಳುವ ದಣಿವಿನಿಂದ ಉಂಟಾಗುತ್ತವೆ. ವಿಮಾನ ಹಾರಾಟದಲ್ಲಿ ಹಕ್ಕಿಯ ಹೊಡೆತದಿಂದ ಅಥವಾ ಇಂಜಿನ್/ ಪ್ರೊಪೆಲರ್‌ನ ಒಡೆದ ಭಾಗಗಳಿಂದ ಹಾನಿ ಉಂಟಾಗಬಹುದು. ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸದ ಉದ್ದೇಶವೆಂದರೆ– ವಿಮಾನವು ಸುರಕ್ಷಿತವಾಗಿ ಕೆಳಗಿಳಿಯಲು ಅಗತ್ಯವಾದ ವಿನ್ಯಾಸ ಮಿತಿ ಹೊರೆ ಹೊರುವ ಸಾಮರ್ಥ್ಯವನ್ನು ಗಳಿಸುವುದು. ದಣಿವು ಉಂಟಾಗುವುದನ್ನು ಕಡಿತಗೊಳಿಸುವ ಬದಲು, ದಣಿವಿನಿಂದಾಗಿ ಉಂಟಾಗುವ ಪ್ರಳಯಕಾರಿ ವಿಫಲತೆಯನ್ನು ತಡೆಗಟ್ಟುವುದೇ ಹಾನಿ ಸಹನಾಶಕ್ತಿ ವಿನ್ಯಾಸದ ಅತಿ ಮುಖ್ಯ ಉದ್ದೇಶವಾಗಿದೆ.







C.M.A.IT.BT.NT:-2

ON SECURE ROUTING PROTOCOLS FOR MOBILE AD HOC NETWORKS

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1. Introduction: An ad hoc mobile network is a collection of mobile nodes that are dynamically and arbitrarily located in such a manner that the interconnections between nodes are capable of changing on a continual basis. In order to facilitate communication within the network, a routing protocol is used to discover routes between nodes. The primary goal of such an ad hoc network routing protocol is correct and efficient route establishment between a pair of nodes so that messages may be delivered in a timely manner. Route construction should be done with a minimum of overhead and bandwidth consumption. The efficient routing protocols can provide significant benefits to mobile ad hoc networks, in terms of the performance, mobility and reliability. Many routing protocols for such networks have been proposed so far [1]. Amongst the most popular ones are Adhoc On demand Distance Vector (AODV), Destination Sequenced Distance-Vector Routing protocol (DSDV), Dynamic Source Routing Protocol (DSR) and Optimum Link State Routing (OLSR). In ad hoc mobile networks, the user mobility level, the range of possible network scenarios and the traffic load generated by their applications are the key aspects that make the task of selecting a routing protocol challenging one. Most recently, the researchers are concerned with the power and security aspects also as the key aspects that influence the design of

new power aware protocols for network scenarios vulnerable to attacks. The proposed study undertaken for research is motivated by these studies reported in the current literature.

2. Literature Review:

While the security requirements for ad hoc networks are the same as the ones for fixed networks, namely, availability, confidentiality, integrity, authentication, and non-repudiation, the mobile wireless networks are generally more vulnerable to information and physical security threats than wired networks [1]. A survey of secure routing protocols in ad hoc networks can be found in [2]. More recently, the power aware routing protocols and topology control algorithms have been developed to address the issue of limited energy reserve of the nodes in ad hoc networks. A maximum lifetime routing protocol in wireless ad hoc networks has been proposed in [4]. An authenticated routing protocol for ad hoc networks based on cryptographic mechanism to defeat all identified attacks has been proposed in [3]. In [5], the performance issues of ad hoc routing protocols in a network scenario used for videophone applications have been discussed. Since wireless nodes are energy constrained, the cooperation among nodes in wireless ad hoc networks for communication with far off destinations using nodes as relays has been investigated in [6]. The QoS routing for wireless ad hoc networks has been studied in [7].

3. Need for the Study:

Initial work on ad hoc routing has been confined to only the problem of providing efficient mechanisms for finding paths in very dynamic networks, without considering security. Because of this, there are a number of attacks that can be used to manipulate the routing in an ad hoc network. Securing protocols for mobile ad hoc networks presents challenges due to characteristics such as lack of pre-deployed infrastructure, centralized policy and control. Thus, there is greater need for contributions to the design of secure ad hoc routing protocols in view of the growing applications in multimedia data communication.

4. Objectives:

The objectives of the proposed study are:

- To analyze and compare the state-of-the art algorithms for secure routing in mobile ad hoc networks
- To propose novel secure routing algorithms based on cryptographic mechanisms which are efficient
- To perform simulation experiments and analyze results to demonstrate the efficacy of the proposed algorithms in terms of the various performance parameters, namely, the average packet delivery rate, end-to-end delay and routing load.
- To carry out performance analysis by varying the routing protocols, network range, number of nodes and user mobility.

5. Methodology Proposed:

The methodologies proposed to be considered are:

- Development of suitable cryptographic algorithm based on public key
- Design secure routing protocol for ad hoc network using the proposed cryptographic algorithms
- Perform simulation experiments using popular network simulators such as NS-2 and analyze the results in terms of various performance parameters
- Compare the performance of proposed algorithms with the methods reported in current literature.

6. Conclusions:

The mobile ad hoc networks are increasingly found in various network scenarios comprising diverse types of mobile devices handling different types of information, e.g. digital video applications, biometrics for security surveillance, etc. The outcome of the proposed research work is expected to be of significant applicability in the design of secured systems in ad hoc network scenarios.

References:

1. C. Sivaram Murthy and B. S. Manoj, Ad hoc wireless networks: Architectures and protocols, Prentice Hall, New Jersey, USA, May 2004.

2. D. Wang, et al. , A survey of secure routing in ad hoc networks, The 9th Intnl. Conf. on Web-age Information Management, IEEE 2008, p.482

3. K. Sanzgiri, et al., Authenticated routing for ad hoc networks, IEEE Jl. On selected areas in Communication, vol.25, no.3, March 2005, p.598

4. A. Sankar and Z. Liu, Maximum lifetime routing in wireless ad hoc networks, IEEE Infocom 2004

5. G. Campos and G. Elias, Performance issues of ad hoc routing protocols in a network scenario used for videophone applications, Proc. 38th IEEE Intnl. Conf on System Sciences, Hawaii, 2005, p.1

6. V. Srinivasan, et al., Cooperation in wireless ad hoc networks, IEEE Infocom 2003

7. B. Zhang, et al., QoS routing for wireless ad hoc networks: problems, algorithms and protocols, IEEE Communications Magazine, October 2005, p.110

C.M.A.IT.BT.NT:-3

HYGROTHERMAL BEHAVIOUR OF GLASS MICROBALLOON EPOXY COMPOSITES

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1. Introduction: Syntactic foams are functionally tunable novel composites endowed with a broad range of mechanical and physical properties including those like vibration damping, insulation and fire retardancy characteristics. These materials can be fabricated in functionally graded configurations with isotropic or direction specific properties achievable by incorporation of reinforcements [1]. Initially they were developed as buoyancy aid materials in marine applications. Presently they are used in aircraft, spacecraft and ship hull structures [2]. In all such applications moisture absorption in the material is an inevitable but undesirable phenomenon that should be understood and taken care off, since absorbed moisture affects mechanical and thermal properties. Despite this drawback, syntactic foams offer a unique advantage over conventionally used core materials such as open cell structured foams, corrugated cores and honeycomb structures. These conventional core materials are either discontinuous in structure or have interconnected open cells. In case of damage to the skin of the composite sandwich structures, water absorption by these cores would be very high. However, syntactic foams having porosity in the form of hollow particles known as microballoons, have closed pore structures, that provides them low moisture absorption characteristics coupled with high compressive strength properties.

Typically, microballoons are lighter than the host polymer used as the matrix material, hence, increase in their volume fraction leads to decreased density of the composite. It is known that the strength of syntactic foams increases with an increase in their density.

There are two methods of changing the density of syntactic foams to directly influence their properties. The first method is to change the volume fractions of matrix and microballoons in the structure. The second method is to use microballoons of different internal radii but with the same outer radii at the same time maintaining constant volume fractions of matrix resin and microballoons. The second method gives greater design flexibility as any change the properties of syntactic foam can be correlated with the material composition to just one parameter, viz., the internal radius of microballoons.

Several studies were reported on the characterization of syntactic foams and their mechanical and electrical properties [3 –7]. However, only few studies were found on the evaluation of hygrothermal behaviour of syntactic foam castings [8-10], and practically none on the fibre reinforced syntactic foams. Therefore the present studies were aimed at characterizing the moisture absorption behaviour of syntactic foam (castings) and their fibre reinforced versions (laminates), keeping the microballoon loading as the material variable parameters. Accordingly, specimens were immersed in distilled water maintained at 50°C and also exposed to 70°C/85% RH condition, till saturation was reached and hygrothermal analysis carried out.

2. Experimental Details

2.1 Materials

The matrix system used consisted of, a bi-functional epoxy resin (LY5052) and aliphatic amine hardener (HY5052) supplied by Huntsman Advanced Materials (India) Pvt Ltd, Bombay, and the glass microballoons used were of low density (0.15g/cc), to fabricate these SF- castings. A bidirectional woven glass fabric of 280gsm was used as reinforcement.

2.2 Preparation of Syntactic foam (SF) castings

SF- castings of different compositions were fabricated by slow mixing of all the constituents (resin, hardner and microballoons). The required quantity of resin and the corresponding quantity of the hardener were taken in the ratio 100:38 in a beaker and gently mixed using a glass rod and avoiding entrapment of air bubbles. Weighed quantities of microballoons (0.1%, 0.3% and 0.5% of the resin weight) were added into the mixtures taken in separate beakers. These slurries were then poured into a cavity mould assembly (Fig.1), made of MS plates and 3mm spacers and the slurry allowed to cure for 24 h at room temperature. The solid (cured) castings containing different % of microballoons and measuring about 250mm × 250mm × 3mm in size, were then released from the mould and completely cured by subjecting to a step post cure schedule of 50°C/1/2hr, 70°C /1hr and 85°C/2hr in a precision controlled hot air oven

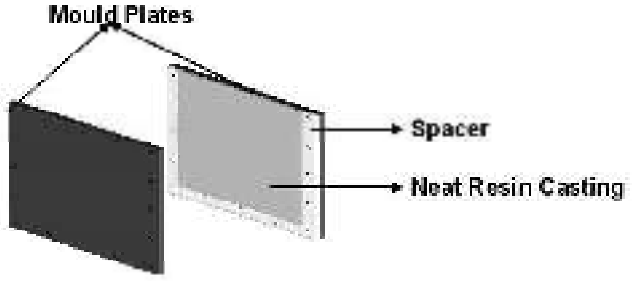


Fig.1 Mould assembly for syntactic foam castings

2.3 Preparation of glass fabric reinforced syntactic foam (GRSF) laminates

8 layers of the woven glass fabric cut into 300mm × 300mm size, were manually impregnated with microballoon filled (of different percentages) epoxy (resin + hardner) mixture, and vacuum bag moulded (Fig.2), and RT- cured for 24 hrs. The laminates so obtained, were found to contain fibre weight fractions in the range of 0.57 to 0.64 %.

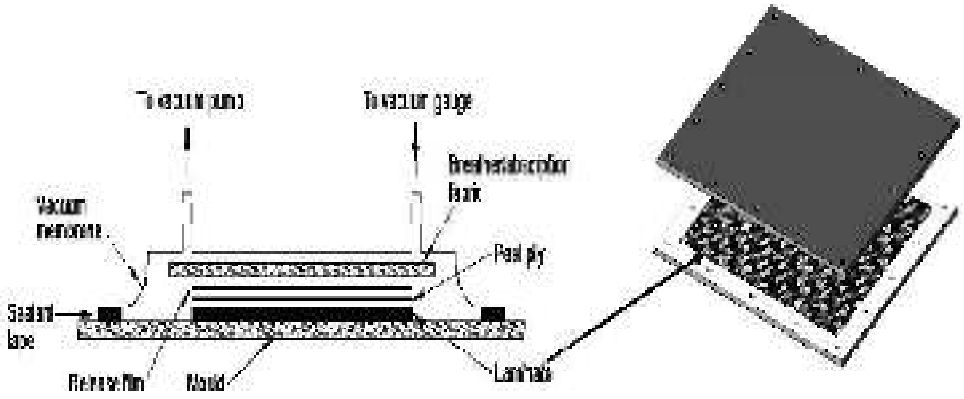


Fig.2 : Vacuum Bag Moulding of GRSF –laminates

2.3 Test Specimen Preparation

Both the SF- castings (post cured) and the laminates were then cut into specimens of size 25mm × 25mm × 2mm for moisture absorption studies and size 10mm × 10mm × 2mm for density measurements by water displacement method. The specimens cut from the laminates, however, were edge coated with the epoxy system to prevent edgewise moisture absorption, and subjected to a post cure cycle of 50°C/1/2hr, 70°C/1hr followed by 85°C/2hrs. For each composition, a minimum of 5 test specimens were considered and average values reported.

2.4 Environmental Conditioning

One set of specimens (both from castings and laminates) were immersed in the constant temperature distilled water bath maintained at 50°C, while another set of specimens simultaneously exposed to 70°C/85%RH in a temperature/humidity chamber. Before exposure, initial weights of the dry samples were recorded. Weight gains were monitored daily, initially for one week and then on alternate days, till saturation levels were reached, with care taken to wipe out surface bound moisture in the specimens. The %moisture gain at any time was computed using the following expression

$$Mg(\%) = \frac{(W - W_0)}{W_0} \times 100 \qquad (1)$$

Where W the weight of specimen at any time and W_o the weight of the dry specimen

The data generated on the specimens were tabulated and plotted as a function of microballoons content, for a detailed analysis of the results obtained and correlated with the composite compositions.

3. Results and discussion

3.1 Characterization of SF – castings and GRSF-laminates

Prior to conducting the moisture absorption studies, the densities and porosities of both type of composites considered were found out as a function of % microballoons. The theoretical densities are calculated using the mixture rule, and densities measured by water displacement method. Further, the porosity measurements were made using densities, following ASTM D 2734 procedure, and the equation given below

$$Vv = \frac{(\rho_{th} - \rho_{m})}{\rho_{th}} \times 100 \qquad (2)$$

Where ρ_{th} and ρ_{m} are the theoretical and measured densities respectively.

The results are summarized in table.1 and table.2 for SF - casings and GRSF- laminates as presented below.

Table1: Effect of % microballoons on densities and porosities of SF- castings

% Micro balloon loading	Theoretica density (g/cc)	Measured density (g/cc)	Porosity (%)
0.0	1.150	1.142	0.695
0.1	1.141	1.132	0.788
0.3	1.135	1.128	0.616
0.5	1.128	1.123	0.531

Table.2: Effect of % microballoons on densities and porosities of GRSF- laminates

% Microballoon loading	Theoretical density (g/cc)	Measured density (g/cc)	Porosity (%)	Fibre weight fraction (%)
0.0	1.809	1.774	1.934	63.80
0.1	1.738	1.694	2.531	60.22
0.3	1.658	1.615	2.590	56.96
0.5	1.675	1.609	3.940	61.35

From the above data it can be seen that, for the SF-castings (table-1), both the porosity and density of these composites, decrease as the microballoon content is increased, clearly indicating the effect of microballoon addition in making the structure lighter and at the same time reducing its porosity. However, in case of GRSF-laminates (table-2), while the density shows a decreasing trend as expected, the porosity is seen to increase with microballoon addition. The table also shows a decrease in the fibre content (i.e increased resin content). These simultaneous variations in density and resin content of the laminate with microballoon addition, are attributable to the complexities in the fabrication of these 3-phase composites.

3.2. Moisture absorption behaviour

Moisture absorption curves for SF -castings immersed in 50°C/ distilled water are shown in Fig.3, while in Fig.4 are shown the moisture absorption curves for SF - castings subjected to 70°C/85%RH exposure condition.

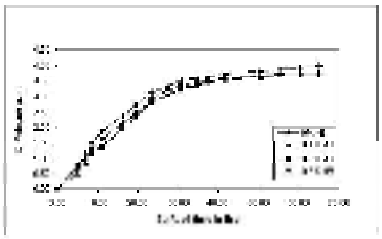


Fig.3 : Moisture gain curve for SF -castings under 50°C/ Immersion condition

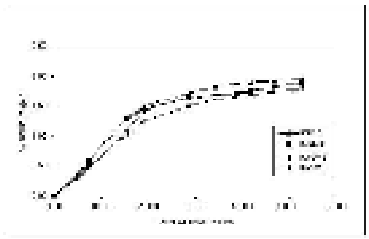


Fig.4 : Moisture gain curve for SF- castings under 70°C/ 85%RH

From Fig.3, it can be seen that, the moisture absorption in the SF -castings increases with the immersion time in general, but decreases with increased % microballoons loading. A similar trend is also noticeable from fig.4 for SF -castings exposed to the 70°C/85%RH environment. It can also be observed that, the moisture absorption under exposure condition, takes longer time to attain equilibrium than under immersion condition.

The effects of microballoon loading on the diffusion characteristics of SF -castings, under the influence of two different environments are summarized in table.3 below

From the above table it can be seen that, while the M_m and D_c values decrease with increase in microballoon content, the t_m values show an increasing trend. While these results indicate qualitative trends, the magnitude of the changes are marginal, obviously due to the small percentage of microballoons chosen, due to practical difficulties experienced during processing in the composites.

Further, Fig.5 and Fig.6 presented below, show moisture gain curves for GRSF - laminates immersed in 50°C/distilled water and 70°C/85%RH conditions respectively

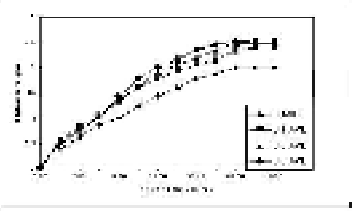


Fig.5 : Moisture gain curve for GRSF -laminates under 50°C/Immersion condition

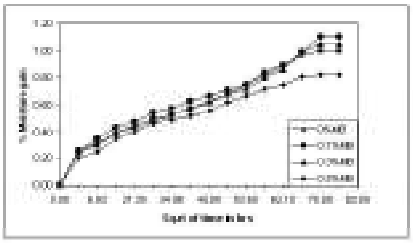


Fig.6 : Moisture gain curve for GRSF- laminates under 70°C/ 85%RH condition

From fig.5, it can be seen that, the moisture absorption in the GRSF- laminates increases with increased % microballoons loading. A similar trend is also noticeable from fig.6 for GRSF-laminates exposed to the 70°C/85%RH environment. This is attributed, to the increased porosity and resin content observed in the laminates (Ref table-2). Presence of some broken microballoons, caused during the manual impregnation and vacuum bagging processes and some defects arising at

Table.3: Moisture diffusion parameters of SF- castings under two different environments

% Microballoons	Saturation moisture content, Mm (%)		Diffusion coefficient, Dc [$mm^2/sec \times 10^{-7}$]		Saturation time (Days)	
	50°C/Immersion	70°C/85% RH	50°C/Immersion	70°C/85% RH	50°C/Immersion	70°C/85% RH
0.0	4.010	1.972	10.36	33.51	153	162
0.1	3.791	1.900	8.08	30.57	155	165
0.3	3.715	1.865	5.98	31.28	159	167
0.5	3.695	1.800	4.92	25.56	160	168

the fibre – microballoon interfaces, could be possible reasons for the increased porosities observed in the GRSF laminates. Comprehensive microstuctural studies and analysis are needed on these aspects.

The effects of microballoon loading on the diffusion characteristics of GRSF -laminates, under the influence of two different environments are summarized in table.4 below.

Table.4: Moisture diffusion parameters of GRSF laminates under different environments

% Microballoons	Saturation moisture content, Mm (%)		Diffusion coefficient, Dc [mm2/sec × 10-7]		Saturation time (Days)	
	50°C/Immersion	70°C/85% RH	50°C/Immersion	70°C/85% RH	50°C/Immersion	70°C/85% RH
0.0	1.69	0.89	7.88	27.00	90	100
0.1	2.29	1.02	7.12	25.95	92	105
0.3	2.34	1.05	4.56	23.40	95	107
0.5	2.30	1.10	5.54	24.49	99	110

From the above table it can be seen that, while the M_m and t_m values increase with increase in microballoon content, the D_c values decrease slightly. These trends once again are in conformity with the effects of microballoon addition on the porosity and density of the GRSF- composites as already discussed.

4. Conclusions:

- The densities of SF- castings and GRSF –laminates decreased with microballoons additions. However, while the porosity of SF – casting decreased as expected, that of GRSF laminates increased with microballoons content, showing an opposite trend, attributable to the complexities associated with the processing and fabrication of 3-phase composites, and their simultaneous effects on porosity and resin content of the laminates.
- The saturation moisture levels in SF- castings decreased, with microballoon addition, while those of GRSF – laminates showed somewhat an opposite trend, due to increased porosities.
- Further the moisture absorption values were higher under immersion condition than under in the exposure conditions in both type of composites, which was as expected.

References:

1. Gupta N., Karthikeyan CS., Sankaran S., Kishore "Correlation of Processing Methodology to the Physical and Mechanical Properties of Syntactic Foams With and Without Fibers" Materials Characterization ,October 1999, Volume 43, Issue 4, Pages 271-277

2. Bardella L., Genna F ., "On the elastic behaviour of syntactic foams" Int J. Solids Structure, 2001,138, pp 7235 – 7260.

3. Soo-Jin Park., Fan-Long., Jin, Changjin Lee., " Preparation and physical properties of hollow glass microspheres –reinforced epoxy matrix resins" Materils Science and Engineering:A, 2005,Volume 402, issues 1-2, p 335-340

4. Guptha N., Shashank priya, Rashed Islam, William Ricci, " Characterization and electrical properties of epoxy glass microballoon syntactic foams",

5. Rizzi E., Papa E., Corigliano A., "Mechanical behaviour of a syntactic foam, experiments and modeling", Int J. Solids Structure, 37 (2000), pp 5773– 5794.

6. Gupta N., Kishore E,. Woldesenbet and Sankaran S., "Studies on compressive failure features in syntactic foam material", J Mater Sc, 36, 18 (2001), pp 4485-4491.

7. Kim HS., Oh HH., "Manufacturing and impact behaviour of syntactic foam",J. Applied Polymer Science , 76 (2000), pp 1324-1328

8. Nikil Gupta, Eyassu Woldesenbet "Hygrothermal studies on syntactic foams and compressive strengthdetermination", Composite Structures, 61 2003), 311 – 320.

9. Karthikeyan, CS., Kishore., Sankaran S., " Effect of absorption in aqueous and hygrothermal media on the compressive properties of glass fibre reinforced syntactic foams", , J of Reinforced plastics and Composites, 2001:20(11): 982-93

10 Ishai O., Hiel C., Luft M., "Long term hygrothermal effects on damage tolerance of hybrid composite sandwich panels", Composites, 1995, 26 (1), 47-55.

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NOVEL EMBEDDED PASSIVES BASED RADAR ABSORBING STRUCTURES DEVELOPMENT AT ADE: A REVIEW

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Introduction: Aeronautical Development Establishment (ADE) is a forerunner in Unmanned Air Vehicle (UAV) development. In battlefield scenario, the UAV in its surveillance and reconnaissance role in the enemy territory has to be essentially ***designed*** for **low observability (LO) or stealth** to avoid being detected by the enemy radar. The radar LO features ensure survivability of the UAV by reducing its detectability by the enemy radar. Stealth design encompasses signature reduction of all types of signatures such as ***radar cross-section (RCS***), infra-red (IR), acoustic and visual signatures. The unmanned combat air vehicle, UCAV, has to be primarily designed for radar stealth. Radar LO is achieved at the design stage by external shaping and by application of radar absorbing materials (RAM), which have to be designed for electromagnetic absorption and the desired structural strength as the radar absorbing structures (RAS) form integral structures on the UCAV.

The electromagnetic parameter that needs to be reduced is the RCS. The RCS, which is the electromagnetic signature of UCAV, is a measure of the backscattered power and is not a simple scalar constant, but a very strong function of frequency, aspect angle and polarization of the impinging electromagnetic *(em*) wave. RCS depends on the shape and electrical size of the air-vehicle quantified in terms of wavelength and its constituent materials. Shape design of the UCAV is the first line of RCS control (RCSR). In shaping, external surfaces of the UAV are shaped in such a way that there are no surfaces seen at normal incidence to the radar resulting in the scattering of the backscattered power away from the direction of the radar. This method of monostatic RCSR has some ***limitations*** in that it demands apriori knowledge of threat sectors. If all angles of incidence are equally likely, shaping offers no advantage. Shaping offers RCSR over a limited range of aspect angles and is a high-frequency technique. If RCSR has to be achieved over wide frequency bands, a range of aspect angles and polarization of the *em* wave, then RAS have to be applied in addition to external shaping.

LACUNA IN RAS DESIGN: Aircraft applications have been a strong driver for RAS design and development. RAS technology is **highly classified** and hence, in the open literature, reported RAS design methods are based on mix-and-match of the constituent absorptive materials to achieve the desired RCSR. An exhaustive list of constituent absorptive materials and RAM formulation is available in open literature, (E. F. Knott, etal, 1993[1]; G. T. Ruck, D. E. Barrick, W. D. Stuart, and C. D. Kirchbaum, 1970 [2]; J. D. Kraus, 1984 [3]; E. C. Jordan and K. G. Balmain, 1982 [4]), but, there is no accurate electromagnetic design of RAS relating the constituent materials in terms of their electromagnetic characteristics to the desired RCSR. This results in long development cycles with no assured reliability in the end product. It should be noted that RAS design essentially *translates* to the design and development of infinitesimally thin, resistive sheets called ***spacecloths***, which have to be designed for desired sheet resistance specified in Ohms/sq. (Abouzhara, 1987 [5]).

In this paper, we report ***novel*** RAS development at ADE in a successful effort to achieve self-sufficiency in stealth technology. This development is being reported for the first time in open literature and a patent application is in an advanced stage of preparation.

NUMERICAL STUDIES AND DESIGN CURVES FOR RAM/ RAS

Figure 1 illustrates the role of spacecloth in a single layer RAM, which is also known as Salisbury screen, (Salisbury, 1955 [6]).

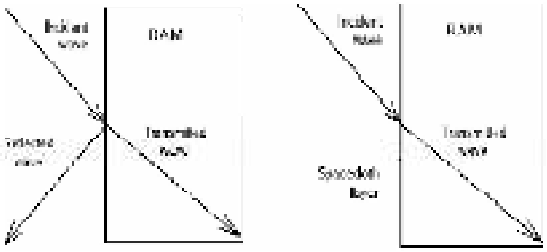


Fig. 1. Role of spacecloth in a single layer RAM

The spacecloth layer functions as an impedance matching resistive layer and has to be designed for specified surface resistivity in Ohms/sq. It allows the *em* wave to enter into the RAM without any reflections at the front face. The single layer RAM shown in figure 1 has a spacecloth front layer with a dielectric spacer backed by a conducting back plane, which is the perfect electric conductor or the PEC. The thickness of this RAM is $\lambda_g/4$ at the design frequency.

Mathematical formulation of spacecloth is given elsewhere (Chandrika Sudhendra, M.Sc. Thesis, IISc, 2006 [7]), wherein spacecloths based on various types of geometries of chip-resistor grid networks on dielectric substrates have been analyzed using Maxwell's equations and boundary conditions.

Figure 2 gives the design curves for a single layer dielectric RAM. From the figure, it may be observed that a 377 Ohms/ sq. spacecloth would give an infinite dB of RCSR at the de

sign frequency but would result in a spot frequency application. Since this does not meet the peak RCSR bandwidth, we have designed and developed spacecloths with a surface resistivity of 400 Ohms/sq, for desired RCSR of – 30 dBsm. This design is predicted to give 40% bandwidth with –20 dB RCSR for the whole of X-band (8 to 12 GHz).

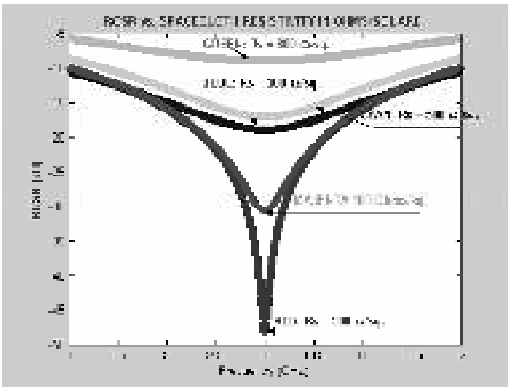


Fig. 2 Design curves for a single layer RAM

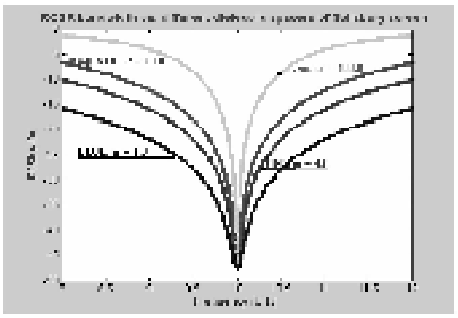


Fig. 3 Design curves with different spacer dielectric constants for single layer RAM

Figure 3 gives the variation of RCSR with different dielectric constants of the spacer of RAM. From the figure, it may be deduced that with an increase in the spacer dielectric constant, the thickness of RAM would become smaller but with the penalty of decreased bandwidth.

NUMERICAL STUDIES AND DESIGN CURVES FOR MULTILAYER RAM/RAS.

A single layer RAM/RAS could be used for application over a single frequency band such as C or X. But broadband operation of RAM/RAS would be required in many applications to achieve broadband stealth. To achieve broad banding of RAM, a multilayer RAM is designed. In a typical multilayer RAM designed for broadband applications, multiple layers of spacecloths would be required, with each spacecloth separated by a dielectric spacer and finally backed by PEC. This construction of RAM results in what is known as Jaumann absorber.

The multilayer RAM is modeled using transmission line approach. Various spacecloth/resistive layers are modeled as shunt elements across a shorted transmission line. The resulting reflection coefficient of the transmission line is optimized/minimized for the desired RCSR over specified frequency bands.

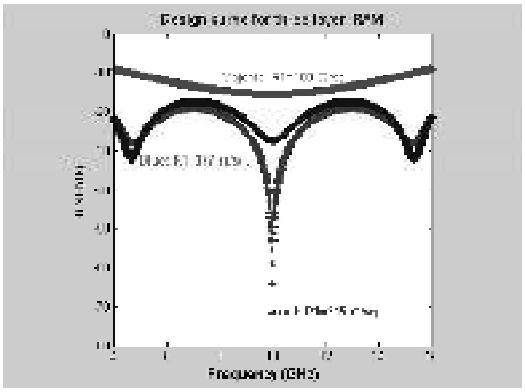


Fig. 4 Design curves for three layer RAM

It may be observed from figure 4 that the best value of spacecloth surface resistivity is with 315 Ohms/sq. for the first layer and the successive two layers with quadrature taper variation of surface resistivity. This RAS would cover a frequency range from 4 to 16 GHz with a minimum RCSR of –20 dBsm and a best RCSR of –70 dBsm at the design frequency. In order to further increase the bandwidth of RAM/RAS, a seven-layer RAM design is given in figure 5. Quadrature taper for surface resistivity of spacecloths is assumed.

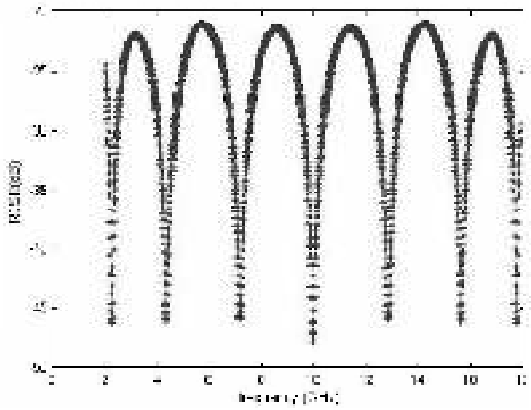


Figure 5 Design curve for seven layer RAM

It may be observed from figure 5 that the seven layer RAM/RAS would give the best possible RCSR covering frequency bands from 2 to 18 GHz, with a minimum RCSR of –22 dBsm and best possible RCSR of -50 dBsm. In a practical situation, a wide band RCSR of –20 dBsm is considered sufficient. There is only one limitation with this type of RAS, which is its thickness. The thickness of this seven layer RAS would be 4 cms. It is observed that there is only a thickness limitation but the weight in a practical situation does not increase significantly as the dielectric spacers are all comprised of *Rohacell* foam and the PEC layer could be of fine aluminium mesh.

NOVEL RAS DEVELOPMENT AT ADE: Based on the mod

eling described in the preceding section, we have designed and developed two different types of spacecloths based on
i. Chip resistor grid networks and
ii. Embedded Passives (EP) resistor grid networks.

Initially, the spacecloths were designed based on ***novel*** chip-resistor grid networks and developed on RF substrates, using conventional printed circuit board (PCB) design and development methods. A photo of spacecloth of size 300 mm x 300 mm developed using chip-resistor grid networks on FR4 substrate is shown in figure 6.

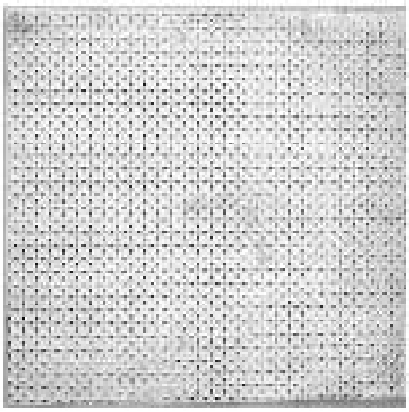


Fig. 6. Chip-resistor spacecloth on FR4 substrate. Size: 300 mm x 300 mm

The chip resistor spacecloth has been evaluated for its performance in terms of its S-parameters by using waveguide simulator in conjunction with vector network analyzer. The expressions given in equations 1 and 2 are used for calculating the S-parameters (reflection and insertion loss) of spacecloth inside waveguide simulator. These equations are derived elsewhere [7]

$$\Gamma_{11} = \frac{-\eta_0}{\eta_0 - 2R\cos\theta}$$

$$T_{12} = \frac{2R\cos\theta}{\eta_0 - 2R\cos\theta}$$

Figure 7 gives the theoretical and experimental performance curves of spacecloth inside waveguide simulator. It is observed that the theoretical and experimental insertion loss values of the spacecloth agree reasonably well. The prototype spacecloth was fabricated using commercial, off-the-shelf chip resistors.

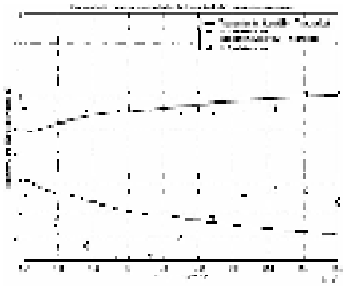


Fig. 7 Performance curves of S-band spacecloth on Teflon substrate

EMBEDDED PASSIVES RESISTOR GRID NETWORK BASED SPACECLOTH AND RAS DEVELOPEMENT

The concept of chip resistor grid networks for achieving spacecloths yielded very good results and the design was validated with experimental results. But, the limitation of chip resistor spacecloth is that it requires large number of discrete chip-resistors to be soldered onto the substrate. Soldering related defects would result in loss of reliability in the performance of spacecloth. In order to eliminate this problem, we have reported the use of novel embedded passives (EP) resistor grid network based spacecloth and RAS. ***This development was the first of its kind reported in RAS development, in the open literature.***

Discrete surface mount passive components such as resistors account for 90 percent of the total component count on a typical PCB today. These components also account for 30 percent of all solder joints and occupy close to 40 percent of the total PCB area and 70 percent of the board assembly costs are attributed to the passive components. By integrating passive components such as resistors within the substrate instead of being on the surface, embedded passives offer advantages such as

a. Higher functional density,
b. Reduce system real estate,
c. Reduced cross talk and interference, resulting in improved EMC performance,
d. Reduced size and weight,
e. Eliminate the need for discrete components and assembly.
f. Improved design accuracy through the availability of quasi-continuous component values

Spacecloth based on a square grid network of EP resistors is shown in figure 8, The embedded passives in spacecloth are basically passive components such as resistors, which now form an integral part of the substrate and are in the form of etched patterns of resistors placed between the interconnecting substrates of a PCB. Discrete passives such as chip resistors are totally eliminated and the reliability issues related to soldering are effectively eliminated. (Snogren, 2004 [8]).

Using this concept we have designed various types of RAS such as triangular grid network and hexagonal grid network based RAS, for satisfying various requirements. The EP resistor spacecloth design and fabrication is reported elsewhere (Chandrika S. etal, 2007, [9]). The EP resistor spacecloth development makes use of conventional PCB fabrication methods and standard chemicals for etching. '*Selective etching'* of the EP resistor spacecloth PCB demands very high accuracy in the etching process. The resulting EP resistor spacecloth is integrated into various RAS designs and functions as a conventional spacecloth

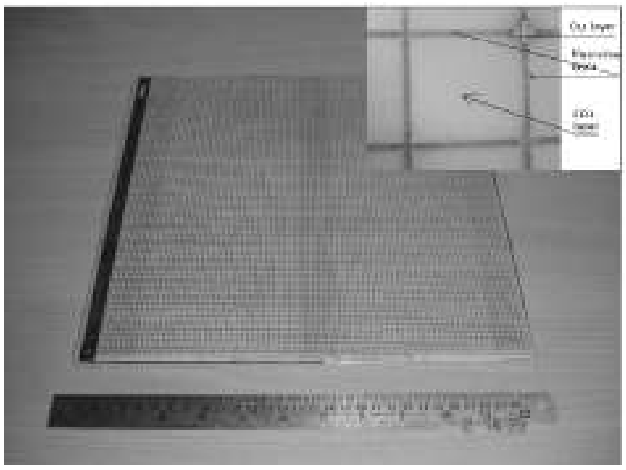


Fig. 8 Square grid EP resistor based prototype RAS. Frequency: X-band. RAM designed for –28 dB absorption

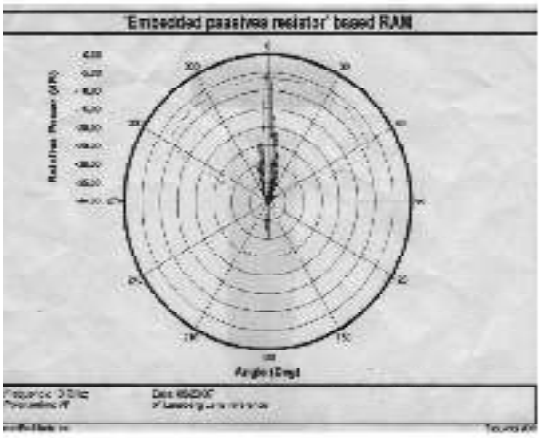


Fig. 9 Experimental RCSR plot of EP resistor grid network based RAM. Frequency: 10 GHz. Polarization: Vertical.

Figure 9 gives the experimental plot of RCSR obtained with the square grid EP resistor network based RAS given in figure 8. The spacecloth is designed for a surface resistivity of 400 Ohms/sq, with a predicted RCSR of –30 dBsm. The RCS patterns are recorded using the microwave RCS measurement facility at ADE. It is observed that the experimental RCSR of this prototype RAS is –28 dBsm over the whole of X-band. Hence, the experimental results agree very well with the predicted results and are highly encouraging.

Different types of RAM/RAS described in the preceding sections are based on Jaumann absorber principle and result in increase in thickness for broadband applications. Ideally, a RAS would have to be designed which is ultra-thin and broadband. We have addressed this limitation in RAS by reporting a novel ultra-thin RAS based on metamaterials and EP resistors.

ULTRA-THIN RAS DEVELOPMENT : An ultra-thin RAS based on metamaterials/frequency selective surfaces (FSS) grid networks is given in figure 10.

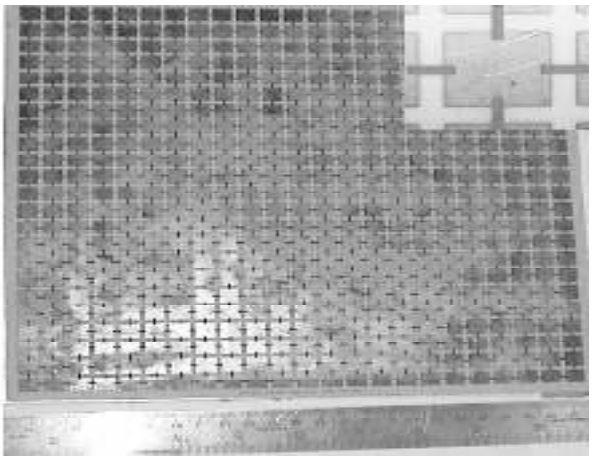


Figure 10. Ultra thin RAM based on metamaterials and EP resistors

The thickness of *ultra thin* RAM is 0.1 mm compared to a conventional RAM whose thickness is 150 mm at C-band. The RAM gives an RCSR of –15 dB over the whole of C-band. A thickness advantage of more than 100 times is achieved with this type of RAM. The details of RAM development have been reported in (Chandrika S. etal, 2008, [10]).

CONCLUSION: In this paper, we have reviewed the development of some **novel** radar absorbing structures at ADE. This development assumes high importance as the RAM technology is highly classified and is absolutely essential for achieving self-sufficiency in design of UAV/air-vehicle for stealth.

ACKNOWLEDGEMENTS: The authors would like to convey their grateful thanks to Dr. D. Bannerjee, Distinguished Scientist and CC (AMS) for his guidance and encouragement. Grateful thanks are due to Shri. P.S. Krishnan, Outstanding Scientist and Director, ADE for his constant guidance, encouragement and motivation. Our thanks are also due to Shri S. Gurudev, Group Director for his continued encouragement and support. Our hearty thanks are due to Dr. K.A.Jacob, former GD, who initiated the RAM development activity at ADE. We acknowledge the support of Dr. V.Ramachandra, Sc. F, ADE for providing the RCS experimentation facility.

REFERENCES

[1] E. F. Knott, J. F. Shaeffer, and M. Tuley, Radar Cross Section. USA: Artech House, 1993.

[2] G. T. Ruck, D. E. Barrick, W. D. Stuart, and C. D. Kirchbaum, Radar Cross Section Handbook. New York: Plenum Press, 1970.

[3] J.D. Kraus, Electromagnetics. Mc.Graw Hill Book Company, 1984 .

[4] E. C. Jordan and K. G. Balmain, Electromagnetic Waves and Radiating Systems. USA: Prentice Hall, 1982, ch. 5, pp. 459–460.

[5] Abouzhara, "*Automated Wide-Band Surface Resistivity Measurements of Resistive Sheets*," IEEE Transactions on

Instrumentation and Measurement, vol. IM-36, pp. 1031–1035, 1987.
[6] W. W. Salisbury, *"U.S. Patent, Absorbent body for electromagnetic waves,"* 1952, No. 2599944.
[7] Chandrika Sudhendra, *"A novel chip resistor spacecloth for radar absorbing materials",* M.Sc. Engg. Thesis, IISc, Sept. 2006. (Thesis guide: Dr. A. Mohanty, SERC)
[8] R.C.Snogren, *"Embedded Passives in Printed Circuit Boards"*, Defence Manufacturing Conference, 2004.
[9] Chandrika S, A. Mohanty, A.C.R. Pillai, *"A novel embedded passives resistor spacecloth for radar absorbing materials",* Proc. IEEE IRSI 2007, pp.117-119.
[10] Chandrika S and Dr. ACR Pillai, "Novel ultra-thin radar absorbing materials using metamaterials and embedded passives resistors", Proc. IEEE - ISM08, pp. 153-155.

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COLOUR AND PICTORIAL COCKPIT DISPLAYS

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Abstract: The presence of colour in certain displays can also contribute to image realism. Colour Displays have potential to use more of the available information channels in the human visual system. The judicious use of color can increase coding capacity and flexibility and has the potential to speed up the location, thereby reducing search times and processing of displayed information. Experience has shown that the tripartite categorization of coding helps pilot when density of symbols in the display is high, where relevant information must be discriminated, where symbol legibility is degraded and where prevailing population stereotypes are used. This paper takes us through the journey of use of color in aircraft cockpits, more emphasizing on cockpit displays, under various levels of ambient light influencing the cockpit and pilot, human physiological principles in effective use of colour, the various perceptual factors influencing color processing and finally concluding on the various factors on how color can be effectively used in order to achieve the most optimized performance of pilot during flights.

Keywords: Colour perception, Quantitative, Qualitative, Pictorial Display Formats, rods, cones, x-y Chromaticity Diagram, Tripartite Colour Coding, Next Generation Cockpit Display System.

Historical Background of Cockpit Displays

An aircraft Cockpit Display features several computer displays, to display information regarding the aircraft's situation, position and progress.

Prior to the **1970s**, air transport operations were not considered sufficiently demanding to the required advanced equipment such as, the electronic flight displays. Also, computer technology was not at a level, where sufficiently light and powerful circuits were available. Gradually, the increasing complexity of transport aircraft, the advent of digital systems and the growing air traffic congestion around airports began to change the situation.

The average transport aircraft in the **mid-1970s** (see figs. 1 and 2) having hundred cockpit instruments and controls, and the primary flight instruments were already crowded with indicators, crossbars, and symbols, and the growing number of cockpit elements were competing for cockpit space and pilot attention.

The success of the NASA-led glass cockpit work is reflected in the total acceptance of electronic flight displays began in **1979.** The safety and efficiency of flights has been increased with improved pilot understanding of the aircraft's situation relative to its environment (or "situational awareness").

By the end of the **1990s**, LCD panels were increasingly favored among aircraft manufacturers because of their efficiency, reliability and legibility





Fig. 1 Bristol Beaufighter Cockpit Fig. 2 Do 335 Cockpit

The glass cockpit has become standard equipment in airliners, business jets, and military aircraft. By the **end of the century** glass cockpits began appearing in general aviation aircraft as well.

Usage of Colour in Cockpit Displays

Previously, **monochrome displays** were used in the cockpit. Gradually, advanced Cockpit displays have been designed using Colour and Pictorial Displays. Colour Displays have several advantages over monochrome. Some of them are listed below:

Colored screens are more ***visually appealing*** than monochrome screens. Anecdotal remarks and quantitative ratings by participants in user studies consistently reinforce this conclusion. Color adds an extra dimension to the visual experience, enabling pilots to draw upon the full capability of their senses.

Image quality varies widely between and within general

classes of displays, including cathode ray tubes, electroluminescent panels, vacuum fluorescent displays, and Liquid Colour Displays (LCDs). By comparison, a color LCD (thin-film transistor/active matrix) provides a reasonably bright image that refreshes quickly and affords a wider viewing cone.

Graphic Simplicity. Color monitors afford designers a greater opportunity to produce simple-looking screens. The reason is that adjacent colors of differing hue (spectral wavelength composition) and similar value (lightness versus darkness) create natural borders, whereas adjacent gray tones are incrementally less effective. As a result, colored elements do not always need edge demarcation to assure distinctiveness, for example, where monochrome screens do. In comparison to colored screens, most monochrome displays are burdened with extra on-screen elements, adding to their visual complexity.

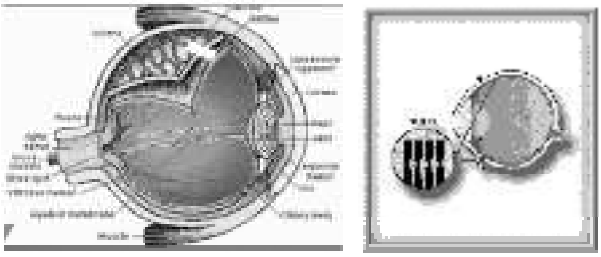
Color Coding. Color is a terrific method of coding important information. When color is not available, one must resort to other coding techniques. Warnings, for example, can be made larger and bolder than other text, physically segregated from other information, highlighted by means of demarcation lines or an inverse video effect, or be presented using a symbol in place of text. Color is a most compelling coding technique when it comes to detecting warning information embedded within other information. In fact, human factors studies have shown that color outperforms other visual codes, such as size, shape, and brightness as a coding technique. It performs particularly well when the task is to search for an item or group of items among many, or to track a moving target.

More Information. Color displays offer the potential to present more information at a time than monochrome displays. As discussed above, it is simply a matter of having one dimension for communicating information. A senior scientist quotes "Color gives you an effective way to visually separate groups of information so that the information is easier for users to find," he says. "This helps you avoid a trade-off imposed by monochrome screens—putting in less information to avoid visual clutter."

Physiology of Colour

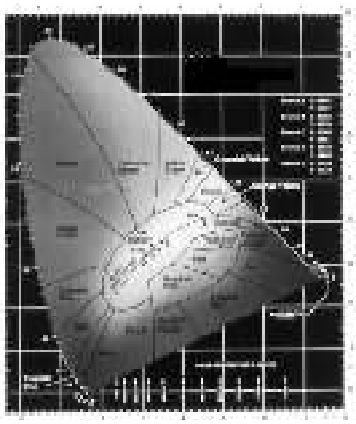
White light is composed of (spectrum) electromagnetic vibrations, the wavelengths of which are evenly distributed from 350 to 750 nm. Light with a wavelength of 750 nm is perceived as red, and light with a wavelength of 350 nm is perceived as violet. The quality of the intermediate wavelengths is perceived as blue, green, yellow, orange, moving from the wavelength of violet to that of red.

Colour perception results as a neurophysiological response elicited by light entering the eye, or by any other activity producing excitation of the neurons subserving colour vision (like pressing on the eyeball, for example). A particular colour sensation can always be related to a particular output ratio of the three types of photoreceptors (**cones**) that form part of the neural tissue (retina) that covers the back of our eye. In addition, there is also a fourth, much more sensitive (and actually much more numerous) class of photoreceptors, the **rods** (so-called because of their cylindrical shape), that are active during night vision (figs. 3 and 4). The rods can only signal luminance information, but, at twilight (**mesopic vision**), the signals of rods and cones can be mixed, resulting in more or less desaturated colours. The cones, which are only activated at relatively high light levels, can be sub-divided into three classes, which are roughly tuned, by their different light-sensitive pigments, to the short, middle and long-wave portion of the visible spectrum (the electromagnetic waveband from 380-770 nm). Therefore, they are usually referred to, in modern terminology, as S, M and L cones (cf. Walraven, 1997). Lights that differ in spectral composition will generally produce different ratios of S, M, and L pigment absorptions, thus enabling the eye to distinguish the difference in colour. However, this does not mean that there is a fixed relation between a multi-spectral light and its associated colour response. The latter is determined by a triplet of cone outputs, but that particular triplet may be generated in many different ways. In fact, the number of possible wavelength combinations that can produce a given colour response is unlimited. This may be intuitively appreciated when realising that each cone type can respond over a wide range of wavelengths that may nevertheless be indistinguishable when appropriately adjusted to produce the same output. So, if a particular colour has the cone signature L/M/S = 3/7/2, a light of any spectral composition, but producing the same 2/7/3 signal ratio, will produce exactly the same colour sensation. This is another way of saying that, to certain degree, the visual system is essentially colour-blind. It is because of this deficiency (the trichromacy of colour vision) that we only need three phosphors for generating a wide gamut of colours on a colour monitor



Figs.3 and 4. Eye

Since colour vision is trivariant, colour can be represented in a three-dimensional space. That can be any space that somehow reflects the way in which a light is registered in the photopigments of the cones. Ideally one might use a space with dimensions directly measuring the S, M and L light catches (because that is the relevant signature of a colour), but unfortunately the (standardised) system generally used is still the 1931 X, Y, Z system of the CIE (Commission Internationale de l'Eclairage). Here X, Y, Z, the so-called tristimulus values, may be conceived of as the light energy



absorbed in a set of artificial photoreceptors with spectral absorptance characteristics that are different from those of the cones, but nevertheless traceable to them by linear transformations.

Colour is usually not expressed in the absolute quantities X, Y, Z but in relative units, representing the contribution of X, Y and Z, as proportions of the total light input, that is x = X/(X+Y+Z); y = Y/(X+Y+Z); z = Z/(X+Y+Z) Note that x + y + z = 1, so there is no need for specifying more than two of these so-called

Fig 5: The CIE (1931) x,y Chromaticity Diagram

chromaticity coordinates. The convention is to use x and y, which thus form the coordinates of the well-known x, y CIE chromaticity diagram (Fig 5).

The chromaticities that can be generated on a colour CRT are bounded by triangle of phosphor chromaticities (R,G,B). stimulate a single receptor class, whether real (S, M, L) or artificial (X, Y, Z). This means, that neither x or y can take values equal to unity.

Colour results from the interaction of light with an appropriately designed nervous system. Vision is mainly concerned with the colour, form, distance, and three-dimensional extension of objects. It begins with the impact of light waves on the retina of the eye, through the combined action of several muscles sets that aim the eyes and determine the shape of the lens. These two process called convergence and accommodation respectively, are "colour dependent". The lens itself does not transmit all wavelengths equally. Additionally, a pigment in the central part of the retina transmits yellows while absorbing blues. With age, the lens also yellows along with the reduction in transmittance occurs in the fluids that support the eye. Actually a great deal of individual variation occurs: some eyes are very transparent, while others are naturally yellowed. This contributes to differences in colour sensitivities between persons, which is connected to the optical nerve which conducts the light stimuli to the optical center of the brain. Blue-blindness is in the central foveal region. Red and green are more prominent in the center of the eye. This is because the cones are densely populated at the center of the eye (which contain more of red and green pigments and very less of the blue type) and rods at the extreme periphery where the eye can detect only unclear and colourless shapes. Our visual systems are able to detect yellows and blues further into the periphery than reds and greens.

The shorter wavelengths i.e., blue is focussed in front of the retina and longer wavelengths, i.e, red is focused behind the retina. Red appears closer, blues more distant. Very pure colours need more refocusing than less pure ones.

The combined relative sensation of brightness produced by individual spectral colours shows that sensitive of human eye is greatest for green light, decreasing towards both the red and blue ends of the spectrum. The maximum is located at about 550 nm, a yellowish green where the maximum spectrum energy of light is located.

Accommodation mechanism: An edge is the basic element in the perception of form. It can be created by adjacent areas that differ in brightness, colour or both, it is used to guide the accommodation mechanism that brings images into focus on the retina where, through the eyes constant motion, the edge moves across the receptors in a constant manner. So for sharp, focused images, it is necessary to combine colour and brightness differences.

Another important attribute of visual photoreceptors is that they adjust their level of sensitivity to the overall light level. Consequently, the perceived brightness of objects depends upon the adaptive state of the eye. Further more, the photo pigments response level is also dependent upon the wavelength.

The muscles of the two eyes, working together, also serve the important function of converging the eyes on any point being observed, so that the images of the two eyes coincide. When convergence is non-existent or faulty, double vision results. The movement of the eyes and fusion of the images also play a part in the visual estimation of size and distance.

U**Perceptual factors influencing colour processing:**

As explained above and more, the factors mainly affecting the display in front of the pilot are display image quality and information-handling capability.

In view of this, pilots prefer colour because of the following reasons.

1. Preference of colour over monochromatic presentation.
2. Colour has potential for greatly increasing information coding capability and flexibility
3. Reduces visual search time for complex display
4. By addition of colour contrast, symbol visibility increases and thus reduces display brightness requirements.
5. Enhanced operator performance of complex, high-workload situations and severe dynamic operational environment.
6. Memory is better for colour than for either shape or number of a short term.
7. Power to unify or cluster elements from a complex visual field.

All the above factors help the pilot in the following:

a. Control of the aircraft
b. Status information about sub-systems
c. Situation displays – tactical threats and navigation position

Keeping in view of the various characteristics our human visual system and its spectral response and to cater to pilot's

requirement in the actual aircraft environment, there is a need for colour coding when the density of symbols is high, relevant information should be discriminated and symbol legibility is degraded.

Therefore, in order to choose the colours and its combinations in a colour display, various theories have been proposed by scientists with respect to colour coding, some of which are mentioned below.

Colour Coding – Theory – I:

a) Quantitative display formats – Present data in specific increments, interval or ration scales. Colours can categorize the data and aid processing by representing numerical ranges.

b) Qualitative – to convey vehicle status information; classify by data or condition.

Tripartite Colour coding – Theory – II:

a) ***Single-Purpose Colour Coding*** *:* Green – advisory information, Amber – caution, Red – danger

b) ***Environmental Colour Coding****:* Suggests the actual appearance of features in the environment: Blue – sky, Brown - ground

c) ***Dual-Purpose Colour Coding:*** Combination of single-purpose and environmental colour coding.

Other influencing factors in the cockpit environment:

1. Chromatic adaptation: Prolonged viewing of a specific colour renders the visual system less sensitive to that colour. Eg. Cyan appears green. Magenta is redder.

2. Chromatic induction: Colour perception is influenced by other colours present in the display., for eg., white may appear slightly yellow or pink when presented against a blue background.

3. Hetero-chromatic matching: Brightness perception is affected by the degree of contrast between adjacent colours.

4. Display Luminance is mixed with ambient light reflected by the display media and any cover plates or filters, spectrally attenuated by sunglasses or visors, mixed with glare source induced veiling luminance within the eyes Due to these, human perception of colour tends to change, visual system **adapts to colour with prolonged viewing**. This is due to mixing of emitted display colours with the ambient lighting that results in a colour shift as well as in perceived desaturation.

5. Other factors include presentation time, angular sub-tense, surface area over which the colour is displayed, shapes, etc.

Care to be taken for using colour effectively

1. Avoid simultaneous display of highly saturated spectrally extreme colours.
2. Pure blue should be avoided for text, thin lines and small shapes.
3. Avoid adjacent colours that differ only in the amount of blue.
4. Older operators need higher brighter levels to distinguish colours.
5. Colours change in appearance as the ambient light level changes. Should be chosen accordingly.
6. Avoid red and green in the periphery of large-scale displays.

Colours recommended for Cockpit Displays

1. Relatively unsaturated colours –Yellow, Green, Magenta, Cyan, Orange.

2. Most colour-combination confusions to be avoided - red on green, yellow on blue.

3. Best colours – Cyan, White, Green – most distinguishable

4. Most uncomfortable colour – Magenta.

5. Alphanumerics

a. Foreground colours – Red, Green, White, Yellow, Magenta

b. Background colours – Aqua, Gray

6. Elaborate displays

a. Cyan more preferred than blue

b. Blue used in contexts where it need not be read, e.g. sky.

7. Colour Combinations

a. Search Times: Fastest – Red on Gray, White on Gray, Red on Pink, Yellow on Light, Aqua, White on Blue, Medium – Red on Dark Aqua, White on Pink, White on Light Aqua, Red on Blue, Yellow on Dark Aqua, Slowest – Red on Light Aqua, Yellow on Gray, White on Dark Aqua, Yellow on Blue, Yellow on Pink.

b. Map Displays:- Point features – Red for enemy,White for friendly,Yellow for bridges, Symbols outlined in black, Linear features –Green for railroads and obstacles, Magenta for cities, Pink for roads, Cyan for streams, Terrain features:- Blue for open water, Aqua for forested terrain, Gray for non-forested terrain.

Pictorial Display Formats usage of the above mentioned Tripartite coding system

The tripartite coding system has been used as part of the display formats applied to an **electronic map** (figs. 6 and 7) in a horizontal-situation display. Principles for color discrimination, symbol coding, and color naming have been applied for the super-imposed symbols (targets, waypoints etc) and for the map symbology (land, water, roads).

Three types of features are identified: point features, linear features and terrain features. **Point features** include red for enemy, and white for friendly points. **Linear** features include green for rail roads and obstacles, magenta for cities, pink for roads and cyan for stream. **Terrain features** to be coloured blue, aqua and gray for open water, forested terrain and non-forested terrain, respectively. The above are suggested colours by a team of scientists after lot of studies, but some of the colours have been modified by others so as to achieve more clarity for identification of maps.



Figs. 6 and 7 Map Displays

Color Design for an Integrated Display of Hazard Information

In good design practice every decision regarding the data set to be displayed, the associated user procedures, and the data hierarchy should be initially reviewed by the design team (human factors experts, subject matter experts, and engineering experts) and then re-examined several times during the course of an iterative development process of design/test/redesign/retest.

As an example, the starting point for an integrated hazard display is integrated navigation and traffic information, intended to be viewed on the navigation display of commercial airliners. It should be consistent in content and graphics, with the existing display of navigation data and Traffic Collision Avoidance System traffic data. It integrates further traffic data obtained either from automated position reports from other aircraft or from ground surveillance. It also includes the graphics of software tools that help the pilots plan conflict-free routes.

The color scheme of the display includes labeling of altitude relations, manipulation of luminance contrast for attention management, and honoring of most cultural and prior cockpit color-coding conventions and standards.

The various steps involved in the colour design are:

1. Data Planning

*a. Data Inventory / Data Analysis.*U The data to be displayed are the weather Data, traffic and navigation data of the display, 3D Terrain Data, with Hazard Detection.

*b. Attention Management.*U The data were sorted into categories and the categories ordered in a hierarchy of urgency. This urgency hierarchy provides the rationale for designing the various graphic elements of the display.

c. Design of the Graphics Implementation

The hierarchy of data urgency provides the guidance for the design of the graphics, including color assignments.

2. Decide where chromatic color will be used and why. The most important usage of chromatic color is caution-and-warning color codings for symbols of aircraft predicted to be a traffic hazard, for hazardous terrain, and for weather. Chromatic color is also used to visually group classes of aircraft. Static grouping includes groups of aircraft above, below, and at the altitude. Data relating to planning waypoints are visually grouped by means of chromatic color. Status of pushbuttons for route-planning tools is indicated by chromatic in-fills. Representation of altitudes of non-hazardous terrain is accomplished with grayscale shading and does not require chromatic color.

3. Choose colors. The color choices are based on a number of considerations. Cultural constraints and standards are considered first in selecting hues and saturations for labeling the hazard data. Warning status and caution status require saturated red and saturated yellow or yellow-orange, respectively. Terrain hazards are labeled with striped texture, to make a distinction from weather hazards and to provide high salience. The luminance values are chosen on the basis of perceptual layering demands. Very pale green is used for low intensity weather for several reasons. The areas covered by low intensity weather can be quite large, and aircraft often fly through it. Use of a low-saturation green for this level of weather allows high luminance-contrasts with aircraft and other symbols. It also avoids simultaneous- and successive-contrast problems that can occur with large areas of saturated color. Warning-level weather is usually confined to small areas so the relatively low luminance of high-saturation red is a minor problem. Caution-level weather also tends to be small, and maximum purity and high luminance can be gotten simultaneously in yellow.

Development of next generation cockpit display system

The recent advances consists of the implementation of large amounts of information quickly in an understandable format, enabling the aviator to improve mission performance. Current front-line cockpit display systems (fig.8) utilize low-resolution



Fig. 8. Next-Generation Cockpit Display System

analog video to present two dimensional (2-D) images on many separate displays. The future cockpit will be capable of integrating large picture digital video with three dimensional (3-D) and 2-D color images. This system will be capable of rendering icons, maps, and world-views. It will be compatible with head mounted displays and multiple large displays to improve war-planning and combat aviator situational awareness.

Conclusion

1. By using colour, the pilot is able to fly the aircraft with more display clarity and information.
2. Colour displays thus make more effective use of operative capabilities than monochromatic displays.
3. Response to colour coding is better than shape coding or alphanumeric coding.
4. Colour has the potential to exploit more of the available information channels in the human visual system.
5. With the development of advanced colour and pictorial displays such as icon-based panoramic, next generation displays, capabilities of pilots to fly the aircraft both for civilian and military purposes are enhanced.

Acknowledgements

The authors are thankful to the Director, ADE for giving per

mission to publish this paper. Specifically, the authors are grateful to Group Director, Sri S. Gurudev and the Divisional Head, Avionics Systems Division, Sri. K.G. Ram Manohar for their encouragement and guidance.

References

1. "Developing the Next Generation Cockpit Display System" by B.C. Read III, D. Barker, R.G. Bishop, L.M. Concha, J.M. Emmert, R.L. Ewing, G.L. Fecher, P.JarusiewicJr., G.D. Peterson, M.Rubeiz, A.M. Sayson - US Air Force, Wright Laboratory, Ohio.

2. "Display Technology – Human Factors Concepts" – Alan Stokes, Christopher Wickens and Kirsten Kite, SAE International.

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SMART NON INTRUSIVE MACHINE MONITORING SYSTEM

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ABSTRACT: Numerous laws and principles of nature are based and formulated on the fact that "Energy can neither be created nor destroyed". And that "Energy cannot be converted completely from one form to another" is a thermodynamic requirement for a more realistic approach. This incomplete conversion of energy leads to secondary conversion, which is unavoidable and this energy dissipated is proportional to the main intended energy conversion. For example, in an atomic bomb explosion the primary conversion is to pressure energy but the intensity of secondary sound waves propagating are directly proportional to heat and pressure energy generated.

Based on the above, a modest attempt is made to use these energy by-products, that is sound and IR images to analyze the health of an aviation engine or a common lathe and also to monitor its operation to optimize maintenance down time. As the method being employed is of continuous monitoring technique just in time just enough maintenance can be employed, resulting in -"low down time max operations time". Today the most challenging task for any production unit or an operating agency (like aviation) is to maximize production/operation with least maintenance down time. This has to be coordinated such that safety to both equipment and operators are not compromised. By using the above non intrusive techniques accuracy in measured monitored parameter is increased. Operation till signs of deterioration or change in the normal operation can be achieved avoiding unnecessary over maintenance as in case of scheduled maintenance or Planned Preventive Maintenance.

1. INTRODUCTION: In an atomic bomb explosion the primary conversion is to pressure energy but the intensity of secondary sound waves propagating are directly proportional to heat and pressure energy generated, or the secondary energy emitting from any system is directly a measure of the quality of primary energy conversion.

Based on the above laws and principles, a modest attempt is made to use these energy by-products, that is sound and IR images to analyze the health of an aviation engine or a common lathe and also to monitor its operation to optimize maintenance down time. As the method being employed is of continuous monitoring technique just in time just enough maintenance can be employed, resulting in -"low down time max ops time".

2. METHODOLOGY

Sound as a tool- Sound which is a propagating wave by itself, is an highly complicated form of secondary energy and hence the following philosophy has been adopted,

i. Sound recording /sensing.

ii. Conversion of sound to digital data (*.wav file)

iii. Synthesizing these waves to get a cloud of points for amplitude /time between (-1 to +1) using MATLAB

iv. Spectrum analysis.

v. Comparison of measured values continuously with a pre recorded test condition data set for health monitoring.

vi. AI interface to decide on the kind of maintenance requirement and at what instant it is required.

b. As a test case a machine shop with three production line machines were considered. The sound recording with the following states were undertaken

i. All three machine working

ii. With one machine off and only two machines on

iii. Two machine off and one machine working

iv. Individual machine working independently

v. Ambient noise of the environment was also recorded

c. The main aim of this paper was to find a method of continuously monitor the operation state of these machine. In a real time scenario there would be a human intervention to be able to monitor the operating state of these machine or an intrusive sensor like a temperature sensor /pressure sensor. This would result in an compromised operating efficiency or waste of manpower.

d. We all are aware of human sound deciphering capability , for example – at home we all come across very advanced sound analyzing capability displayed by small children. Today's street is filled with cars and a lot of similar cars operate at any given time. The sound emitted from all these vehicles exhibit a complex frequency set and a very complex sound pattern which is very difficult to decipher. But a small child processes the signal so efficiently that the child will come to know when its father's car makes an entry with its signature horn or sound pattern. This is achieved through both signal processing, which is highly complicated when it comes to computers to achieve.

e. However for a low level machine monitoring system the

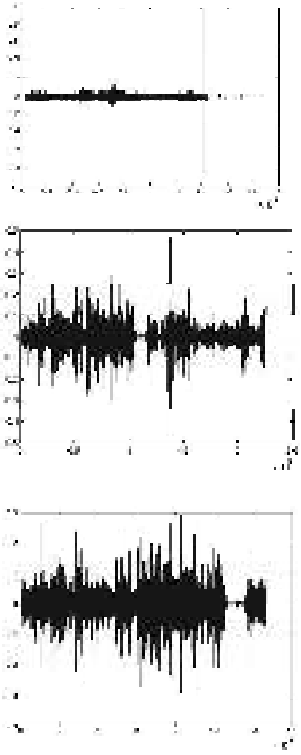
amplitude of noise generated by the machines are used as a parameter to decide what is the operating condition of these machine.

f. The first most critical task in the above exercise would be creating a meaningful library of all possibilities of machine operating condition for the sake of comparison.

g. The second important task would be having tolerances to cater for aberrations.

h. The principle which could be used here would be detecting change of state in the machine condition and its effect on the environment.

2. Following shows the conversion of a typical operating state in graphical form. This is a typical library signal is also shown.



IR Image as a tool - Radiation in the form of infrared is also a very strong secondary energy, which is emitted during any energy conversion especially involving heat which is true in most of the cases. The IR image, which is a dispersion of wave lengths (colors) is a direct indicator of the location of energy conversion and the kind of energy conversion, for example an Gas Turbine engine will have cold zone in the air intake area and will be represented as blue zone and the combustion chamber area will have white to red zone depending on the quality of combustion. Using MATLAB we can convert an IR image giving us the instantaneous representation of the system under consideration to an array of numbers which vary in 3 dimension (R,G,B). The zone under consideration can be effectively monitored and any change in the pattern of wavelengths be seen as a change in color suggesting deterioration or need for maintenance. Philosophy that can be adopted would be as follows,

i. IR image the system in question Gas turbine or a lathe in a test condition.

ii. Convert the image into a set of nos representing the RGB values for all possible points the picture is made off, this would depend on the quality of picture and resolution. It would be an array of RGB values for each point defining the picture. ex{ (0,45,65); (0,48,68); (2,48,67)……etc.}. It is noticed that the white color will have all three RGB values max and RGB values "0" for black.

iii. Decide on zones to be monitored like the combustion chamber, compressor, exhaust in a Gas Turbine or the bearing areas, tool tip in case of a common lathe.

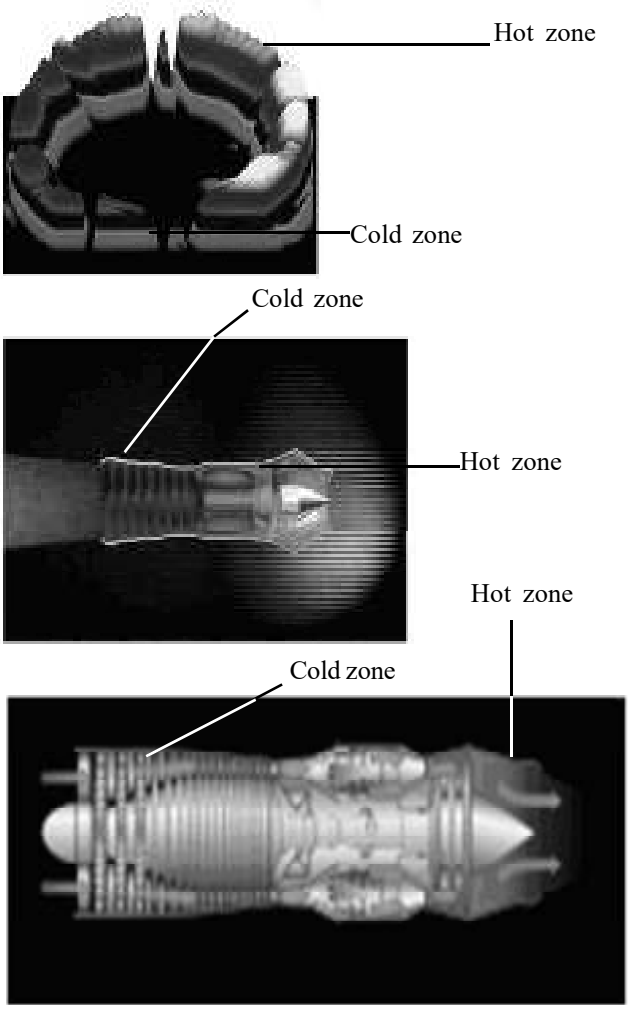
iv. Create test condition data base using ideal lathe or through simulation (CFD/Virtual machining).

v. Sample and create real time IR images during normal operation for the system under consideration.

vi. Continuously compare real time data with the ideal data.

vii. AI intervention to decide course of action through wave length analysis.

To demonstrate the above IR images of a typical turbine engine was considered as shown below



RGB VALUES FOR THE ABOVE ENGINE

0 0 17 59 84 149 240 246 246 242 80 86 125 172 126
45 77 123 204 200 154 112 99 89 110 97 110 139 102 113
163 234 172 149 180 190 167 181 182 182 144 171 193 193 151
190 174 187 195 240 198 204 235 237 238 178 202 247 162 160
244 246 196 229 78 135 237 239 241 242 242 243 243 243 221
227 222 214 199 143 204 239 239 241 242 242 243 244 245 244
203 198 192 168 73 184 239 239 241 242 242 243 243 242 230
175 174 168 163 99 130 226 230 234 231 222 212 189 135 106
158 147 140 139 134 131 187 133 133 133 99 93 123 104 89
110 124 173 138 105 101 151 88 100 97 83 83 98 90 76
160 144 114 132 188 134 135 115 100 120 92 80 83 102 99
169 169 169 146 117 145 228 246 246 245 160 151 187 244 240
179 179 179 179 179 153 118 207 218 217 208 201 201 213 216
188 188 188 188 188 188 188 188 188 188 188 188 188 188 188
197 197 197 197 197 197 197 197 197 197 197 197 197 194 139
207 207 207 207 207 207 207 207 207 207 207 207 207 158 227
207 216 216 216 193 199 201 216 216 216 204 204 203 201 207
190 217 217 217 217 232 188 203 210 207 224 233 216 234 234
186 224 224 224 210 223 196 193 224 224 224 224 210 224 211
176 214 215 215 200 214 189 185 214 214 214 214 203 214 213
170 205 205 205 194 204 181 181 204 204 204 204 199 205 205
163 195 195 195 184 194 174 176 195 195 195 195 189 196 196
157 185 186 186 175 185 171 176 179 182 186 186 181 186 186
179 196 196 196 156 164 203 227 227 205 188 174 162 166 166
218 218 218 218 218 218 218 218 218 218 218 218 218 182 203
208 208 208 208 208 208 208 208 208 208 208 208 208 171 145
198 198 198 198 198 198 198 198 198 198 198 198 198 198 198
189 189 189 189 189 185 137 180 190 191 204 204 202 201 196
180 180 180 176 137 117 189 246 246 245 201 193 219 244 243
170 169 133 113 175 165 163 166 163 152 97 80 96 142 142
129 108 158 157 107 97 138 82 82 91 83 78 92 72 65
143 158 130 133 128 120 185 127 127 127 98 90 117 113 91
158 168 163 157 117 142 215 216 221 219 197 180 160 103 93
197 192 187 172 61 159 238 239 241 241 242 243 242 237 216
222 216 211 185 204 208 239 239 241 242 242 243 244 244 243
230 222 204 227 68 148 239 239 241 242 242 243 244 244 233
142 192 193 198 193 169 208 243 243 244 219 240 245 148 159
175 221 158 155 201 192 180 194 194 194 138 157 206 206 158
87 98 159 208 173 146 144 115 82 130 102 124 152 95 119
0 0 53 98 127 184 181 184 186 173 99 98 110 153 128
0 0 0 0 19 93 99 115 131 129 105 100 128 141 128

3. RESULTS

From the above the nos around 225 to 250 shows the hot zone. MATLAB image processing techniques have been used to convert the image into nos. The IR images are zone specific as the engine relative to its mountings are stationary. The colour change (wave length change) will reflect as a change in RGB value. This can be easily detected and monitored.

As this is a continuous monitoring system the image processing can be undertaken on a sample rate predefined depending on the type of machine and time the machine will take to degrade once the failure has set in. For example for a turbine the sample rate can be high (1 sample every 1 sec) and for a common diesel engine it could be l sample every 30 sec etc)

The most critical task in this case is to predefine, the band of operation. As the technique is highly sensitive there could be a possibility of detecting spurious data which would hinder normal operation the tolerance levels and the areas where this can be allowed are to be accurately decided through extensive data analysis.

As stated earlier the processed data is available almost continuously non critical items can be exploited to its full till almost failure with a moderate Factor of Safety. This will result in a direct saving on machine downtime and increased operation.

The analyzing computers provided with self learning capability could improve upon the knowledge base of the equipment under analysis for more accurate prediction and operations with reduced FOS.

4. CONCLUSION

Today the most challenging task for any production unit or an operating agency (like aviation) is to maximize production/operation with least maintenance down time. This has to be coordinated such that safety to both equipment and operators are not compromised.

By using the above non intrusive techniques accuracy in measured monitored parameter is increased. Operation till signs of deterioration or change in the normal operation can be achieved avoiding unnecessary over maintenance as in case of scheduled maintenance or Planned Preventive Maintenance.

5. REFERENCES:

www.http://searchservervirtualization.techtarget.com/topics/0,295493,sid94_tax303444,00.html

http://www.freepatentsonline.com/5446672.html

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ARTIFICIAL INTELLIGENCE IN THE COMPLEX WORLD OF FINANCIAL MARKETS

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KEYWORDS: Semantic Networks, Orders, Regulatory Structures, Markets, Prediction.

ABSTRACT: The financial market is a complex, data intensive and internationally evolving environment that supports the buying and selling of financial products and commodities. For the past several years, many major firms (banks, hedge funds etc) have developed systems to demonstrate how Artificial Intelligence (AI) technology can support this convoluted and seemingly random environment. Many of these highly proprietary systems have been quietly deployed; others have been abandoned as incomplete prototypes. The financial markets' problem domain have been reviewed from a knowledge-based perspective by providing a global object oriented view and a local process view of the trading and compliance domain. Both views demonstrate the complexity inherent in formally defining the financial markets' environment. This complexity prevents a complete predictive analytical and cognitive model of the environment of the financial markets.

Artificial Intelligence technology is most applicable to problems where a cognitive model of human judgment performs better than a mathematical model. Essentially, it is shown that the reason why some financial markets' AI applications are successful and why others fail is due to representational adequacy of the underlying cognitive model. It is also discussed how integration and validation have an impact on system development. The financial markets continue to be a changing domain for innovative Artificial Intelligence applications. Finally, the goal of the paper demonstrates the consolidation research in this area and shows why some AI applications are successful and why others fail.

1. Introduction: In economics, a financial market is a mechanism that allows people to easily buy and sell (trade) financial securities (such as stocks and bonds), commodities (such as precious metals or agricultural goods), and other fungible items of value at low transaction costs and at prices that reflect the efficient market hypothesis.

Today, the world of finance is a complex, data intensive and international environment that is seemingly very random.

Market participants know that improved information technology provides competitive

Business advantages, and improves the fairness of the market for all participants. A market is fair when all market participants have access to the same information about market products. In the nineteenth century, market information was publicly displayed on a large blackboard (this was called the "Big Board" at the New York Stock Exchange).Like blackboard expert system models, market participants would all look at the board and fire rules to determine their market activity. In the financial markets' environment, this blackboard model

proved inadequate: as the number of products increased, the board quickly ran out of space. Moreover, information was not really public: it was public to those market participants who had access to the board.

Today, the relationship between improved information technology and market fairness and competition is still valid. The ticker still exists, and the principal of disseminating and exploiting market knowledge has been seen in the deployment of several systems utilizing expert system and artificial intelligence techniques. Many firms have developed systems to demonstrate how this technology supports the buying and selling of financial products and commodities in applications such as automated news understanding, credit assessment, risk management, market surveillance, auditing, and trading. Many of these highly proprietary systems have been quietly deployed; others have been abandoned as incomplete prototypes.

Since the financial markets developed early in the US and Europe, majority of the discussion presented here refers to these markets. Indian financial markets have been maturing fast fairly recently and hence we do not sufficient information to include into this report.

The **goal of this paper** is to show why some **Artificial Intelligence** applications are successful and why others fail. To do this, we first model the financial markets' problem domain from a knowledge-based perspective. We provide two declarative representations of the financial markets' environment: an **object oriented view** and a **process view** of the trading and compliance domain. Both models demonstrate the complexity inherent in formally defining this environment. This complexity prevents a complete **predictive analytical model** of the financial markets' environment, and leads us to discuss some of the reasons for an **expert systems approach**. This approach is motivated by situations where a **cognitive model** of human judgment performs better than an analytical model. Since human judgments are dynamic and are often difficult to test in predictive situations, we expect that the expert system approach will fail if the underlying cognitive model is inadequate. Finally, we discuss a **knowledge-based approach** that does seem to integrate the best of both approaches: the development of collaborative systems.

2. Financial Markets: An Object-Oriented View: Object-oriented models seek to simultaneously specify objects together with morphisms (rules and operations) defined on these objects. Objects send messages to other objects; object semantics are defined by the reception of messages. Our object-oriented view of the financial markets' environment defines a complex set of competitive worlds that are highly distributed in space and time. Each world is an instantiation of markets, market participants, products, orders, news, and regulatory structures. Figure 1 summarizes some of the objects and messages in a world in the form of a semantic network.

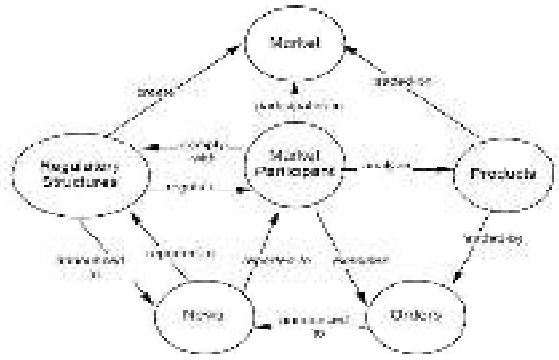


Figure 1: A Semantic Network Representation of the Financial Markets (simple view)

Products represent assets (e.g., securities such as bonds and stocks) or contracts (e.g. options to buy or sell an asset within a specified future time), or may represent an index computed on an underlying product (e.g., an interest rate, or an average price of a "basket" or set of securities).

Market participants buy and sell products by performing a set of actions that maximize an economic objective function. Buy and sell transactions are recorded as orders.

One way that market participants can maximize an economic objective function is by firing the following rules: Buy low and sell high.Do it before anyone else.If these actions are common to a set of market participants, then the only market participants that will maximize their economic objective functions are those that have a *product knowledge advantage* (so that they can effectively determine what is "high" and "low"), and those that have an *order execution advantage* (so that they do not wait to achieve these actions: waiting may change the price to a sub-optimal level).

Orders are used to indicate different timing and size parameters for trades. There are many different types of orders that are based on the number of combinations for size (product quantity), side (buy or sell, long or short), price limits, time limits, and other constraints (stop orders, orders on the opening or close, "fire or kill" orders, and others).

The improvement in order execution has been continuing since the installation of telegraph communications over one hundred years ago (and continues today in the context of global markets and 24-hour trading). These improvements include better order, billing and clearance systems that can handle large numbers of transactions. In this context, Artificial Intelligence has been applied to financial telecommunication network management; funds transfer; and image, voice, and forms processing. One goal in the financial markets is to discover product knowledge advantages in order to assess the price of a product. If all market participants have perfect information and the same execution capabilities, then *on the average*, none will have any knowledge advantage over the other. In this ideal environment, the price of a product on a market converges to its "true price." In the real financial mar

kets' environment, there are price deviations between the true price and the market price because not all traders have complete information. These deviations are further exaggerated by rumors, "good news," "bad news," panics, and crashes. The existence of the true price is a consequence of the so-called efficient market hypothesis: the true price of an object is the price observed if all traders act rationally, have perfect information about the object, and are all participating in the market. This hypothesis is usually accepted when all traders have access to identical telecommunication and information systems: all information obtainable about an object is known to all participants. Consequently, in this rational and perfect information scenario, there is no profitable way to speculate.

Regulatory structures prevent illegal knowledge advantages in the market so that trading remains fair and orderly. Regulations are laws that exist in at the government agency level, the market level, and the market participant compliance level. In some sense, the regulatory structures define the market. In our model, regulatory structures monitor trading and may execute particular actions if they determine that the market is not fair or orderly. One of the more challenging applications of **Artificial Intelligence** in financial markets is in the detection of (legal and illegal) knowledge advantages in trading and regulation. Such systems have been deployed for assessing potential opportunities (risk assessment, underwriting, and exposure), evaluating lost opportunities (auditing), and compliance with different regulatory structures.

Markets comply with different regulatory structures. The most regulated markets are *exchanges*. These are centralized markets registered with a government agency, such as the **Securities and Exchange Board of India (SEBI)**. The least regulated are *crossing markets*, where buyers and sellers agree between themselves on the order. Orders that do not take place on an exchange but do take place within a system of brokers are said to take place on over-the-counter (OTC) markets. To complete the above object-oriented specification of the financial markets' environment, we require the existence of several inter-dependent markets. This linkage can be accomplished in several ways

1. A product can be traded on several markets at once.
2. A product trading on one market can effect the trading of a different product on another market.
3. A market participant can participate on several markets at once.
4. Information may (or may not) reach all market participants.

In our model, the object used to disseminate information among market participants and regulatory structures is called ***News***. Figure 1 is a model of a single world: a more complete model of financial markets would consist of instances of the figure (which can be drawn in multiple layers), with inter- and intra- layer messages linking the different markets, products, news, market participants, and regulatory structures in different layers. Any causal model of the financial markets' environment must be incomplete. As market participants become aware of the different information flows affecting the environment, feedback from news causes the objects to change and evolve new products, new markets, new regulatory structures, and new market participants.

Any complete causal analytic models either do not exist or are too complex to justify short-term predictions. In this sense, the financial markets' environment behaves like a living organism.

1. Financial Markets: A Process View: Process models emphasize information transformation. In this section, we show a model of the financial markets' environment in terms of a generic structure of processes that create and monitor events. This model is a variation of the Predict- Detect-Isolate-Correct feedback loop discussed in the ISO network management model. Network management is another domain known for event complexity and Artificial Intelligence applicability.

A procedural model can be used to model a trading and regulation situation. Both are shown pictorially in Figure 2. The difference between these scenarios concerns their dual interpretation of an event. In trading, the goal is to discover events (with low probability) that represent a buy or sell opportunity; in regulation, the goal is to discover events (with low probability) that represent a possible indication of something unusual that must be further investigated for non-compliance.

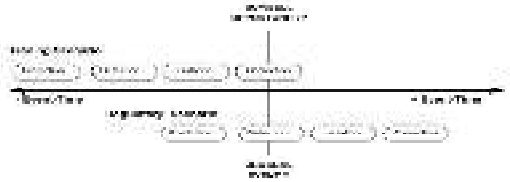


Figure 2: Trading and Regulation Scenarios

The basic financial markets' model is shown as a data-flow diagram in Figure3. In this diagram, the efficient market hypothesis that that all world knowledge (market and news) is available to each process is assumed.

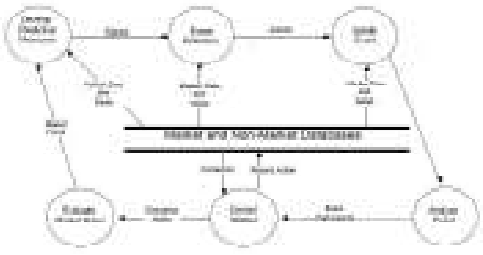


Figure 3: Financial Markets' Environment as a Real-Time Process Model

Prediction refers to the determination that an event will occur in the future. Prediction involves the creation of a model that can represent past experiences. In a market trading scenario, the prediction process determines the likely buy or sell signals by defining a computation based on certain database inputs. For example, a trading model may have a set of predic

tive rules that are based on price and volume movements, such as "If the 10-day moving price average crosses the price curve in a broadening bottom pattern, then signal a buy, otherwise hold." There is a relationship between the process model and the object-oriented model. In some sense, all objects interact with their world by performing the Predict-Detect-Isolate-Correct loop. The process model helps form a local view of the world.

Because of this local view, we can scope small domains to assess the applicability of different **AI technologies**.

Machine learning techniques may be appropriate when a database of actual experiences exist and a standard decision procedure *is assumed to exist*. Here, part of the prediction process consists of inferring rules that can be used in a deductive Predict-Detect-Isolate-Correct loop.

Connectionist (neural network) approaches are appropriate when the application requires the representation of actual experiences in a "compiled form." This approach is sub symbolic: it rules on a numerical representation and computational models utilizing linear and non-linear discriminants. In some sense, this approach can also be considered similar to the analytic approach: the output of the prediction process is can be considered to be an analytic (statistical) model.

From an operational perspective, the two most challenging problems concerning the building of systems based on the above process models for financial applications are complexity ("can it work?") and validation ("does it work?"). Successfully deployed financial systems address both problems. The complexities of financial systems mimic the complexities of the environment. This complexity can be reduced to understandable levels by utilizing system components that already exist. To do this, we require standard definitions for user and data interfaces to permit the interoperability between implementations of cognitive models (knowledge-based systems), implementations of analytic models, and users.

Validation is as much a function of management and user commitment to the system as system complexity: even if complexity is well managed, a system that cannot be validated by demonstrating the support of specific business and user goals will not be deployed.

1. Expert Systems in Financial Markets: Analytical Models vs. Cognitive Models

Many analytical models have been developed for the financial markets' environment in recent years. Several of these models have been used successfully for decision-making and prediction, such as the well-known Capital Asset Pricing Model and the Black-Scholes model for options pricing.

In other domains (such as economic forecasting), even though some analytic models often outperform human decision-makers, the model outputs are not generally well- accepted. Many analysts will usually reject the model's conclusions, especially if they are presented with binary choice between the total acceptance and total rejection of the model's decision. Some reasons for this are:

Incompleteness of the model theory:
Incompleteness of the model inputs:
Incompleteness of the model outputs:
Incompleteness of the explanation:

Cognitive models fail for domains where there is *too much* reliance on judgment: in these domains, judgments are dynamic and their representations are difficult to quantify and verify. The fallibility of human judgment in many decision-making domain echoes the experience of many financial expert systems. Representational failures occurring in human analysts (and the expert systems that model them) include:

Anchoring, Inconsistency, Fallacy, Representativeness, Autonomy vs.

Collaboration, Availability of Expertise, Conflicting Expertise

2. Collaborative Systems: The desirability of developing techniques by which humans and computers collaborate in making decisions, rather than the decision being made by one or the other, has been recognized for some time. As early as 1961, Yntema and Torgerson questioned how to combine the speed of the computer with the "good sense" of the human user, without sacrificing too much of either. They proposed to let the machine make the decisions according to simple rules, but require the analyst to monitor the result and change the machine's answer if the analyst finds the results too foolish.

Relationships between analytical models, human judgment, and cognitive models are shown in Figure 4.

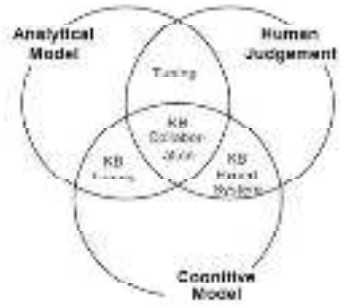


Figure 4: Analytic Models vs. Cognitive Models vs. Human Judgment

1. Summary: We have reviewed the financial markets' problem domain from a knowledge-based perspective by providing a global object-oriented view and a local process view of the trading and compliance domain. Both views demonstrate the complexity inherent in formally defining the financial markets' environment. This complexity prevents a complete predictive analytical and cognitive model of the environment of the financial markets.

Artificial Intelligence technology is most applicable to problems where a cognitive model of human judgment performs better than a mathematical model. Essentially, we have shown that the reason why some financial markets' AI applications

are successful and why others fail is due to the representational adequacy of the underlying cognitive model. We also discussed how integration and validation have an impact on system deployment.

The financial markets continue to be a challenging domain for innovative Artificial Intelligent applications.

Today, successfully deployed AI systems have the important operational property of being successfully integrated with other systems. Future financial markets' AI systems will continue to build on the advantages of system integration by demonstrating the intelligent collaboration among different components.

2. Bibliography:

1. Roy S Freedman, AI on Wall Street, The Encyclopedia of Computer Technology, Volume 28, Marcel Dekker, Inc, New York, 1993.
2. Bernard Grun, Timetables of History, Simon & Schuster, New York, 1979.
3. David Leinweber, "Knowledge-Based Systems for Financial Applications," IEEE Expert, Vol. 3, No. 3, Fall 1988, pp. 18-31.
4. Ivy Schmerken, "Wall Street's Elusive Goal: Computers that Think Like Pros," Wall Street Computer Review, Vol. 7, No. 9, June 1990.
5. C. Joseph, A. Sherzer, K. Muralidhar. Knowledge Based Fault Management for OSI Networks. Proceedings of the Third International Conference on Industrial and Engineering Applications of Artificial Intelligence, ACM, New York, 1990, pp. 61-69.
6. Ross M. Miller, Computer-Aided Financial Analysis, Addison-Wesley, Reading, 1990.
7. R. S. Pindyck and D. L. Rubinfeld, Econometric Models and Economic Forecasts, McGraw-Hill, 1976.
8. D. B. Yntema and W. S. Torgerson, "Man-Computer Cooperation in Decisions Requiring Common Sense", IRE Transactions on Human Factors in Electronics, HFE-2 (1961), pp 20 - 26. Reprinted in W. Edwards and A. Tversky, DecisionMaking, Penguin Books, 1967.
9. M. Lacy, "Artificial Laboratories,"AI Magazine, Vol.10, No. 2, 1989, pp 43-48.
10. H. Abelson, M. Eisenberg, M. Halfant, J. Katznelson, E. Sacks, G. Sussman, J. Wisdom, K. Yip, "Intelligence in Scientific Computing," Communications of the ACM, Vol. 32, No. 5, May 1989, pp. 546-561.
11. C. Apte and R.Dionne,"Building numerical sensitivity analysis using a knowledge based approach," IEEE Expert, Vol.3, No. 2, Summer 1988, pp.371- 378.
12. V. Dhar and A. Croker, "Knowledge-Based Decision Support in Business: Issues and a Solution," IEEE Expert, Vol. 3, No. 1, Spring 1988, pp. 53-62.
13. R.S. Freedman and G. J. Stuzin. A Knowledge-Based Methodology for Tuning Analytical Models. IEEE Transactions on Systems, Man, and Cybernetics, Vol. 21,No. 2, March, 1991

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ARTIFICIAL INTELLIGENCE

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Introduction

Can a Computer have a mind?

Over the past few decades, electronic computer technology has made enormous strides. The computers of today may be made to seem as sluggish and primitive as the mechanical calculators of yesteryear now appear to us. Already computers are able to perform numerous tasks that had previously been the exclusive province of human thinking, with a speed and accuracy, which far outstrip anything that a human being can achieve.

We have developed Intelligent machines which will run the gamut from self-piloting ground and air vehicles to highly advanced robotic systems and we are pleased to have devices which regularly propel us at great speeds across the ground - a good five times as fast as the swiftest human athlete – or that can dig holes or demolish unwanted structures at rates which would put teams of dozens of men. We are even more delighted to have machines that can enable us physically to do things we have never been able to do before: they can lift us into the sky and deposit us at the other side of an ocean in a matter of hours. They will become proficient in every human field of knowledge and expertise. There will be robot doctors, nurses, engineers, technicians, scientists, chefs, soldiers, historians, construction workers, farmers, architects, store managers, investment advisors, language interpreters, gardeners, housekeepers, landscapers, factory workers and many more. They will come in all shapes, sizes and specialties. Some will move about on wheels, some will fly, and others will sport multiple legs and arms and various other appendages. Many will interact directly with humans while others will remain hidden from view most of the time, coming out to do their chores quietly when no humans are in sight. Some will not move at all, as their function will be to search the Internet and databases for new knowledge. But this is just the tip of the iceberg because, for the first time in recorded history, humanity is in a position to build machines so powerful, that their intelligence will surpass that of the smartest human beings on earth. And contrary to what some experts may suppose, it can be done now, using existing computer technology. Where will this road take us? It is anyone's guess. But this is undoubtedly the dawning of the age of the *Super Intelligent Machine.*

Artificial Intelligence: Artificial Intelligence, or AI for short, is a combination of computer science, physiology, and philosophy. AI is a broad topic, consisting of different fields, from machine vision to expert systems. The element that the fields of AI have in common is the creation of machines that can "think".

In order to classify machines as "thinking", it is necessary to define intelligence. Intelligence is the ability to think, to imagine, creating, memorizing, understanding, recognizing patterns, making choices, adapting to change and learn from experience. Artificial intelligence is a human endeavor to create a non-organic machine-based entity that has all the above abilities of natural organic intelligence. Hence it is called as 'Artificial Intelligence' (AI). It is the ultimate challenge for an intelligence, to create an equal, another intelligent being. It is the ultimate form of art, where the artist's creation, not only inherits the impressions of his thoughts, but also his ability to think

How will one recognize artificial intelligence? According to *Alan Turing*, if you question a human and an artificially intelligent being and if by their answers, you can't recognize which is the artificial one, then you have succeeded in creating artificial intelligence. Initial hopes of computer scientists of creating an artificial intelligence, were dashed hopelessly as they realized how much they had underrated the human mind's capabilities.

Artificial intelligence (**AI**) is the intelligence of machines and the branch of computer Science which aims to create it. This field is also defined as "the study and design of intelligent agents, where an intelligent agent is a system that perceives its environment and takes actions which maximize its chances of success.John McCathy who coined the term in 1956, defines it as "the science and engineering of making intelligent machines."

The field was founded on the claim that a central property of humans, intelligence—the sapience of *Homo sapiens*—can be so precisely described that it can be simulated by a machine.This raises philosophical issues about the nature of the mind limits of scientific hubris, issues which have been addressed by myth, fiction and philosophy since antiquity.Artificial intelligence has been the subject of breathtaking optimism,has suffered stunning setbacks and, today, has become an essential part of the technology industry, providing the heavy lifting for many of the most difficult problems in computer science.

History

Mechanical or "formal" reasoning has been developed by philosophers and mathematicians since antiquity. The study of logic led directly to the invention of the programmable digital electronic computer, based on the work of mathematician Alan Turing and others. Turing's theory of computation suggested that a machine, by shuffling symbols as simple as "0" and "1", could simulate any conceivable act of mathematical deduction. This, along with recent discoveries in neurology, information theory and cybernetics, inspired a small group of researchers to begin to seriously consider the possibility of building an electronic brain.

The field of AI research was founded at a conference on the campus of Dartmouth College in the summer of 1956.The attendees, including John McCarthy, Marvin Minsky, Allen Newell and Herbert Simon, became the leaders of AI research for many decades.They and their students wrote programs that were, to most people, simply astonishing:computers were solving word problems in algebra, proving logical theorems and speaking English. By the middle of the 1960s, research in the U.S. was heavily funded by the Department of Defense and laboratories had been established around the world.AI's founders were profoundly optimistic about the future of the new field: Herbert Simon predicted that "machines will be capable, within twenty years, of doing any work a man can do"and Marvin Minsky agreed, writing that "within a generation ... the problem of creating 'artificial intelligence' will substantially be solved".

They had failed to recognize the difficulty of some of the problems they faced. In 1974, in response to the criticism of England's Sir James Lighthill and ongoing pressure from Congress to fund more productive projects, the U.S. and British governments cut off all undirected, exploratory research in AI. The next few years, when funding for projects was hard to find, would later be called an AI winter".

In the early 1980s, AI research was revived by the commercial success of expert systems,a form of AI program that simulated the knowledge and analytical skills of one or more human experts. By 1985 the market for AI had reached over a billion dollars. At the same time, Japan's fifth generation computer project inspired the U.S and British governments to restore funding for academic research in the field. However, beginning with the collapse of the Lisp Machine market in 1987, AI once again fell into disrepute, and a second, longer lasting AI winter began.

In the 1990s and early 21st century, AI achieved its greatest successes, somewhat behind the scenes. Artificial intelligence is used for logistics, data mining, medical diagnosis and many other areas throughout the technology industry.The success was due to several factors: the incredible power of computers today, a greater emphasis on solving specific subproblems, the creation of new ties between AI and other fields working on similar problems, and above all a new commitment by researchers to solid mathematical methods and rigorous scientific standards.

Expected Traits of a Intelligent Machine

The problem of simulating (or creating) intelligence has been broken down into a number of specific sub-problems. These consist of particular traits or capabilities that researchers would like an intelligent system to display. The traits described below have received the most attention.

· Deduction, reasoning, problem solving

· Knowledge representation

1. Default reasoning and the qualification problem
2. The breadth of commonsense knowledge
3. The subsymbolic form of some commonsense knowledge
· Planning
· Learning
· Natural language processing
· Motion and manipulation
· Perception
· Creativity
· General intelligence

Methods used to create intelligence

Introduction

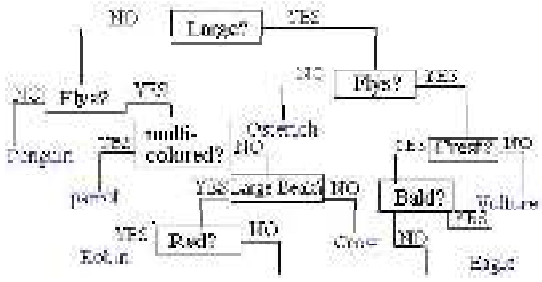
In the quest to create intelligent machines, the field of Artificial Intelligence has split into several different approaches based on the opinions about the most promising methods and theories. These rivaling theories have lead researchers in one of two basic approaches: Bottom-up and Top-down. Bottom-up theorists believe the best way to achieve artificial intelligence is to build electronic replicas of the human brain's complex network of neurons, while the top-down approach attempts to mimic the brain's behavior with computer programs.

· Bottom up Approach

Neural Networks and Parallel Computation

· Top Down Approaches

Expert Systems



Applications in Top-Down Approach

-Chess

-Frames

Applications

· Finance
· Medicine
· Heavy industry
· Transportation
· Telecommunications
· Toys and games
· Music
· Aviation
· Speech recognition

The Future of A.I. : Artificial intelligence in the 90's is centered on improving conditions for humans. Research is focusing on building human-like robots. This is because scientists are interested in human intelligence and are fascinated by trying to copy it. If A.I. machines can be capable of doing tasks originally done by humans, then the role of humans will change.

Robots have already begun to replace factory workers. They are acting as surgeons, pilots, astronauts, etc. According to Crevier, a computer scientist, robots will take over clerical workers, the middle managers and on up. Eventually what society will be left with are machines working at every store and humans on every beach. It is like we'll all be living as millionaires.

The visions of some of scientists seem like unrealistic utopian views. Other scientists and theorists envision a more negative takeover. "The thinking power of silicon 'brains' will be so formidable that 'if we are lucky, they will keep us as pets'"(Postman). But what if these visions become a reality? Will humans have to worry about their futures if artificial intelligence takes over? The advancements in the quest for artificial intelligence have and will continue to affect our jobs, our education and our lives.

Bibliography

1) The Emperor's New Mind - Roger Penrose
2) New Scientist Magazine - Dr. Mark Humphrys ,University of Edinburgh
3) AI: Theory and Practice - Dean, Allen, Aloimonos
4) Essentials of AI - Ginsberg
5) Wikipedia, the free encyclopedia

C.M.A.IT.BT.NT:-9

APPLYING SOLAR ENERGY AS AN EFFECTIVE SOLUTION TO SOLVE DRINKING WATER PROBLEM IN INDIA

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In the list of 122 countries rated on quality of portable water, India ranks 120, a very low rating. It is estimated that by 2020, India will become a water-stressed nation.The ground reality is that of the 1.42 million villages in India, 1,95,813 (13.8%) are affected by chemical contamination of water. The quality of ground water which accounts for more than 85% of domestic supply is a major problem in many areas as none of the rivers have water fit to drink. Prime issues in potable water are bacteriological contamination (which leads to diarrhea, cholera and hepatitis which is widespread in India), hardness, salinity, fluoride, arsenic and nitrate contamination. Fortune magazine stated that "Water promises to be to the 21st century what oil was to the 20th century: The precious commodity that determines the wealth of nations." The positive aspect of this problem is that it can be solved. The solution extends at various levels (international/national to individual households). There is a worldwide search for solutions. But analysts are finding fault with the way many solutions are

being implemented. Too often, Western ideas and technologies are introduced without a clear understanding of the peculiar conditions of the host countries. Building centralized water treatment plants and distributing water is a costly affair. In one of the reports, WHO has stated "scarcity of water is best tackled by encouraging individual householders and local community organizations to provide water sanitation projects instead of governments and aid agencies". So, an engineering solution deployed at household level is a very important aspect in solving this problem.

At household level, solution is through water purification. There are host of purification solutions. However cost of the technology in terms of installation and maintenance is not low, considering the usage in mass with major users from rural and financially weaker sections of the society. Another issue is that of dependence on electricity. This paper dwells on improvements in solar technology (improved solar still and solar irradiation) that can be applied to solve this problem at individual household level. Solar energy can satisfy the unique requirement of low cost required to solve this problem.

Details:-

Problem statement:-

India has 4% of the world's water, however studies show average availability is shrinking steadily. In the list of 122 countries rated on quality of portable water, India ranks 120, a very low rating. It is estimated that by 2020, India will become a water-stressed nation. Nearly 50% of villages still don't have any source of protected drinking water. The water problems facing India is comparable to that plaguing the sub-Saharan Africa, which is known to be with poor rainy conditions. Fortune magazine stated that "Water promises to be to the 21st century what oil was to the 20th century: The precious commodity that determines the wealth of nations." Right across India, there is mounting pressure on dwindling supplies of fresh water, and conflicts over access to water have even provoked riots in some areas. India's rapid economic growth has also intensified the competition for water, and even in the capital Delhi more and more people are depending on tankers for their drinking water. This indicates how precious water is for the development of nation in the next century.

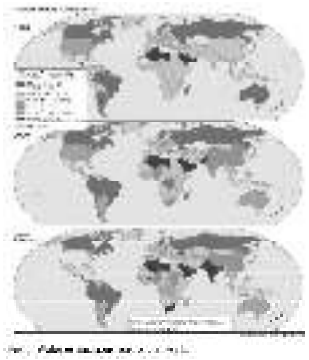


Fig1:- Water estimations across the world

37.7 million People –over 75% of whom are children are affected by waterborne diseases every year. Overdependence on groundwater has brought in contaminants, fluoride being one of them. Nearly 66 million people in 20 states are at risk because of the excessive fluoride in water. While the permissible limit of fluoride in water is 1 mg per litre in states like Haryana it is as high as 48 mg in some places. Delhi water too has 32 mg. But the worst hits are Rajasthan, Gujarat and Andhra Pradesh. Nearly 6 million children below 14 suffer from dental, skeletal and non-skeletal fluorosis. Arsenic is the other big killer lurking in ground water putting at risk nearly 10 million people. The problem is acute in Murshidabad, Nadia, North and South 24 Paraganas, Malda and Vardhaman districts of West Bengal. The deeper aquifers in the entire Gangetic plains contain arsenic. High nitrate content in water is another serious concern. Fertilizers, septic tanks, sewage tanks etc are the main sources of nitrate contamination. The groundwater in MP, UP, Punjab, Haryana, Delhi, Karnataka and Tamil Nadu has shown traces of nitrates. However it is bacteriological contamination which leads to diarrhoea, cholera and hepatitis which is widespread in India. A bacteriological analysis of the water in Bangalore revealed 75% bore wells were contaminated. Iron; hardness and salinity are also a concern. Nearly 12,500 habitats have been affected by salinity. In Gujarat it is a major problem in coastal districts. Often babies die of dehydration and there are major fights in villages for fresh water. Some villages have seen 80% migration due to high salinity. Clean water is a necessity for the human metabolism and for basic hygiene. Contaminated water serves to spread contagious diseases. Unsafe drinking water is responsible for 80% of diseases in developing countries. The most common water borne infectious and parasitic diseases include hepatitis A, diarrhoea diseases, typhoid, roundworm, guinea worm, leptospirosis, and Schistosomiasis. Every year, diarrhoea diseases alone cause 3 million deaths and 900 million episodes of illness. Health is not the only issue; impure water is a major burden on the state as well. Till the 10th plan the government had spent Rs 1,105 billion on drinking water schemes. Yet it is the poor who pay a heavier price spending around Rs 6700 crore annually on treatment of waterborne diseases. There is an urgent need to look for alternative sources of portable water in places where water quality has deteriorated sharply.

"**No single measure would do more to reduce disease and save lives in the developing world than bringing safe water and adequate sanitation to all.**"

- UN Secretary General, Kofi Annan This problem will affect you and me who don't have water problem today. Thu, Jun 25, 2009 (IBN Live) :- "Even as India reels under chronic water shortages in its cities, the Asian Development Bank (ADB) on Thursday urged it to increase existing water tariff" "Water tariff in India is too low. People there pay 20 times more for tobacco and 40 times more on alcohol," director of urban development of ADB, Hun Kin said in Singapore. "ADB

is involved in (providing finance) to improve municipal water supply situation in India. It's a fact that municipalities have a performance issue," Kin said. The director called on the Central and state governments in India to make the system more responsible to attract foreign investment. "They (foreign investors) will go to get returns and unless stakeholders pay for consuming water, it will be difficult to convince companies to enter there." "Recycling of one cubic metre of water costs between Rs.25-50 in India but it costs Rs 10-20 for availing fresh water. Here is the problem," said managing director of pump manufacturing company Grundfos Pumps, NK Ranganath Vice-chairman of the Asia Pacific Water Forum Governing Council, Ravi Narayanan said: "Though there is some investment bottleneck in India, opportunity for foreign players is still huge. The government is set to invest Rs 300 billion in next five years (in water sector)." If Indian engineers and entrepreneurs don't take charge and address the opportunity, imported solutions will enter and will force government bodies to spend from their precious little. Final result cost of drinking water will increase for you and me.

Solution:-

If we look at the Fig 1, water estimations for 2015, It is India, parts of middle east and part so Africa that will face the acute shortage. India has to take the lead here. Rest of the world will follow this problem slowly. We in India have to develop the solution. It is a problem to be solved so urgently. The water crisis can be solved. Some of the top solutions will be in the topics:

- **Water purification**
- Water supply and distribution
- Wetlands management
- Coastal engineering
- Erosion and sediment control
- Groundwater hydrology
- Storm water control and treatment
- Sewage and wastewater treatment
- Ocean water desalination

Concerning water purification and distribution addressing the problem of potable water, studies has shown that, problem cannot be solved by big corporation that build centralised water treatment plants. They will be expensive, as water has to be pumped to and from the water treatment plant to the individual household. In an interview with the BBC (published in 2000), the World Health Organisation spokesman Brian Appleton said that "problem is best tackled by encouraging individual householders and local community organisations to provide water sanitation projects instead of governments and aid agencies". There is a worldwide search for solutions. But analysts are finding fault with the way many solutions are being implemented. Too often, Northern ideas and technologies are introduced without a clear understanding of the peculiar conditions of the host countries. "It is no good if you go into a completely new environment and have no data and try to do development without first doing research," says Professor Schreier (a resource-management specialist at the University of British Columbia). Even when research is done, the people who know most about the problem, the users, are often not part of the research. This also suggests, scientists and engineers has to be encouraged to work on local solutions that could get cost advantages from existing resources and could increase locals participation. This will help in increased awareness on water conservation, use and sustenance.

Requirements:-

Functionality:- Output water quality should match the WHO and ISO potable water quality requirements. Apart from water quality, design solution should provide enough quantity. Considering today's nuclear families of average 5 people, the potable water need for drinking and cooking is fixed at 30- 35 litres per day. As the design is to propose a 'green' product, it should strive for energy conservation/energy reuse and high efficiency parts design.

Cost:- Because cost is so critical to the success of this technology, financial constraints will be paramount priority for any design solution. The sale price of the product must be low enough to appeal to low income sections, but high enough to sustain the business. Also the cost of maintenance should be very low, to drive down per litre of water cost.

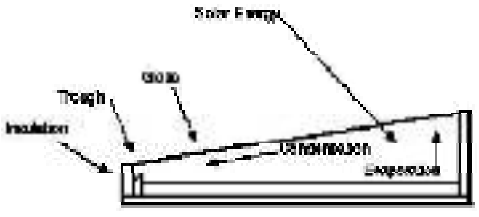
Quality:- Product quality is the next priority for the design solution. The design should be robust with minimal parts. Long duration of the parts is a requirement considering the expected low replacement rate. Parts should be highly efficient in design.

Proposed Design Solution:-

There are many ways water problem is addressed. This paper dwells on an idea that integrates and improves existing design of 'solar still' as a solution to provide improved quality drinking water.

Solar still

Solar still is a solar distillation technology. The first known use of stills dates back to 1551 when it was used by Arab alchemists. It is considered as a survival technique for obtaining potable water in cases of emergency for forces.



Solar still works on the basis of evaporating contaminate water and condensation of water vapour, just like the natural water cycle. This simple technique is a slow process. A marginal increase in efficiency is required to deploy this to provide enough water at household levels. Efficiency can be increased by means of increasing the rates of underlying

heat cycles, namely increasing evaporation rate and increasing condensation rate.

Commercial optimal designs in terms of water heating systems are available already. These systems are generally providing 100 litres of water daily. However in India, water is consumed for bathing during morning hours (between 6-10AM).

However water gets heated between 10-4 due to suns intensity. Due to this mismatch in consumption time and heated water generation time, significant amount of energy gets lost in to atmosphere. The current proposal reuses this loss heat, by using the heated water as the basis of solar still rather than designing own radiation for increasing water temperature.

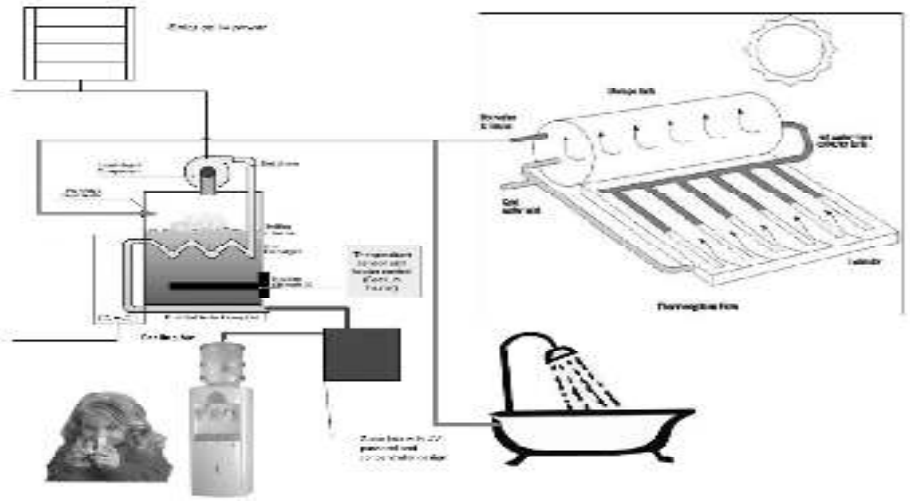
Evaporation rate can be increased by lowering the boiling point and this can be achieved by lowering the pressure in the evaporation chamber. A centrifugal compressor that is powered by solar battery is designed. This compressor reduces the pressure in evaporation chamber and will be help in increasing the evaporation rate.

The steam generated will go through the heat exchanger system of stored water (to be evaporated), looses heat and condenses to water. This condenser rate is increased de to coil design and a blower fan in the 2nd heat exchanger cycle.

Both compressor and blower fans will be powered by solar electric power, there by eliminating any dependency on the electricity.

During rainy seasons, the output of water may come down. As water generation should be dependable, a backup electric heater is designed for water evaporation. As the water boiling temperature is reduced, heater electricity consumption will also be optimal. An electronic monitoring and control system can make the system autonomous to provide constant water output on all 365 days of the system.

The design is depicted in the following diagram.



The paper proposes the design idea. This design needs to be implemented on an experimental basis. Valuable conclusions can be derived only with such an experimental setup.

Conclusion:-

The design can satisfy the perceived goals as follows

1. Proposed solution is expected to meet the water quality.

• In First stage, water is heated to the possible maximum temperature (about 100 degrees). This step kills bacteria and viruses due to pasteurisation.

• In second stage water is evaporated at reduced boiling point. This will separate odour, colour, minerals, solid wastes and dissolved chemicals from water.

• In third stage, water is exposed to concentrated UV radiation (sourced from solar radiation). This will kill any left over bacteria's as in traditional water purifiers

• The inlet water to the entire system is from municipal water distribution or from rain water harvesting or from ground water. This is normally filtered as it is considered for usage for bathing. Three stage water purification and water distillation process is expected to provide the best possible water purification.

2. Proposed solution is expected to deliver the required amount of water output

• Commercial water heaters for individual home need heats 100-200 litres of water. Drawing 35 litres is not a reduction in this capacity for bathing. As 100-200 litres is the storage tank capacity that can hold water over night. For bathing purposes, 50-60 degrees is considered good. Proposed design draws water out when the sun is also bright. Drawing out 35 litres is considered to be feasible.

• Added compressor and fan for condensation are electronically controlled to operate optimally. Lowering of boiling point due to lowered pressure will boil out more quantity of water. This will nullify he traditional slow process in simple water still.

3. Proposed solution is expected to meet the cost criteria

• Proposed solution hooks on to a water heating system. As water heating is combined, it will reduces the cost of the

system and reduce parts count. Water heating systems have the government subsidy due to electricity saving. As the hooked system reuse possible heat loss from the water heating system, it acts as an efficiency impro vement for water heating system.

• Proposed solution uses electricity as backup. In Indian context, we can expect 300+ shiny days. Water output is generally good for most of the days

• Proposed design uses solar cells to fulfil the electricity requirement of compressor and fan. Although solar cell technology is costly, considering low maintenance cost, it will balance out

References:-

_ Solar Energy, principles of thermal collection and storage, second edition by Suhas P Sukhatme, 1996, Tata McGra-Hill publishing company limited, New Delhhi

_ http://www.azadindia.org/social-issues/water-problem-in-india.html

_ http://news.bbc.co.uk/2/hi/south_asia/676076.stm

_ http://www.marketskeptics.com/2009/07/indias-thirst-drives-water-to-crisis.html

C.M.A.IT.BT.NT:-10

E-WASTE

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ABSTRACT: In today's world, life without technology especially electronics and electrical equipments cannot be imagined. With extensively using computers and electronic equipments and people dumping old electronic goods for new ones, the amount of E-Waste generated has been steadily increasing. Electronic waste or e-waste is one of the rapidly growing environmental problems of the world. This paper is an attempt to bring out the hazardous effects of e-waste, proper methods of disposing and handling e-waste and recycling techniques.

KEYWORDS: E-WASTE, HAZARDOUS EFFECTS, RECYCLING TECHNIQUES

1. Introduction: Lifestyle in developing countries especially India has changed considerably after the advent of industrial revolution. Today, life without electrical and electronics goods cannot even be imagined. In fact, most goods are no longer considered a luxury but an absolute necessity. They are touching every aspect of our lives -the way we cook, the way we communicate, work in office, entertain ourselves or keep in touch with our family. But, with this technological revolution, looms a disaster that will sure damage the quality of our lives and of generations to come. This disaster comes in the form of a new stream of waste called electronic waste or e-waste, as it is popularly called. The ever-increasing e-waste is the fastest growing stream of waste in the world, not surprising when we consider that the electronic industry is the fastest growing manufacturing industry. Rapid technology change, low initial cost, and high obsolescence rate have resulted in a fast growing E-waste problem and has become a major issue around the globe because of its complex characteristics and its requirement of another set of equally efficient technology and processes to deal with it. The aim of this article is to spread awareness among the readers about various issues involved in generation and management of e-waste, particularly from Indian perspective.

1.1 What is e-waste?

E-waste consists of discarded computers, servers, mainframes, monitors, CDs, printers, scanners, copiers, calculators, fax machines, battery cells, cellular phones, transceivers, TVs, all entertainment electronics, medical apparatus and electronic components besides goods such as refrigerators and air-conditioners, radios – basically any electrical or electronic appliance that has reached its end-of-life. E-waste comprises of a broad and growing range of electronic devices ranging from large household equipments to small consumer goods. While e-waste contains both valuable materials such as gold, palladium, silver and copper, it also contains harmful substances like lead, cadmium and mercury etc. In the absence of suitable techniques and protective measures, recycling ewaste can result in toxic emissions to the air, water and soil and pose a serious health and environmental hazard.

1.1.1 Computer Waste

Computer waste is the most significant of all e-waste due to the gigantic amounts as well as the rate at which it is generated. In addition, its recycling is a complex process that involves many hazardous materials. Computer waste is generated from the individual households; the government, public and private sectors; computer retailers; manufacturers; foreign embassies; secondary markets of old PCs. Of these, the biggest sources of PC scrap are foreign countries that export huge computer waste in the form of reusable components. Almost 50% of the PC's sold in India are products from the secondary market and are re-assembled on old components. The remaining market share is covered by multinational manufacturers (30%) and Indian brands (22%).

1.1.2 Rate of Obsolescence

The most disturbing aspect of e-waste is the incredible rate at which it is accumulating. One major reason for this is the incredibly decreasing rates of obsolesce. The electronics industry thrives on new aspirational products. Consumers are drawn to latest cellular phones, personal stereos, air conditioners, consumer electronics and computers. The extreme obsolesce of these products spawns a unique disposable mindset where products are replaced rather than repaired.

Though this rapid obsolesce is a result of rapidly evolving technology, it is clear that the throw-away principle yields great monetary benefits to the corporates.

Item	Discard/ Replace Rate
Mobile Phone	1-3 Years
Computer	2 Years
Camera	3-5 Years
Television	10-15 Years
Refrigerator	10-15 Years
Washing Machine	10-15 Years
IT accessories	Very fast

Table-1 Discard Rate if Electronics Items

1.2. Classification of e-waste

E-waste has been categorized into three main categories, i.e., Large Household Appliances, IT and Telecom and Consumer Equipment. Refrigerator and washing machine represent large household appliances; PC, monitor and laptop represent IT and Telecom, while TV represents Consumer Equipment. Each of these e-waste items has been classified with respect to 26 common components found in them. These components form the 'building blocks' of each item and therefore they are readily 'identifiable' and 'removable.' These components are metal, motor/ compressor, cooling, plastic, insulation, glass, LCD, rubber, wiring/electrical, concrete, transformer, magnetron, textile, circuit board, fluorescent lamp, incandescent lamp, heating element, thermostat, brominated flamed retardant (BFR)-containing plastic, batteries, CFC/HCFC/HFC/HC, external electric cables, refractory ceramic fibers, radioactive substances and electrolyte capacitors of L/D greater than 25 mm).

The composition of e-waste is very diverse and differs in products across different categories. It contains more than 1000 different substances, which fall under 'hazardous' and 'non-hazardous' categories. Broadly, it consists of ferrous and non-ferrous metals, plastics, glass, wood and plywood, printed circuit boards, concrete and ceramics, rubber and other items. Iron and steel constitutes about 50% of the e-waste followed by plastics (21%), non-ferrous metals (13%) and other constituents. Non-ferrous metals consist of metals like copper, aluminium and precious metals, e.g. silver, gold, platinum, palladium, etc. The presence of elements like lead, mercury, arsenic, cadmium, selenium and hexavalent chromium and flame-retardants beyond threshold quantities in e-waste classifies them as hazardous waste.

The electronic and electrical goods are largely classified under three major heads, as: 'white goods,' comprising of household appliances like air conditioners, dishwashers, refrigerators and washing machines; 'brown goods,' comprising of TVs, camcorders, cameras, etc.; 'grey goods,' like computers, printers, fax machines, scanners, etc. The grey goods are comparatively more complex to recycle due to their toxic composition.

1.2 Sources of e-waste in India

The electronics industry is the world's largest and fastest growing manufacturing industry and is recognized as one of the engines of economic development in India. In India, e-waste is mostly generated in large cities like Delhi, Mumbai and Bangalore. The main source of e-waste generated in India can be categorized as follows:

1.2.1 Individuals and Small Businesses

The contribution of the individual households is currently very small (22%), though this is also likely to grow appreciably in the future. The preferred practice to get rid of obsolete computers is to get them in exchange from retailers when purchasing a new computer, or passed on to relatives or friends. The useful span of a computer is becoming lesser and lesser as newer versions arrive in market every few months. Often new software is incompatible or insufficient with older hardware forcing customers to buy new computers.

1.2.2 Large Corporations, Institutions and Government

The business sector accounts for 78% of all installed PC's in India. Large institutions upgrade employee computers regularly. For example, Microsoft, with over 50000 employees worldwide (some of them having more than one computer) replaces each computer about every three years. By law, it is illegal for large users to dispose of computers via a landfill, and thus, this e-waste goes to the re-use/recycling export market.

1.2.3 Original Equipment Manufacturers

Manufacturers of components and assemblers are another important source of ewaste generation in the country and it is extremely difficult to capture the exact quantity of waste generated by this group. Equipment manufacturers generate e-waste when units coming off the production do not meet the quality standards and must be disposed off. The waste consists of defective IC chips, motherboards, CRTs and other peripheral items produced during the production process. It also includes defective PCs under guarantee procured from consumers as replacement items.

1.2.4 Illegal Imports

The import of e-waste, which is illegal, is another major source of e-waste in India. Preliminary estimates point out that the quantity brought in is very significant and cannot be ignored. These imports take place both in legal and quasi-legal ways, since e-waste is either misclassified as 'metal-scrap' or imported as second hand or 'end-of-life' goods, which soon become e-waste. About 80 per cent of e-waste generated in the US is exported to India, China and Pakistan, Taiwan and other African countries. This is done because cheaper labour is available for recycling in these countries.

2. Health and Environmental Impact of E-waste

Disposal of e-wastes is a particular problem faced in many regions across the globe. E-waste that is landfilled produce contaminated leachates which eventually pollute the groundwater. Mercury, Cadmium and Lead are known to be very strong leachates. Acids and sludge obtained from melting

computer chips, if disposed on the ground causes acidification of soil. Incineration of e-wastes can emit toxic fumes and gases, thereby polluting the surrounding air. Improperly monitored landfills can cause environmental hazards. When exposed to fire, metals and other chemical substances, such as the extremely toxic dioxins can be emitted. The most dangerous form of burning e-waste is the open-air burning of plastics in order to recover copper and other metals. The toxic fallout from open air burning affects the local environment and broader global air currents, depositing highly toxic byproducts in many places throughout the world. There are thousands of chemicals found in e-waste that are poisonous and can lead to chronic health problems for not only those who are exposed to e-waste but for generations to come. Though listing of all these chemicals/ substances is beyond the scope of this article, some of the most hazardous ones and their ill effects are listed below:

2.1 Lead: Lead is used in glass panels and gaskets in computer monitors, solders in Printed Circuit Boards (PCBs) and batteries. Lead tends to accumulate in the environment and have acute and chronic effects on plants animals and microorganisms. It also has toxic effects on various systems in the body such as the central (organic affective syndrome) and peripheral nervous systems (motor neuropathy), the hemopoietic system (anemia), the genitourinary system (capable of causing damage to all parts of nephron) and the reproductive systems. It also affects the endocrine system and impedes brain development in children.

2.2 Cadmium is used in SMD chip-resistors, IR detectors and semiconductors. Some older Cathode Ray Tubes (CRTs) also contain Cadmium.
Cadmium is a potentially long-term cumulative poison. Toxic cadmium compounds accumulate in the human body, especially in the kidneys and are also cancerous.

2.3 Mercury is used in alkaline batteries, sensors, thermostats, mobile phones, medical equipments, flat panel displays and fluorescent lamps. It is estimated that 22% of world's annual consumption of Mercury is for electrical and electronic equipments and is likely to increase as flat displays are replaced by CRTs.
Mercury causes damage to human brain and kidneys as well as the developing foetus. When inorganic mercury spreads out in the water, it is transformed into methylated mercury, which bio-accumulates in living organisms and concentrates through the food chain, particularly by fish. It also causes harmful skin diseases.

2.4 Chromium used in floppy disks and as corrosion resistor of untreated and galvanized steel plates and as a decorative and hardener for steel housings. Chromium can cause damage to DNA and is highly toxic for the environment.

2.5 PVCs/ Plastics are used for cabling and computer housings. The largest volume of plastics used in electronics is PVC (almost 26%) These release Dioxin when burnt and also adversely affect the immune system of humans.

2.6 Barium is used in CRT for protection against radiation. Barium causes brain swelling, muscle weakness, damage to the heart and liver.

2.7 Beryllium is found in computer motherboards and finger clips. It is used as a copperberyllium alloy to strengthen connecters and tiny plugs while maintaining electrical conductivity. Exposure to Beryllium can cause lung cancer. It also causes a skin disease that is characterized by poor wound healing and wart like bumps. Studies have shown that people can develop beryllium disease many years following the last exposure.

2.8 Toner is found in plastic printer cartridge containing black and colour toners. Inhalation of toner dust can cause respiratory tract irritation. Carbon black is classified as a carcinogen for humans. Reports say that colour toners (magenta and yellow) contain heavy metals.

2.9 Phosphor is an inorganic chemical compound applied as a coating in the interior of CRT faceplate. It affects the display resolution and image luminance seen in the monitor. The Phosphor coating contains heavy metals such as Cadmium and other rare earth metals like Zinc and Vanadium as additives. These metals are very toxic. This is a serious hazard posed to those who dismantle CRT manually.

2.10 Brominated Flame Retardants release particles that can damage human endocrine system. These are used in the plastic housings of electronic equipment and in circuit boards to prevent flammability.

2.11 Polycyclic aromatic hydrocarbons (PAH) are produced when organic compounds are burnt.PAHs affect lung, skin and bladder. Epidemiological studies in the past on occupational exposure to PAH provide sufficient evidence of the role of PAH in the induction of skin and lung cancer.

3. Recycling Methods

Due to the lack of governmental legislations on e-waste, standards for disposal, proper mechanism for handling these toxic hi-tech products, mostly end up in landfills or partly recycled in a unhygienic conditions and partly thrown into waste streams. Proper techniques to handle and dispose exist, but rarely followed by informal recyclers.

3.1 Proper Techniques

The state-of-the-art recycling of e-waste comprises three steps:

3.1.1 Detoxification: The first step in the recycling process is the removal of critical components from the e-waste in order to avoid dilution of and / or contamination with toxic substances during the downstream processes. Critical components include, e.g., lead glass from CRT screens, CFC gases from refrigerators, light bulbs and batteries. There are two ways of dismantling e-waste for detoxification:
a) Manual dismantling is the first, more traditional way to separate hazardous materials from recyclable materials, and

to generate recyclable materials from electronic waste. The dismantling process itself is performed with simple tools such as screwdrivers, hammers and tongs.

b) Mechanical dismantling is the second, more modern way to separate hazardous materials and to generate recyclable materials from electronic waste. The dismantling process itself is performed mechanically. Typical components of a mechanical dismantling plant are crushing units, shredders, magnetic separators and air separators.

3.1.2 Shredding: Mechanical processing is the next step in e-waste treatment, normally an industrial large scale operation to obtain concentrates of recyclable materials in a dedicated fraction and also to further separate hazardous materials. Typical components of a mechanical processing plant are crushing units, shredders, magnetic- and-eddy-current and air-separators. The gas emissions are filtered and effluents are treated to minimize environmental impact.

3.1.3 Refining and Conditioning: The third step of e-waste recycling is refining. Refining of resources in e-waste is possible and the technical solutions exist to get back raw with minimal environmental impact. Most of the fractions need to be refined or conditioned in order to be sold as secondary raw materials or to be disposed of in a final disposal site, respectively. During the refining process, to three flows of materials is paid attention:

Metals, plastics and glass.

The final disposal of materials from dismantling, refining and conditioning processes takes place in landfills. Landfills are subject to relatively strict emission controls and are comparatively restrictive regarding the materials accepted: since the year 2000 combustive materials have no longer been admitted for final disposal in landfills.

3.2 Indian Methods

In India, recycling centers are largely unauthorized. Only 1% or 2% of the e-waste lands in authorized centers. The recycling process is neither scientific nor environmental friendly. The collection and allocation of e-waste is done by middlemen, scrap dealers and rag pickers. The informal recycling system includes acceptable processes such as dismantling and sorting but also very harmful processes such as burning and leaching in order to extract metals from electronic equipment. Some of the recycling processes are extremely harmful and have negative impacts on the workers' health and the environment.

3.2.1 Manual Dismantling:

The accrued electronic and electric waste in India is dismantled and sorted manually to fractions printed wiring boards (PWB), cathode ray tubes (CRT), cables, plastics, metals, condensers and other, nowadays invaluable materials like batteries, LCDs or wood. The valuable fractions are treated in refining and conditioning processes No sophisticated machinery or personal protective equipment is used for the extraction of different materials. All the work is done by bare hands and only with the help of hammers and screwdrivers. Children and women are routinely involved in the operations

3.2.2 Refining and Conditioning The different e-waste fractions are processed to directly reusable components and to secondary raw materials in a variety of refining and conditioning processes.

3.2.3 Final Disposal:

Solid waste is deposited in a municipal landfill. Systematic gas and water collecting systems are not installed; hence significant emissions to water and air are caused. About 25,000 workers are employed at scrap-yards in Delhi alone where 10,000 to 20,000 tonnes of e-waste is handled every year. Other e-waste scrap-yards exist in Meerut, Firozabad, Chennai, Bangalore and Mumbai

4. Recommendations for Action

Rapid product obsolescence in electronic industry has made e-waste crisis uncontrollable. The solution to this does not lie in finding new hiding places for e-waste or in exporting it to poorer nations but in preventing the problem at its manufacturing source.

Few recommendations for action are given below:

4.1 Making Producers Responsible

Adopting the principle of 'Extending Producer Responsibility' (EPR) producers must be made responsible and accountable for their products' entire life-cycle which will make them change the design and process technology by using materials that are less hazardous and easy to recycle. Product take back is also an efficient way of implementing EPR where a producer takes back the product at the end of its life. Take back is also necessary to place the burden of the environmental impact of a product back on those who design it in order to provide incentive for immediate improvement and making profit.

4.2 Ban illegal imports

There is a lack of clarity on the issue of e-waste and the current hazardous waste rules are unable to govern and effectively monitor the e-waste recycling. All imports of ewaste must be strictly prohibited. India is a signatory to the Basal Convention. (Basel Convention is the United Nations Environment Programme) on the control of Transboundary Movement of Hazardous wastes and their disposal but large quantities of e-waste are still imported illegally.

4.3 Organizing the Recycling Sector

The recycling sector though informal, plays a major role in recovery and reuse of computer componernts. Promotion of eco-friendly recovery and recycling techniques should be developed in collaboration with premier technology institutions. The unorganized sectors should be formalized by giving licenses to the existing ones and a watchdog committee should be set up to ensure that they handle domestic waste only and in a eco-friendly manner.

4.4 Educate Consumers

General public and consumers should be made aware of the

hazards or threats posed by the e-waste generated by the products they buy to the general health and environment. The producers as well as government must bring about this awareness through public awareness campaigns. Awareness of e-Waste management is the key to getting more customers to come forward and dispose of their e-Waste in a safe manner.

Customers must know that the way to dispose their e-Waste is simple. Their interest and attention to this aspect will go a long way in keeping out the dangers of e-Waste.

4.5 Design for Recycle

The problem of e-waste can be reduced to a large extent if the motivation to design smaller, faster, lighter and cheaper shifts to designing of products that are cleaner, upgradable, long-lived and easily recyclable. Input materials must not be toxic or hazardous and safe to recycle and there must be an established pre-identifiable recycling market and mechanism. Warnings must be placed for any possible hazard in dismantling or recycling and the product must be made for rapid and easy dismantling or reduction to a usable form.

5. Where to dump our e-waste?

A growing number of consumers are aware that electronic waste, or e-waste, is a dangerous substance which needs to be disposed of with care. Many consumers find it cheaper to buy new than to upgrade, and often find themselves getting rid of perfectly good equipment, while others are discarding truly broken or useless electronics. For domestic waste, if the equipment to be disposed is still useful, one can consider donation instead of throwing it into trash. However, donation of electronic goods such as mobile phones, memory devices should be done carefully to avoid any sort of misuse. If the equipment is truly a waste then it can be given to a company which accepts and is capable of handling e-waste properly. In an urban area, the Department of Sanitation can provide information about recycling e-waste locally whereas in a rural area, many companies have mobile services which set up a collection center in a central location one day a month. In some cases, the company, which manufactured the equipment, will take it back. If the equipment is over a certain age, its collection and disposal will come at a cost, but it is well worth it to ensure that the e-waste is being handled properly, and that the usable parts will be recycled into new equipment. In some places it is mandatory for the customers to pay an e-waste processing fee when purchasing the equipment. In such cases the company that manufactured it is obligated to take it back and properly dispose of it.

6. Conclusions

We recognize the importance of preserving our environment and contributing to the global community. If the consumers discard their electronic waste appropriately, the government provides adequate collection/drop off facilities for end of life products and the manufacturers manage the treatment and recycling of their products, the problem of ewaste can be reduced to a large extent and this world would be a better place not only for present but for future generations too.

References

1. http://www.wisegeek.com/how-can-i-safely-dispose-of-e-waste.htm
2. [Source: annual report 2003, MAIT]
3. Pinto VN. E-waste hazard: The impending challenge. Indian J Occup Environ Med 2008; 12:65-70
4. E-waste posing health hazard. Available from: http://www.hindu.com/2006/03/20stories/2006032019320300.htm.
5. Freeman M. H. 1989. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill Company, USA.
6. E-waste guide 2008. A knowledge base for sustainable recycling of e-waste. http://india.ewateguide.info
7. Recycling of e-waste in China and India: Workplace and Environmental contamination, Greenpeace International 2005,
8. Toxics Link - www.toxicslink.org

THEME 6

ELECTRICAL ELECTRONICS COMMUNICATION AND ENERGY (J.C.BOSEEYAM)

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E.E.C.E:-1

BATTLEFIELD LASERS AND OPTOELECTRONIC SYSTEMSOVERVIEW OF THE ADVANCES IN TECHNOLOGY AND APPLICATIONS

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Abstract: Technological advances in optics, optoelectronics leading to more rugged and efficient laser devices are largely responsible for making them indispensable in modern warfare. In this Paper the distinguishing features of lasers from that of the conventional light sources and different types of lasers are described. The Lasers that are used in the present scenario for military and defence application are discussed. The development activity in the field of optoelectronic systems is also presented here.

Distinguishing features of Laser: The unique properties of Laser light that distinguish it from the conventional light sources are Monochromaticity, Directionality, Coherence and Intensity. Monochromaticity refers to single frequency or wavelength property of the radiation. Laser beam is highly directional which means that it spreads very little as it travels through the space. Coherence is indeed the most important property that discriminates laser itself from ordinary light and conventional sources. In a coherent light all photons have the same phase as a function of time. Coherence has two aspects temporal coherence with respect to time and spatial coherence which is preservation of phase across the width of the beam. Only lasers exhibit a high degree of temporal and spatial coherence. Extreme high intensity is due to very low divergence of the beam. It is quite astonishing to see that the *brightness of a 1 milli Watt Helium Neon (3×10^8 Wm^{-2} Sr^{-1}) laser is more than the great sun (2×10^7 Wm^{-2} Sr^{-1}).* Figure 1. shows the output of a Helium Neon laser operating at 632.8 nm.

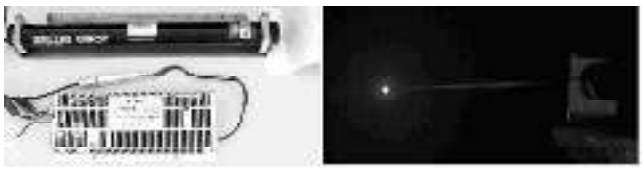


Figure.1 Helium Neon Laser

When the beam of a low powered laser strikes a rough surface such as paper or wood, it is reflected in all the direction. The portion of this light reaches the observer several meters away, the observer can see a bright spot that appears to be stippled with many bright and dark points. This speckled appearance is the characteristic of the coherent light caused by interference. The bright spot is detected by the spot trackers or the guidance heads.

The output of a laser may be Continuous, constant amplitude or Pulsed by using the techniques of Q- switching, mode locking and gain switching. In a pulsed operation much higher peak powers can be achieved. In pulsed laser, the excitation mechanism supplies energy in short bursts. The output rises quickly to a high level and drop off suddenly producing a burst of laser light. In CW lasers, the excitation mechanism supplies a constant power to the active medium. The system is in a steady state condition where loss and gain are in balance. This results in constant output beam.

Building Blocks of LASER

The four functional elements that are necessary in lasers to produce coherent light by stimulated emission are shown in figure 2.

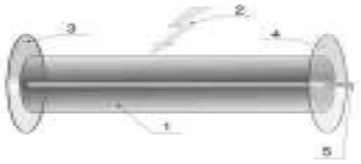


Figure.2
1. Active medium
2. Laser pumping energy (Excitation mechanism)
3. High reflector (Parallel mirrors)
4. Output coupler
5. Lasing Action

LASER is an acronym for Light amplification by stimulated emission of radiation, the word light in LASER is not limited to visible spectrum only. There are IR lasers, UV lasers, X-ray lasers etc. Lasers range in size from microscopic diode lasers to huge Neodymium lasers used for research, military and other high energy applications. The excitation mechanism is a source of energy that excites or pumps the atoms in the active medium from a lower to a higher energy state in order to create population inversion, a state where the number of atoms raised to higher energies greatly exceeds that of the atoms at lower energy, wherein stimulated emission will prevail over stimulated absorption with the result the incident light of frequency f = E2-E1/h will be amplified.

The *excitation mechanism* usually consists of electric

current flow through the active medium. Solid and Liquid lasers employ the optical pumps.

The *Active medium* is collection of atoms or molecules that can be excited to a state of inverted population. A beam of light entering one end of the active medium is amplified through stimulated emission until a coherent beam of increased intensity leaves the other end of the medium.

The two *parallel mirrors* one of which is partly transparent acts as the feedback mechanism in such a manner that they reflect the coherent light back and forth through the active medium.

Lasing Action

When stimulated emission occurs some of the photons escape, but the photons which travel along the axis of the system are reflected back when they reach the mirrors thus stimulating further emission as they pass through the material. As the photons emitted are in phase with the incident photon they generate a coherent light beam (*Output coupler*). Figure 3 shows the schematic of the laser energy level transitions involved.

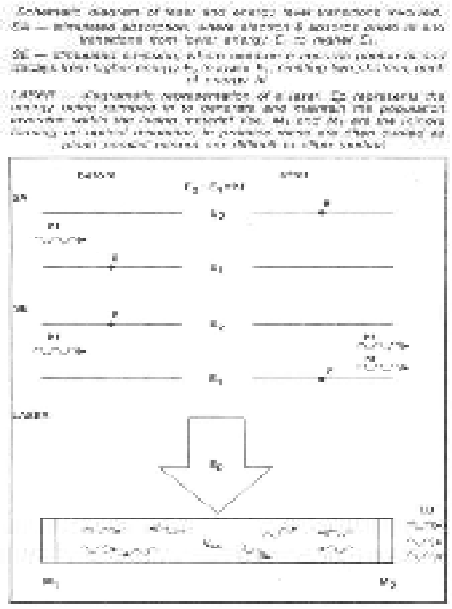


Figure 3 Energy level transition of a LASER

Types of Lasers: The important family of lasers utilizes a gas or mixture as the active medium. Excitation is achieved by current flow through gas. Tens of thousands of laser wavelength have been obtained in all kinds of laser media in solids, liquids, gases and chemical laser etc. Table shows the comparison of the different types of lasers their operational wavelength and their applications.

LASER TYPE		OPERATING WAVELENGTH	PUMPING SOURCE	APPLICATIONS
GAS LASER	Helium Neon	632.8 nm	Electrical discharge	Interferometry, Holography, Scanning and alignment
	Carbon dioxide Laser (CO_2)	1064 nm	Electrical discharge	Laser Weaponry, DEW systems
CHEMICAL LASER	Hydrogen Flouride (HF) Laser	2.7 µm to 2.9 µm	Chemical reaction	Laser weaponry, Space based Laser (SBL) for ballistic missile
	Deutrium Flouride Laser (DF)	3.6 to 4.2 µm	Chemical reaction	Tactical high energy laser, Projectiles, Better transmission in atmosphere used in Tactical High Energy Laser (THEL) laser
	Chemical Oxygen Iodine Laser (COIL)	1.315µm	Chemical reaction	Laser weaponry, Airborne Laser (ABL)
METAL VAPOUR LASER	Thulium YAG laser	2.0µm	Laser diode	Laser RADAR - LIDAR
SOLID STATE LASER	Ruby laser	694.3 µm	Flash lamp	Holography

	Nd:YAG Laser	1.064 µm	Flash lamp, Laser diode	Range finding, Target designation, Weapon systems Airborne and Ground based
	Alexandrite Laser	750 to 820 nm	Flash lamp	LIDAR
SEMICONDUCTOR LASER	AlGaAs	0.63 to 0.69 µm	Electrical current	Telecommunications, Holography, Weapons, Battlefield illumination , Forward looking Infrared Camera, FLIR
	InGaAsP	1.0 to 2.1 µm	Electrical current	Optical discs, Laser pointers and communication
DYE OR LIQUID LASER	Dye Rhodamine	390 to 435 nm	Flash lamp	Spectroscopy

If we look at the laser types that are particularly important for battlefield applications the solid state lasers and gas lasers cover almost all military applications. Among the Solid-state lasers the *Neodymium doped laser* is the supreme, as far as better known defence applications are concerned.

Battlefield Lasers: The Directed Energy Weapon (DEW) includes the Gas Dynamic Laser (GDL) and the Chemical Lasers (CL) which belong to the very high power laser class. These Lasers operate with a peak power of more than hundreds of Megawatt power. The lasers of this class includes the Space based laser (SBL), Airborne laser (ABL), Sea surface laser (SSL- ship based), Advanced Tactical laser (ATL), Underwater laser -imaging, Particle beam weapons (PBW's) and others. The air defense system must be capable of detecting, identifying, tracking and engaging a broad spectrum of air and missile threats in any environment or operational conditions. DEW's has the increased air weapon capabilities. The important features of the DEW's are mentioned below.

- Long range strike
- Speed of light density
- Easier and quicker targeting
- Difficulty in identification of attacker
- High lethality , broad area coverage

Figure 4 shows the DEW lasers in action in a war scenario



Figure 4 Directed Energy Weapons - Lasers

Better known applications of battlefield laser include range finding, target designation, target tracking and guidance. The fire control system of the modern battlefield tanks utilizes the Laser Range Finders. The other forms of armoured combat vehicles too include a ranging instrument. These devices are in use with squad weapons like assault rifles, light machine guns (LMG) etc.

Electro- optic counter measure systems (EOCM): The EOCM find wide acceptance by the armed forces that can offer effective countermeasure against those laser systems already in use. EOCM cause temporary or permanent damage / disability to the optoelectronic device in the field. These systems include the Laser Dazzlers which cause a dazzling effect and offers a less collateral damage. Laser Warner is an integral part of any anti sensor EOCM system. The type of laser threat and the angle of arrival of the laser beam may be used to trigger a cluster of aerosol / smoke grenades to block the oncoming laser radiation. Figure. 5C shows the laser dazzler system.

Laser Range Finders (LRF) and Designators:
The LRF's are compact hand held devices similar to binoculars, that combine the functions of target designation and range finding for the purpose of munition guidance or it forms the subsystem of overall laser tracker with a repetition rate of 10 to 50 pps. Figure 5A and 5B shows the LRF and the Laser Designator (LD)



Figure 5 A,B,C

Optoelectronic System design: The method by which the system or weapon receives commands to move along a certain path to reach the target is guidance. Commands may be internally generated by onboard computer or transmitted to the system by external source or gener

ated by a part of the weapon itself (Seeker/Sensor) which is fed to the on board computer for generating the guidance commands.

Semi-active Laser guidance –Laser Seeker:
The Laser seeker is used for the detection of the reflected laser pulses from the target and for target location. Target designation is done by a ground based laser designator with repetition frequency of 20 Hz. The laser seeker fitted in the weapon should have a higher field of view and clear line of sight to compensate the release errors. The light incident on the sensor is converted to a equivalent voltage. The output is gain switched to cater for the entire dynamic range. The azimuth and the elevation error signals generated serially by the seeker are fed to the control system for the correction of the weapons trajectory. Figure 6A shows the Laser Seeker developed in house for testing and evaluation. Figure 6B shows the operational scenario of the semi- active laser guidance

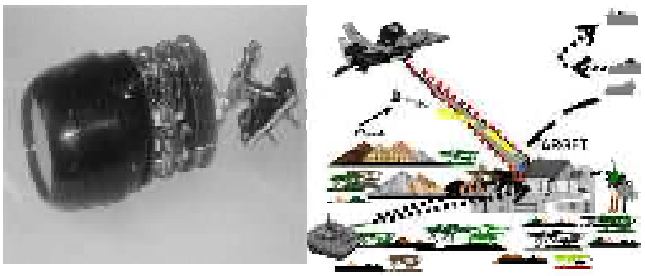


Figure 6A, 6B

Range Simulator for Laser Range Finder (LRF):
Figure 7 shows the block diagram of the processor based Range simulator developed in house for testing the accuracy of the LRF. The LRF uses the pulse echo method to measure the range by using a high power Q- switched pulsed laser. The range simulator generates the delayed echo pulse using a 32 MHz clock for the calculation of the round trip transit time. The precise time delay generated by the counter circuit is interfaced with the Transmitter /Receivers circuit and LRF. The ranges measured by the LRF and the ranges displayed by the simulator are found within the accepted limits.

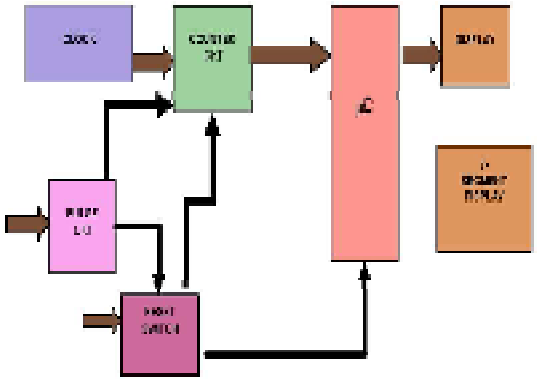


Figure 7. Block Diagram of a Range simulator

Conclusion
Multi Kilowatt compact solid state laser systems and electro optical systems are much in demand for tactical defence applications in performing variety of missions. Research and Development (R &D) establishments have taken a step in developing these systems to meet the futuristic endeavours.

Acknowledgement
The Author is thankful to Shri. P.S.Krishnan Sc 'H', Director ADE,
Shri G.Natarajan Sc'H' Associate Director, for granting permission to present this paper. I also wish to thank Shri A.M.G.Pillai Sc'F' Divisional Head, Shri R.Srinivasan Sc'E' and Shri G.N.V.S.K.V.Rao Sc'C' for their encouragement and guidance during the progress of the work.

References
1. "Infrared System Engineering", by R D Hudson, Jr., John Wiley and Sons, Inc., 1969
2. "Laser Hand Book", Volume-2, by F.T.ARECCHI, E.O.SCHULZ-DUBOIS NEW YORK
3. "Elements of Laser Ranging Techniques" by N.MANASHRAMANI
4. "Topics in Applied Physics" Optical & Infrared Detector, by R.J.KEYES
5. JANES DEFENCE WEEKLY - Magazine
6. LASER FOCUS WORLD – Magazine

E.E.C.E:-2

DIGITAL BEAM FORMER ARCHITECURE FOR MODERN RADARS

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I. INTRODUCTION : A beam former is a processor used in conjunction with an array of sensors to provide a versatile form of spatial filtering. These are complex networks used to precisely control the phase and amplitude of RF energy passing through them. Steering of the beam is achieved electronically by varying the phase and the amplitude of the received signals at each antenna elements and summing the results. By controlling the phase and the amplitude values, apart from steering, the beam pattern itself can be electronically altered i.e., width of the side lobes, position of the nulls, etc. A beam former Estimates the signal arriving from a desired direction. This paper brings out an insight to various types of beam beamformers and main focus is given on Digital Beam Formers and its realization methods based on digital techniques.

II BEAM FORMER –MODES OF OPERATION

Beam formers are typically used in two complementary modes.
I) In RF transmitting systems such *as* radars, beam formers are employed between the RF signal source and the antenna radiating elements to "shape" the resulting radiated electromagnetic field in terms of its instantaneous field intensity in three dimensional space. The result is to "illuminate" a target or region of space with a precisely contoured beam' of RF energy whose characteristics are known and to varying degrees can be controlled.
2) In receiving systems, beam formers are employed between the antenna arrays and the receiver to affect (shape) the relative spatial sensitivity of the system to RF signals originating in its field of view. The result is to effectively "focus" the receive system on a specific target or region of space. Beam formers have been used for many years in a variety of applications such as RADAR, SONAR, communication and surveillance.

III. TYPES OF BEAM FORMERS

A small radiating element has a large beam width and less gain. The directive gain can be increased by using an array of radiating elements. An array of radiating elements results in narrow radiation pattern with more gain. A passive array does not use any active element such as amplifier as a part of array. An Active aperture array contains RF amplifiers for each element is transmit and receive paths as part of array Hence a narrow beam can be formed by combining received signals from an array of radiating elements in receive path and by distributing the RF power to an array of radiating elements and combining in space in transmit path. The beams thus formed can be electronically steered by using phase shifters in transmit and receive path for each radiating element.The beam formers can be realised either by using RF components or by using digital techniques. It can be broadly classified into various categories like Conventional Beam formers, RF Beam formers and Digital Beam formers
Conventional type of analog beam formers have resulted in physically large expensive systems, difficult to design with high precision components, which are highly sensitive to component tolerances and drift. In conventional beam formers, it is achieved by time delaying and summing. However, the availability of inexpensive, high-speed A/D converters and Digital Down Converters (DDCs) has helped to stimulate new opportunities for digital beam formers. In case of Digital Beam Formers, this operation of modifying the phase and amplitude for each antenna element and subsequent addition is done in digital electronic circuits, where as in analog beam formers this is achieved through discrete RF components. Digital beam forming is far superior to beam forming in RF owing to its programmability, flexibility, reliability, accuracy and miniaturization and due to the advances in VLSI, VHSIC and FPGA technologies; digital beam forming is gaining popularity in RADAR applications.

IV. CONVENTIONAL BEAM FORMERS

Based on the nature of the processing signals it is further categorized as Analog Beam Formers and Digital Beam formers.

1. Analog beamformers

In a conventional beam former, the measurement of propagating coherent wave front relative to ambient background noise and spatially localized inferences is enhanced by coherent processing of data collected with an array of sensors, i.e. by time delaying and summing weighted sensor data as shown in Figure below. .

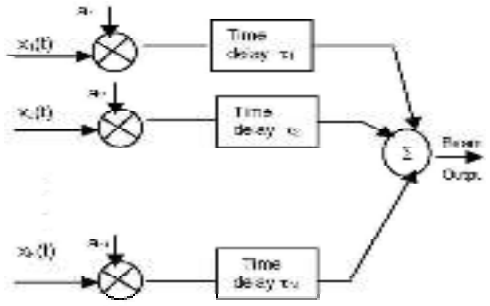


Figure 1. Analog Beam Former

The beam output b(t) of the conventional time domain beam former is given by

$$b(t) = \sum_{n=1}^{N_E} (anxn(t-Tn)) \text{ ---------- eqn (1)}$$

where N_E denotes the number of sensors$_n$ denote the sensor outputs, a_n denote the spatial shading or weighting coefficients applied to the sensor outputs, and τ_n denote the time delays required to point or steer the beam to the specified direction. Here beam forming is performed with the analog sensor outputs itself. Analog beamformers implemented in the RF domain are highly expensive and very complex to design since it is very difficult to implement the high precision RF phase shifters. This necessitated the need to do digital beam forming after down converting and sampling the sensor signals.

2. Digital Beam Formers

In the digital implementation of the beam forming techniques the sample sensor data in time are weighted, delayed and summed to form the discrete beam output. It can be represented as

$$b(kT_o) = \sum_{n=1}^{N_E} a_n x_n(kT_o - M_n T_i) \quad \text{— eqn (2)}$$

where

T_i - input sampling periods
T_o - output sampling periods

Assumed delays T_n s are integer multiples of T_i . Here the exact steering delays τ_n are approximated by an integer number of increments (M_n) of the input sampling interval T_i. In sonar applications the processing has to be performed in the

low frequency domain with discrete samples of sound waves. So in this case, beam forming can be done very easily in the digital domain by simple time delay and sum operation. The main difficulty encountered while using beam forming for Radar applications is that , the processing has to be done in the frequency domain where minute propagation delay to be compensated most often in the order of Pico seconds. But the disadvantages of these kind of beam forming method are that the sensor data has to be sampled at a rate much greater than the Nyquist rate to approximate the time delays, the output sample rate is decided based on the final bandwidth requirement, large amounts of storage required to store these high frequency samples and finally it results into the requirement of high Bandwidth.

To avoid high frequency sampling and hence the high bandwidth requirement Time domain interpolation techniques can be used. This may results in appreciable savings in A/D circuitry and reduction in cable BW requirement. But in the case of radar application, the propagation time delay to be interpolated is much smaller than the input sampling rate.

The following figure shows a method in which beam forming is done with frequency domain samples

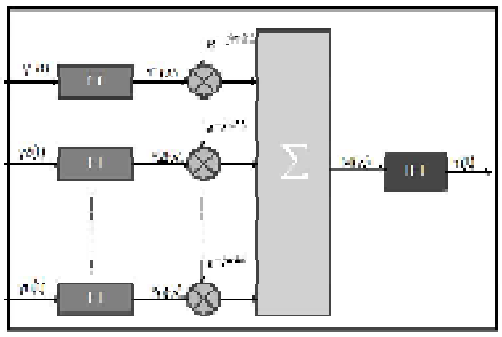


Figure 2. Beam former with Frequency domain samples

It shows that each sensor samples are converted to frequency domain and multiplied with respective delay samples and summed to form the beam and then brought back to time domain using inverse Fourier transform. This will be more accurate if more number of frequency components is considered.

In another approach of Phase shift beam forming the steering delays are realized with phase shifts. The only disadvantage of this approach is that it is suited only for narrow band applications. Most of the radar applications are based on narrow band operations. The computational complexity and input storage requirements of Phase shift beam forming are less compared to other methods. This method is used for the realization of the Digital beam former in this work.

The phase shift beam former can be implemented digitally by sampling the narrow band sensor data at a rate consistent with the bandwidth of interest and summing the sampled data by the beam dependent weighting.

The quadrature beam former of this category requires both sensor input and weighing functions in complex format. The following figure shows the block schematic of the Quadrature beam former.

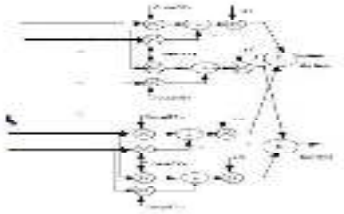


Figure 3 Quadrature Beam Former

The principle of Quadrature beamformer is as follows.
Let s(t) = x(t) +j y(t) be the complex base band signal; x(t) is the real part or the in-phase component; y(t) is the imaginary part or the quadrature phase component.
Let

$$Wp=a_p e^{j\theta p} \qquad eqn\text{--}3$$

be the complex weight for an antenna element, used for beam forming, having amplitude scaling and phase shift. The element weight *Wk* for kth beam for element p can also be expressed as

$$Wpk = akp \cos(\theta pk) + a_{kp} \sin(\theta pk) \text{ ---- eqn (4)}$$

or

$$Wk = Wrk + jW_{ik} \text{ ---------- eqn (5)}$$

Formed beam is given by the following equation,

$$Sk(t) = \sum_{p=1}^{N} x_p(n)\, w_{pk} \text{ ---------- eqn (6)}$$

Where
k - 1 to m
n - Number of antenna elements
m - Number of beams

$$x_p(n) = x_{rp}(n) + j\, x_{ip}(n)$$

and

$$w_{pk} = w_{rpk} + jW_{ipk}$$

V . BEAM FORMERS IN RADAR APPLICATIONS

These beam formers can be realised either by using RF components or by using digital techniques. The following section discusses various realisation architectures of Beam formers for radar applications

1. RF Beam Former (RBF)

In this case the beam will be formed by manipulating the RF signal of each element. The concept of RF beam forming is explained by the following diagram.



Figure 4 Transmitter path

In the following figure RF signal distribution, combining, phase shifting and attenuation are performed as RF signals from / to radiating elements. All these stages will be realized through discrete RF components

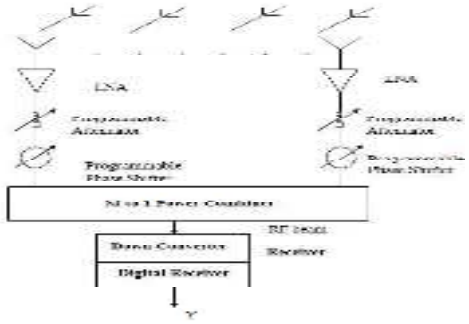


Figure 5. Receiver path

In this, receive beams can be formed at element or at subarray level based on the requirement. The transmit and receive beams are formed in RF domain using phase shifters and attenuators in T/R modules, RF combiners, and dividers. Beam formers at element level will not include subarray combiners in the architecture.
(Refer Figure 6.)

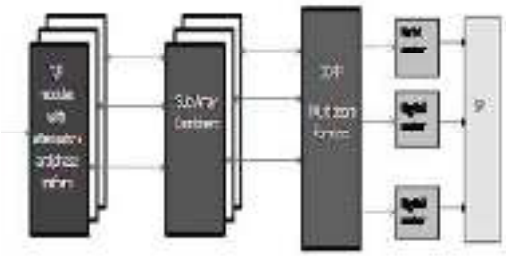


Figure 6. RF Beam Former – Architecture

During the reception process multi beams are formed in RF domain. Normally RF beam formers will contain only power dividers, attenuators, phase shifters and combiners. After the formation of the beam digital receivers are used to digitize and generate complex video signals.

1. Digital Beam Former(DBF)

Here the beam will be formed by manipulating the digital signal of each element. The concept of digital beam forming is explained by the following diagram.

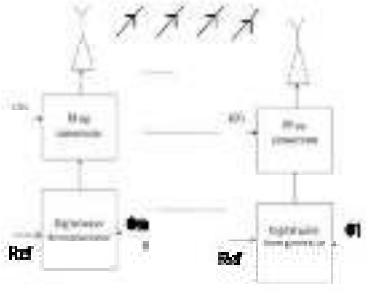


Figure 7. Transmitter path

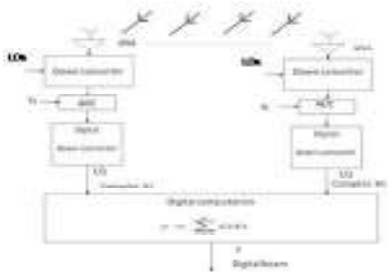


Figure 8 Receiver path

Figure 7. represents the Transmit path and Figure 8. shows the Receiver path. In the transmit path, it can be observed that the digitally synthesized wave form is directly up converted and transmitted. Similarly during reception, with the help of ADCs and Digital down converters circuitry complex video signals are generated and are further processed to form multiple digital beams.

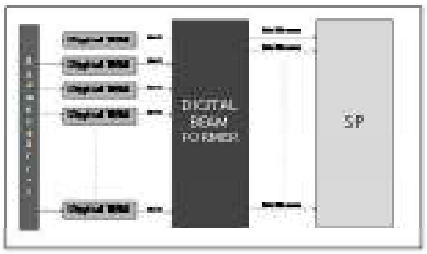


Figure 9. Digital Beam Former – Architecture

In this case also, the receive beams can be formed at element or at sub array level based on the requirement.The Digital Beam Former (DBF) unit will be a part of the active array of the radar. Normally DBF Unit of the Radar system performs synthesis of multi receive beams from the received complex digital outputs. Each receiver module in the Digital Transmit / Receive Modules (TRMs) will generate complex video data in In phase and Quadrature (I & Q) format. The output from the large number of array elements in real time demands high speed data links. The multiple digital beam data are sent to Signal Processing Unit (SP) for further processing through the high speed optical links.

2.1 Element level Digital Beam Formers

Here separate digital channels for each radiating element in during transmit and receive operations. This is accomplished through Digital TRMs. In this case RF attenuators and phase shifters are eliminated from forming the beams. This results in a better side lobe performance with less quantization errors due to attenuator and phase shifters. In addition, this will give an improvement in dynamic range in the presence of nearby clutter by a factor of no. of elements.

Parallel multi beams for simultaneous passive listening in another direction other than illuminated area is also possible. With the help of this kind of architecture adaptive beam forming and nulling is possible. But the throughput will be higher compared to subarray level DBF with more number of re

ceiver channels. This adds to complexity in hardware as well as to the cost.

2.2 Subarray level Digital Beam Formers

In case of sub array level DBF, the signal received from a group of elements will be summed and fed for the beam formation. A combination of TRMs with phase shifter and attenuator circuitry with digital beam formers can be used for the realisation of the same. In this case RF attenuators and Phase Shifters are used only in multiple receive beam former modules. The errors due to the quantization will be poorer compared to element level

In this case an improvement in dynamic range in the presence of nearby clutter by a no of sub arrays can be observed. In this case also, parallel multi beams for simultaneous passive listening in another direction other than illuminated area is possible. Because of DBF, adaptive beam forming and nulling is possible but to a limited extent. Because of the sub array level beam formation the hardware complexity as well as cost is comparatively less with respect to Element level DBF.

VI. QUADRATURE BEAM FORMING PRINCIPLE

The Data from different sensors are sampled in time, weighted, delayed and summed to form the discrete time beam output. The following figure shows the principle of DBF.

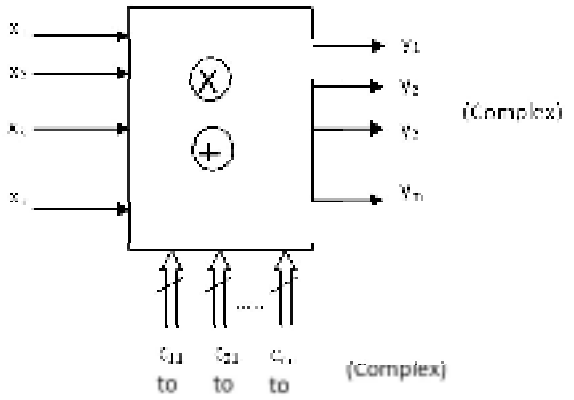


Figure 10. Principle of Digital Beam Forming

Here x_1 to x_n are complex inputs. c_{i1} to C_{in} are complex coefficients corresponding to i^{th} beam. y_1 to y_m are synthesized beams. x_1 to x_n are complex data in real time and y_1 to y_m are complex beam outputs computed in real time.

The input complex data matrix is a n X 1 matrix given by

$$X = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}$$

The complex coefficient matrix is m X n matrix given as

$$C = \begin{bmatrix} c_{11} & c_{12} & c_{13} & \cdots & \cdots & c_{1n} \\ c_{21} & c_{22} & c_{23} & \cdots & \cdots & c_{2n} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ c_{m1} & c_{m2} & c_{m3} & \cdots & \cdots & c_{mn} \end{bmatrix}$$

The output complex data matrix will be m X 1 matrix of format

$$Y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_m \end{bmatrix}$$

Where the computation is given as

$Y = CX$ eqn (7)

VII HARDWARE REALISATION

We have chosen Field Programmable Gate Arrays (FPGAs) for the realization of the DBF hardware modules. FPGAs have undergone a major transition in last few years: From being small basic programmable logic hardware, to the latest FPGAs, being large circuits, with transistor count equivalent to the latest microprocessors and having advanced integrated logic such as embedded processors and Ethernet capabilities.

The disadvantages of long design time of ASICs, the difficulty to alter the design after manufacturing and the expensive development cost when only a small series of chips are needed can be overcome by using FPGAs. Using FPGAs, the design can quickly be prototyped, tested and modified during the development.

FPGA has got easy interface solution both at signal and message level and also have has complex computation capabilities. In the case of FPGA based H/W, it gives both resource and resource management capabilities. In addition, FPGAs are supported with dedicated high speed data interfaces which can be directly interfaced with optical links.

The design modules for the hardware have been designed with the aid of the Xilinx System Generator (XSG) design tool, which provides logic synthesis as well as bit and cycle-true simulation capabilities within the Simulink environment. The design also uses the ISE Foundation tools from Xilinx for development of various interface solutions. Figure 11. shows the design model developed using Xilinx's System Generator tool to form digital beam from 8 channel receiver output. This model is extended for the formation of multiple beams from multiple receiver outputs. (Refer figure 12.) The model shown directly generates the bit file for programming of the Xilinx FPGA on a target board.

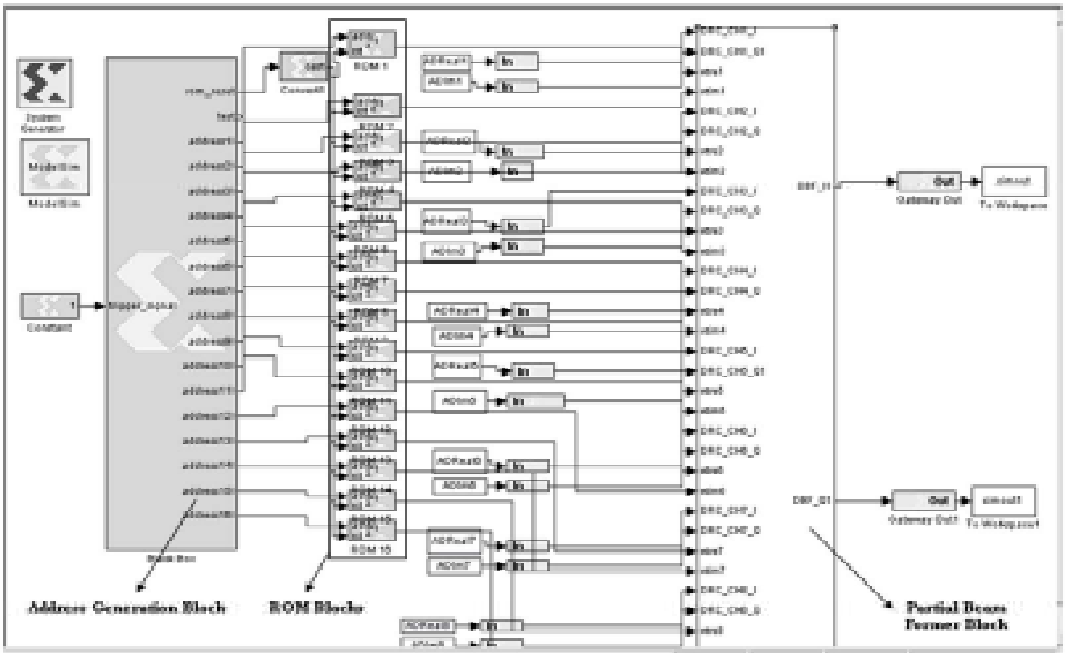


Figure 11. Design Model For 8 Channel Single Beam formation (System Generator)

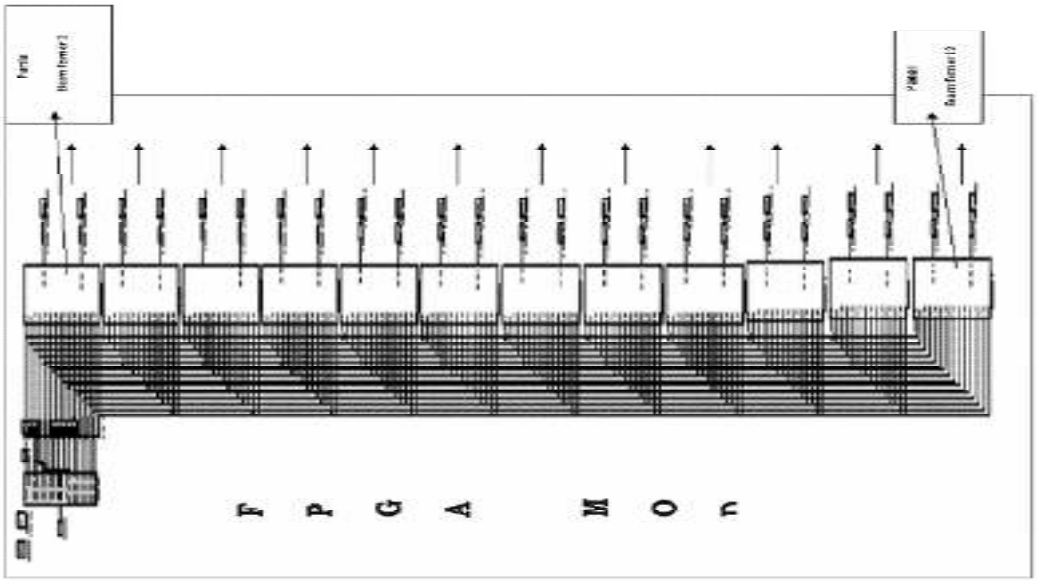


Figure 12 Design Model For 8 Channel 12 Beams formation (System Generator)

VIII. RESULTS

A typical case of one dimensional array with eight elements is considered with a target approaching at an angle 10^0 with a doppler phase shift of $\pi/5$ is considered for the basic digital beam former module algorithm evaluation. Matlab is used for this purpose. The weighting functions are generated for the steering angle of 10^0 with taylor aperture. The design is evaluated by steering the beam at this angle. In the frequency domain plot (Refer Figure 13.) it can be observed that a peak is obtained at 10^0 due to the doppler phase shift of the target.

The above mentioned design model is further developed for FPGA based Hardware in Xilinx System generator environment.(Refer figure 11.) It is also evaluated with the same weighing functions computed for steering angle of 10^0.

It can be seen that in this case also, when the beam is steered at an angle of 10^0 a peak is obtained at $\pi/5$. (Refer Figure 13.) . Thus the responses obtained were in agreement with the algorithm results.

The design model for FPGA based hardware is further extended for multiple receive beam generation. (Refer Figure 12.) . Further the partial beams are formed from a group of

receiver units. In large array systems, which consists of multiple number of row elements, the row level partial beams are further combined to form the final receive beam. But the high speed data bandwidth requirement in real time requires each hardware unit has to be interfaced with necessary high speed optical links.

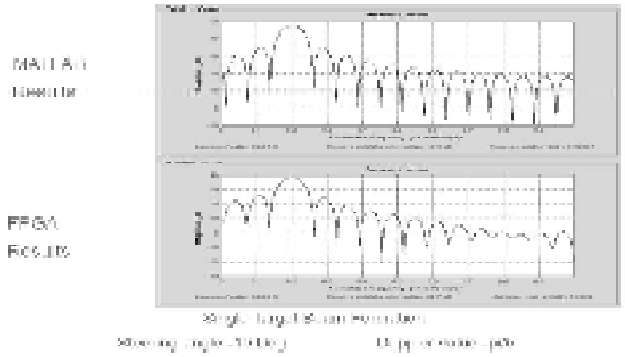


Figure 13. Matlab Vs FPGA Results

CONCLUSION

This paper discusses about various types of beam formers in general by giving more emphasize on Digital beam formers. Quadrature beam former concepts are used for Digital Beam former realization. In addition, it discusses about DBF architectures for large array systems. Technological advancements in the digital domain help us in providing FPGA based compact hardware for the realization. Thus this type of Digital Beam former hardware provides field upgradeable and cost effective solutions to modern Radars. Moreover it can be observed that this kind of architectures give modular and scalable solutions suitable for various radars.

REFERENCES

[1] Carpentier M.H , *Principles of modern radar systems,* artech house,norwood MA, 1988.
[2] Skolnik, Radar Hand book, 3rd ed., McGrawHill, New York, 2008
[3] ModelSim Users Manual, Guide
[4] Array Signal Processing Concepts,Don H.Johnson,Dan E Dudgeon
[5] Byron Edde. *RADAR Principles, Technology, Application*
[6] Doughlas L Perry - *VHDL Programming by example.*
[7] Charles H Roth, Jr -.*Digital Systems Design using VHDL*
[8] Clive Maxfield,The Design Warriors Guide to FPGAs
[9] Optimum array processing,Part IV of Detection ,Estimation and Modulation theory,Harry.L.VanTrees,Wiley Inter Science

E.E.C.E:-3

VME BUS BASED RECONFIGURABLE DIGITAL RADAR RECEIVER ARCHITECTURE

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ABSTRACT

Modern radar systems require multi receive channels that are coherent, synchronized in time, and well matched in phase and amplitude. Digital beam forming systems also require a large number of receive channels with similar coherence and synchronization requirements. In these applications size, weight, power dissipation and cost are critical considerations. This paper describes a VME bus-based, modular, reconfigurable digital radar receiver architecture that allows the rapid development of customized high-performance digital radar systems. The paper emphasizes on Digital Up Conversion, Digital Down Conversion and Pulse Compression techniques. The focus is mainly on the digital design and implementation technique adopted for the generation of high resolution waveforms.

I INTRODUCTION

The real-time signal processing constraints of a radar system are dictated primarily by the two system parameters:

- the time-bandwidth product (TBP)
- the pulse repetition frequency (PRF)

Many radar systems employ a technique known as pulse compression. When using this technique, the transmitter sends a finite-length pulse of radiation (called the transmit waveform) towards the targets. When the targets are within the range of the radar system, reflections of the transmitted waveform will create a return signal which is received by the system.

The receiver continuously convolves the waveform of this return signal with the complex conjugate of the transmit signal, also called the reference waveform. This maximizes the signal-to-noise ratio and produces a sharp peak wherever the waveform of the returning signal correlates with the reference waveform, indicating the presence of a target at that particular range.

This technique is known as pulse compression because it produces a peak that is considerably narrower than the width of the original transmitted waveform. The ability of pulse compression to produce narrow peaks is directly related to the characteristics of the transmit waveform - specifically, its bandwidth and its duration (length). The product of these two parameters is known as the time bandwidth product (TBP). The processing gain through the pulse compression filter is proportional to the TBP of the transmit waveform. The compressed pulse width (range resolution) is inversely proportional to the bandwidth of the transmitted pulse. This paper presents one such approach to implement the waveform, digital down conversion and pulse compression techniques.

II OVERALLARCHITECTURE

The block diagram of a typical digital waveform generator under discussion is given below in Fig 1. The input to the transmit side is the digital baseband signal. The digital hardware block shown in the dotted lines is a Digital Up Converter (DUC) that translates the base band signal to the IF

frequency. The D/A converter (DAC) that follows convert the digital IF samples into the analog IF signal. The RF up converter converts the analog IF signal to RF frequencies. Finally, the power amplifier boosts signal energy to the antenna.

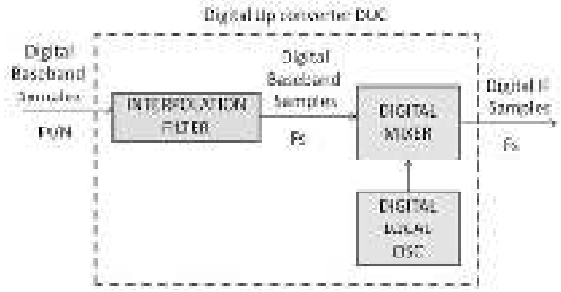


Fig.1 Block Diagram of Digital Up Conversion

During reception the RF tuner converts analog RF signals to analog IF frequencies, the same as the first three stages of the analog receiver.

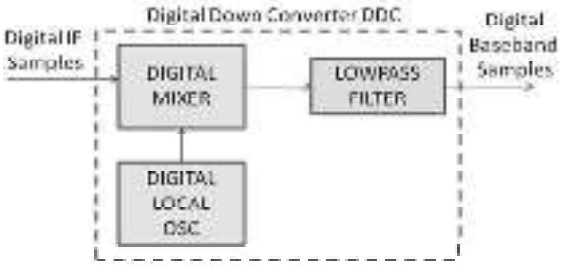


Fig.2 Block Diagram of Digital Down Conversion

The A/D converter that follows digitizes the IF signal thereby converting it into digital samples. These samples are fed to the Digital Down Converter (DDC). The block diagram of a typical Digital Down Converter is given above in Fig 2. The digital mixer and local oscillator translate the digital IF samples down to baseband. The FIR lowpass limits the signal bandwidth and acts as a decimating lowpass filter.

The complex data stream from the DDC flows into the pulse compression unit. This digital processing can be done in either the time domain or in the frequency domain to provide the matched filter for a pulse compressed waveform. In both cases, the input signal is the complex envelope sequence as formed using the DDC. This unit performs a time-domain multiplication, to reduce the magnitude of the side lobes. When doing the processing in the time domain, a Finite Impulse Response (FIR) filter is used to convolve the returning signal with the reference waveform. The output of this convolution operation contains the peaks that represent the targets. When doing the processing in the frequency domain, a Fast Fourier Transform (FFT) is used to transform both the reference waveform and the return signal waveform into the frequency domain. The block diagram of a typical Pulse compression technique is given below in Fig 3.

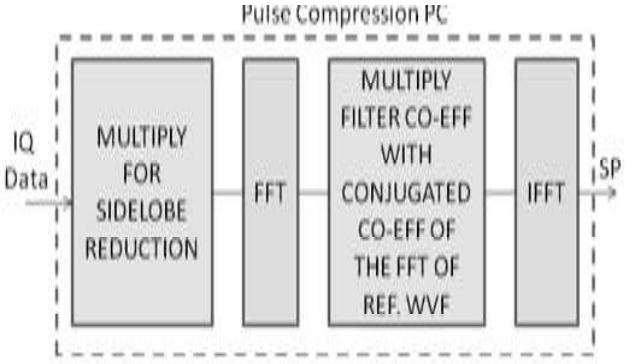


Fig.3 Block Diagram of Pulse compression

The current paper deals with the design and analysis of the above DUC, DDC and PC (in frequency domain) in Matlab. The above techniques were implemented using Matlab Simulink and Xilinx System Generator Tools and tested on Xilinx Virtex2 FPGAs.

III IMPLEMENTATION OF WAVEFORM GENERATION LOGIC

The radar transmit waveform employed determines to a large extent the information that a radar may provide about the target. The major characteristics of radar waveforms are energy in the waveform, resolution provided in range and radial velocity and rejection of unwanted target responses.

Phase-coded waveforms may provide good range and radial-velocity resolution. Phase-coded waveforms employ a series of subpulses, each transmitted with a particular relative phase. These are processed in the receiver matched filter to produce a compressed pulse having a time resolution equal to the subpulse duration, τ_s, and a frequency resolution equal to $1/\tau$, where τ is the total waveform duration. Thus, with n_s contiguous subpulses, the waveform duration $\tau = \tau_s n_s$, and the pulse compression ratio, $PC = n_s$.

Phase-coded waveforms are characterized by the phase modulation applied to each subpulse. There are different types of phase-coded waveforms like Binary Phase Codes, Optimal Binary Codes, Barker Codes, Allomorphic Forms, Minimum Peak Sidelobe Codes, Polyphase codes, Frank Codes, Lewis and Kretschmer Codes, Costas Codes and so on many more techniques are available.

In this implementation technique, the radar transmit waveform generated here is a polyphase coded waveform. The transmit pulse is subdivided into a number of sub-pulses of equal duration. The duration of each subpulse can be configured online through the Controller application. The phase Φ of each sub-pulse is computed offline in Matlab. The I data is $\cos(\Phi)$ and Q data is $\sin(\Phi)$. This predefined profile is computed and stored in the memory for any number of radar waveforms

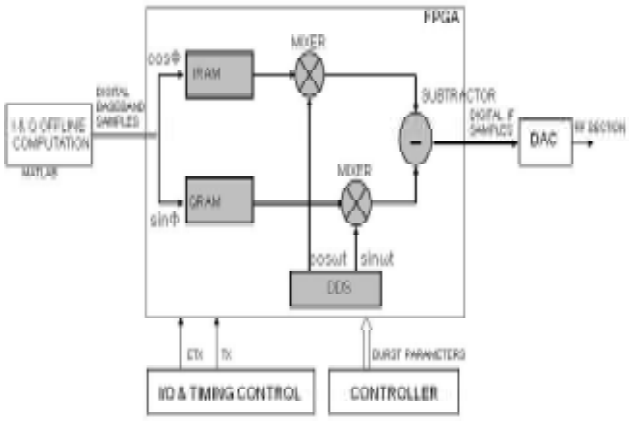


Fig.4 Waveform Generation Logic

The above Fig. 4 depicts the radar transmit waveform generation logic that is designed as a reconfigurable module. As the phase is computed offline and stored in the memory, the phase values for any phase coded technique and for any duration of subpulse can be computed and stored. Here by varying the subpulse duration the range resolution can be varied from waveform to waveform. The Direct Digital Synthesizer (DDS) produces waveforms using digital techniques and provides significant improvements in stability, precision, agility and versatility over analog techniques. DDS are widely used because of their good characteristics such as fast frequency switching and high frequency resolution. The DDS ie the digital oscillator here generates sine and cosine components of the IF. The digital mixer multiplies the IF with the I & Q data from the memory. Then the I & Q components are combined to form the digital IF samples and this output is given to the DAC. Hereby the frequency translation from baseband to IF is performed ie digital up conversion.

All the logic bocks highlighted in blue in Fig 4 are implemented in Matlab Simulink model using Xilinx System Generator block sets. The Simulink model implemented is shown in Fig 5.

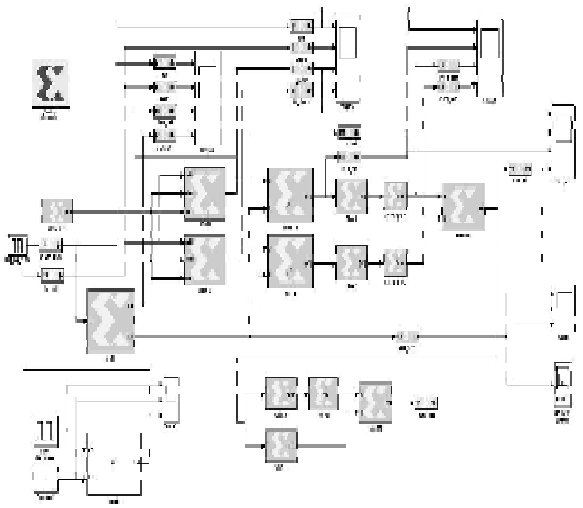


Fig.5 Implementation of Waveform Generation Logic in Matlab

All the blocks in blue in the model are the logics which are programmed into the FPGA. This model was simulated and tested for different waveforms of different IF bandwidths. This modular logic can be reconfigured for a different set of waveforms with different IF bandwidth through the Controller application.

IV IMPLEMENTATION OF DIGITAL DOWN CONVERSION LOGIC

The availability of high speed A/D converters capable of direct sampling of radar receiver IF signals has resulted in the wide application of digital receiver architectures over analog I/Q demodulation. The benefits of IF sampling are elimination of I and Q imbalance, elimination of DC offset errors, reduced channel-to-channel variation, improved linearity, flexibility of bandwidth and sample rate, tight filter tolerance, phase linearity, and improved anti-alias filtering, reduced component cost, size, weight and power dissipation.

In digital down conversion, the signal is sampled by the A/D converter. The A/D converter digitizes the IF signal by converting it into digital IF samples. These samples are fed to the next stage, which is the digital down converter. The digital mixer and oscillator perform the frequency translation from IF down to baseband. The FIR lowpass filter removes the high frequency component. Since the output of the FIR filter is band limited the sample rate can be lowered

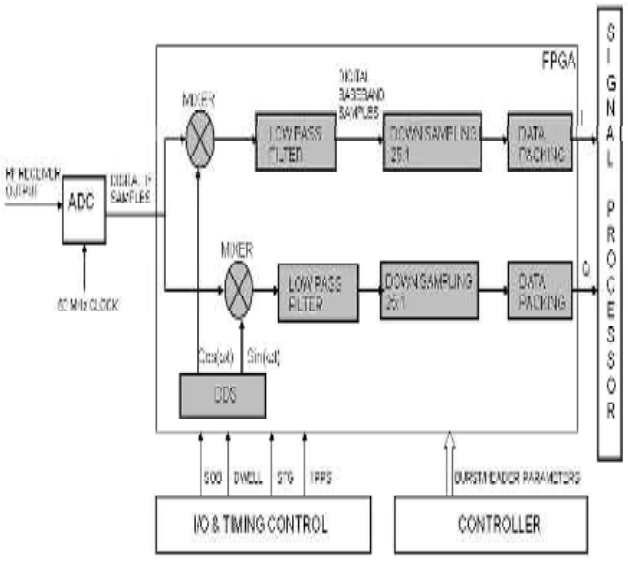


Fig.6 Digital Down Conversion Logic

The down sampler reduces the sampling rate by a factor of N or the filter output is decimated to produce I/Q digital data. The data is then packed as per the signal processor requirements with the appropriate header and control words and then sent to programmable signal processor for further processing. This is shown above in Fig 6.

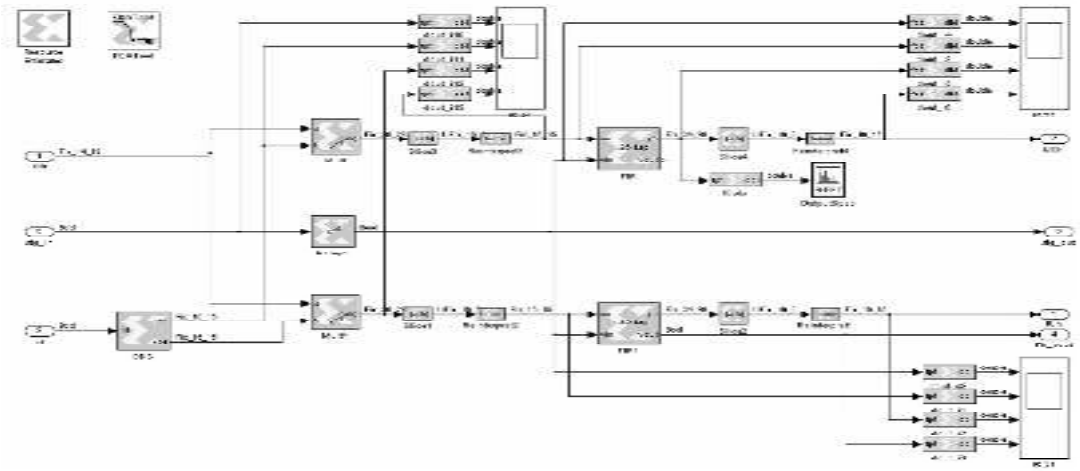


Fig.7 Implementation of Digital Down Conversion Logic

The above shown DDC logic as in Fig 7 is also implemented in Matlab Simulink tool using Xilinx System Generator block sets. The Simulink model implemented as per the above logics shown in Fig 7. This model was also

simulated and tested for different waveforms of different IF bandwidths. The down sampler or the decimator factor varies as the IF bandwidth varies. For subpulse duration of 500ns and clock of 20ns the decimation factor is 25. Hence as subpulse duration changes the decimation factor also changes. The DDC logic is also implemented as a modular logic. Here the model cannot be reconfigured, but instead there could be a number of such similar modular logic models for different decimation factors. The model for a particular decimation factor can then be selected online through the Controller application. In this the FPGA resource utilization for one model for a single channel is two multipliers and two FIR lowpass filters. Hence by having similar models for different decimation factors will consume only a smaller fraction of the available FPGA resources.

V IMPLEMENTATION OF PULSE COMPRESSION LOGIC

With high performance digital computing, the convolution operation required for pulse compression can be done digitally. This digital approach eliminates the calibration requirements and the limited reconfigurability of analog methods. This digital processing can be done in either the time domain or in the frequency domain because convolution in time domain is equivalent to multiplication in frequency domain. When doing the processing in the frequency domain, a Fast Fourier Transform (FFT) is used to transform both the reference waveform and the return signal waveform into the frequency domain. The complex conjugate of the reference waveform's FFT is then multiplied (point-by-point) with the returned signal waveform's FFT. The result is transformed back into the time domain with an inverse FFT to produce the output signal, with peaks that represent the targets.

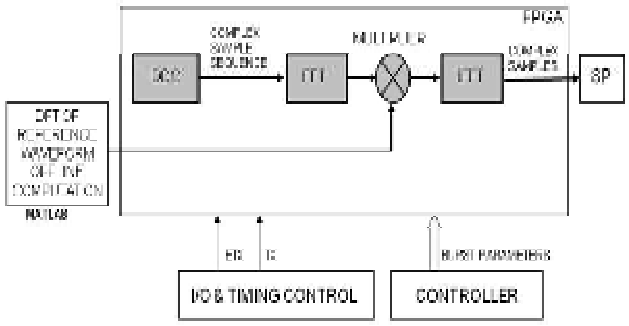


Fig.8 Pulse Compression Logic

The above Fig.8 shows the pulse compression logic that was implemented in frequency domain. The DDC output complex sample sequence goes as input to the pulse compression logic. The PC unit performs an FFT operation to transform the time domain complex sample sequence into a frequency domain representation of the return signal. The program to compute offline the conjugated co-efficient of the FFT of the reference waveform is coded in Matlab and these values are stored in the memory. The point-by-point multiplication of the returned signal sample sequence with the reference waveform data is performed. Then an inverse FFT operation to transform to time domain data stream is also performed. When there is correlation with the transmitted waveform the peak is detected that correspond to the targets

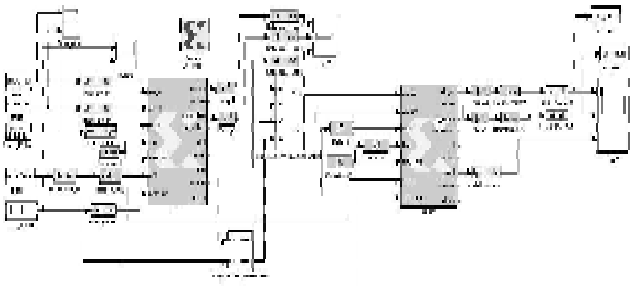


Fig.9 Implementation of Pulse Compression Logic

This logic was also implemented in Matlab Simulink using Xilinx System generator FFT and IFFT block sets. The model was simulated and functionality validated. The above Fig.9 shows the pulse compression model that was implemented and tested.

VI RESULTS

All the above mentioned techniques were tested on VME bus based Digital Radar Receiver cards. The logics are implemented as individual modular models in Matlab. The design files obtained from System Generator was ported and integrated with the VHDL design in the Xilinx tool. The corresponding bit file was generated and programmed on to the Virtex2 FPGA available on the Digital Receiver card which caters for two such radar receive channels.

The functionality and reconfigurability of the digital radar receiver was tested using a full fledged test setup. The Fig.10 below shows the established test setup. Three such Digital Receiver cards were used. These cards are housed on VME chassis and configured and controlled through a PowerPC Single Board Computer (SBC) which is the Controller of the Exciter/Receiver unit.

The Controller receives burst parameters from the Radar Controller. The Controller in the Exciter/Receiver unit configures all the digital receiver cards through the VME bus using DMA transfer of data from burst to burst. Based on the radar timing signals the digital receiver generates the polyphase coded radar transmit waveform. This waveform was looped back to another digital receiver card DDC and PC performed. The data is then packed and sent to the Signal processor over an optical link.

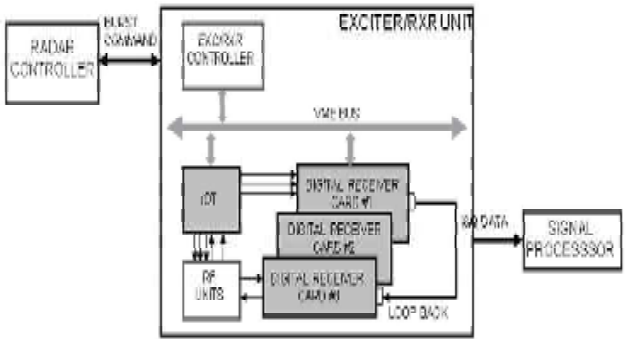


Fig.10 Test setup for testing Digital Radar Receiver

The simulation plots of the waveform generation logic in Matlab Simulink are given below in Fig 11. The first graph shows the I phase values. The second graph shows the plot of theDDS cosine output. The last graph depicts the digital IF samples ie output of DUC logic. The phase change is visible at intervals of 0.5 on the time axis.

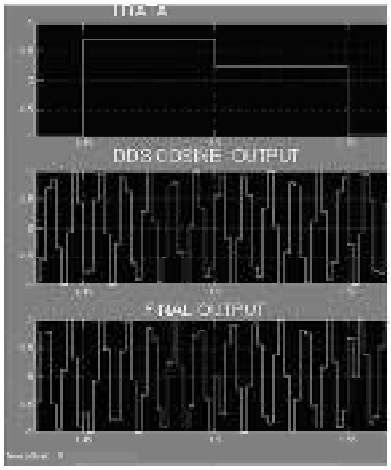


Fig.11 Plots of simulation for Waveform Generation Logic

The spectrum of the polyphase coded radar transmit waveform generated for a pri of 1ms and pulse width of 100us is shown in Fig 12. The radar transmit waveform has an IF bandwidth of 2MHz.



Fig.11 Spectrum of Waveform Generation

The raw I data obtained at the output of the digital down conversion logic is given in Fig 12. This plot is also for a pri of 1ms and pulse width of 100us.

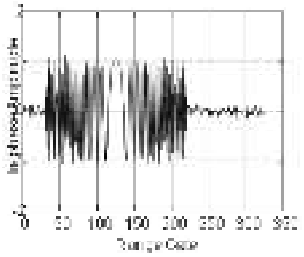


Fig.12 Output of DDC logic

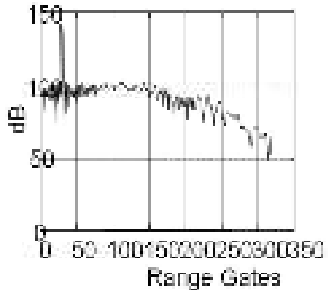


Fig.13 Output of pulse compression logic

The Fig 13 depicts the pulse compression obtained for waveform having a pri of 1ms and pulse width of 100us. The pulse compression gain of around 40dB is obtained.

VII CONCLUSION

This paper has presented a VME bus-based digital radar receiver architecture that can be used for a wide variety of radar applications. The architecture is flexible, scalable, and dynamically reconfigurable, allowing it to support many different radar processing modes. The basic capabilities of this radar receiver architecture can be augmented on to off-the self or custom designed boards.

REFERENCES

[1] M. I. Skolnik, *Radar Handbook*, 3rd Edition, New York: McGraw-Hill, 2008.
[2] G. Richard Curry, *Radar System Performance Modeling*, 2nd Edition, Artech House, Dec 2005.
[3] A.W.Rihaczek, *Principles of High-Resolution Radar*, New York: McGraw-Hill, 1969

E.E.C.E:-4

ACCURATELY PRUNING OF RETRIEVED COLOR IMAGES THROUGH MOMENTS & GLCM

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INTRODUCTION: AS processors become increasingly powerful, and memories become increasingly cheaper, the deployment of large databases for a variety of applications have now become realizable. Databases of art works, satellite and medical imagery, forest , landscape, water ,hills. Have been attracting more and more users in various professional fields. for examples geography, medicine,forest , landscape, water , hills, architecture, advertising, design, fashion, and publishing. Effectively and efficiently accessing desired images from large and varied image databases is now a necessity [1] .

Definition:- Content Based Image Retrieval:- It is the retrieval of images based on the visual features such as color, texture, and shape [2]. Reasons for its development are that in many large images databases, traditional methods of image indexing have proven to be insufficient, laborious, and extremely time consuming. These old methods of images indexing, ranging from storing an image in the database and associating it with a keyword or number, to associating it with a categorized description, have become absolute. This is not CBIR.

In CBIR each image that is stored in the database has its features extracted and compared to the features of the query image. It involves two steps [3]:-

Feature Extraction: The first step in the process is extracting image features to a distinguishable extent.

Matching:- The second step involves matching these features to yield a result that is visually similar.

CBIR systems: Several CBIR systems currently exists, and are being constantly developed examples are[5].

1) QBIC or Query By image Content was developed by IBM, Almaden Research Centre, to allow users to graphically pose and refine queries based on multiple visual properties such as color, texture and shape [5]. It supports queries based on input images , user constructed sketches, and selected color and texture patterns[2].

2) VIR Image Engine by virage inc like QBIC, enables images retrieval based on primitive attributes such as color, texture and structure. It examines the pixels in the images and performs an analysis process, deriving image characterization features[5].

3) Visual SEEK and Web SEEK were developed by the department of Electrical Engineering, Columbia university. Both these systems support color and spatial location matching as well as texture matching[5].

4) NeTra was developed by the Department of Electrical and Computer Engineering University of California. It supports color, shape, spatial layout and texture matching, as well as image segmentation[5].

5) MARS or Multimedia Analysis and Retrieval System was developed by the Beckman institute for Advanced Science and Technology, university of Illinois. It supports color, spatial layout, texture and shape matching [5].

6) Viper or Visual Information Processing for Enhanced Retrieval was developed at the computer Vision Group, University of Geneva. It supports color and texture matching [5].

Problem Motivation : Image databases and collections can be enormous in size, containing hundreds, thousands or even millions of images. The conventional method of image retrieval is searching for a keyword that would match the descriptive keyword assigned to the image by a human categorizer [6].

Currently under development, even though several systems exist, is the retrieval of images based on their content, called Content Based Image Retrieval, CBIR while computationally expensive, the results are far more accurate than conventional image indexing. Hence, there exists a tradeoff between accuracy and computational cost. This tradeoff decreases more efficient algorithms are utilized and increased computational power becomes inexpensive.

A number of overviews on image database systems, image retrieval, or multimedia information systems have been published see eg:-[1],[2],[3],[4],[5],[6] ,[7],[8],[9],[10],[11],[12], [13],[14],[15],[16], [17],[18],[19],[20],[21],[22],[23],[24],[25], [26], [27],[28],[29] etc

Importance of CBIR: In the CBIR we considered image retrieval as a dichotomous classification problem and compared

performances of the two RF strategies with four different datasets with number of images. AS processors become increasingly powerful & memories image databases for a variety of applications have none become realizable. In CBIR the main topic is feature extraction & indexing & retrieval. The retrieval of images based on visual features such as color, texture, shape.

In CBIR we have feature extraction that is Ist step extracting the image features to distinguishable extent.

Matching IInd step matching these features to get results that is visually similar .In CBIR systems currently exist & are being constantly developed e.g.:

1. QBIC - query by image content developed by image database.
2. VIR- image Engine by virage once.
3. Visual seek & web seek developed by department of electrical engineering
4. Netra
5. MARS- multimedia analysis & retrieval system
6. Viper- visual information processing for enhanced retrieval.

Graphical user interface was constructed or graphical user interface design environment for layout tools provided by the guide for designed for our CBIR applications. CBIR is the gap between the high level semantics concepts used by the humans to understand image content & low level visual features extracted from images & used by computer to index the images in the database. In CBIR to improve user access to images. In CBIR first study which compared key frames & keywords in video tasks .key words are more effective but for more ambiguous needs key frames is more useful IInd study analyzed over a million queries using the excite search engine IIIrd study looked at the Google Image based revealed in terms used to describe art 7 abstract images on the web. The pictures on the web are being used to support text & not vice versa. current developments in CBIR have been designed to meet the needs of non art related fields such as science, medicine, the military CBIR has practical applications for variety of fields one of these is the area of visual art Dobbs talk focused on how the visual artists might design CBHIR to fit their needs Artists are uniquely qualified to design CBIR for artistic application while not all artists are strong in communicating & verbally they are adapt that seem most related to our own[30]

Approach to building recognition using perceptual grouping [31]water filling algorithms for extracting edge map features users in many professionals fields are exploting the opportunities offered by the ability to access and manipulate remotely stored images in all kinds of new & exciting ways

The most important are 1. Understanding image users needs and information seeking behaviors

2. Identifications of suitable ways of describing images content.
3. Extracting such from raw images
4. Providing compact storage for large image databases.
5. Matching query & stored images in a way that reflects human similarity judgments
6. Efficiently accessing stored images by content
7. Providing usable human interfaces to CBIR systems.

CBIR software is that system acceptability is heavily influenced by the extent to which image retrieval capabilities can be embedded within users over all work tasks trademark examiners need to be able to integrate image searching with other keys. Engineers will need to modify retrieved components to meet new design requirements one implications of this is that a prime future use of CBIR is likely to be the retrieval of images by content in multimedia system. one e.g. of such synergy revealed by their retrieval experiments was that in the presence of visual cues , almost 100% recall could be achieved even with a 30% error rate in automatic word recognition there is renewed interest in the media about potential real world application of CBIR & image analysis technologies.

(Scientific American 2006 Discovery 2006 CNN-2005) we envision that image retrieval will enjoy a success story in the coming years image retrieval systems are deployed for public usage CBIR technology is being applied to domains as diverse as family albune management, botany, Astronomy, mineralogy, & remoting sensing [32], [33],[34], [35], [36]. In CBIR systems which retrieved images ranked by relevance to the query image only similarty information among the retrieved images is not considered. In the aspect of database support of CBIR we demonstrate the possibility of using p2p systems as the source the storage & the feature extraction computation for images A self organising p2p network & query routing scheme are also proposed for making CBIR efficiently in p2p network experiments are done both on synthetic & real images data .In research & development issues in CBIR cover a rang of topics many shared with main stream image processing & information retrieval.

Current level 1 of CBIR techniques: In contrast to the text based approach of the system described CBIR operates on a totally different principle retrieving stored images from a collection by comparing features automatically extracted from the images themselves the commonest features used as mathematical measures of color texture or shape hence virtually all current CBIR system whether commercial or experimental operates involves filtering the images with Gaussian derivatives at multiple scales [37]& then computing differential invariants the whole image technique uses distribution of local curvature & phrase [37] the advantages of all these techniques is that they can describe an image at varying level of details [useful in natural scenes were the object of interest may appear in the variety of guises] & avoid the need to segment the image in to regions of interest before shape descriptors can be computed dispute recent advance in techniques for image segmentation this remains a trouble some problems the complete set of key frames for the video thus form the story board for the video which can then be manu

ally annotated or stored in an image database for browsing or content based retrieval most commercial CBIR vendors including excallibers & virage now have products automatically at least part of the video data management process[38],[39],[40]. CBIR techniques have been used in the automatic analysis of tennis shot or basket ball games finally the inform media project at Carnegie- melon university has demonstrated how much synergy can be achieved in video retrieval when information from video speech and closed caption text is combined the ability use the speech information to resolve ambiguities in video interpretation has lead to some quite impressive result.

Retrieval by semantic image feature: The vast majority of the current CBIR techniques are designed for primitive to bridge the gap between the level 1 & level retrieval one early system aimed at tackling this problem was GRIM-DBMS.
[41] A number of features characteristics of object shape[but independent of size or orientation]are computed for every object identified within each stored image .Queries are then answered by computing the same set of features fro the query image and retrieving those stored image whose features most closely match those of the query.
We have two main types of shape feature are commonly used global features such as aspect ratio, circularity and moment invariant, virtually all current CBIR system now after query by e.g. searching where users submit a query image and a system retrieves and displaces thumbnails of a 20 closest matching images in the database [42],[43],[44], [46]..
The ability to refine searches online in response to user indications of relevances is known as relevances feedback is particularly useful in image retrieve even though it was originally developed for text . This is firstly because the user can normally judge the relevance of a set of images displayed on the screen within seconds and secondly because so few current system are capable of matching users needs accurately first time round. The usefulness of relevance feedback for image retrieval was first demonstrated for within keyboard based system. The facility has now been successfully implemented in several CBIR system [47],[48]. however there is still considerable scope retrieval system in particular development of better methods for users to convey individual notions image similarity
Trade mark image registration where a new candidate mark is compared with existing marks to ensures that there is no risk of confusion has long been recognized as a prime application area for CBIR. Copyright protection is also a potentially important application area. Enforcing image copyright when electronic versions of the images can easily transmitted over the internet in a variety of formats is an increasingly difficult task. There is a growing need for copyright owners to be able to seek out and identify unauthorized Copies of images, particularly if they have been altered in some ways . The general purpose CBIR packages such as QBIC and virage have been tested on trademark image databases. Several experimental systems specifically designed for trademark searching have also been described in the literature. These includes (TRADE MARK from the electro technical laboratory Tsukuba, Japan[49] STAR from the university of Singapore [50]& ARTISAN from the university of Northumbia at New castle , UK[51] both STAR & ARTISAN were developed in close collaboration with respective national patent offices encouraging results have been reported and it is expected that at least one commercial trade mark search system using CBIR technology will be on the market before the end of 1999.

Brief survey of CBIR: CBIR methods & technical achievements in this area . The survey includes a large number of papers covering the research aspects of systems design & applications of CBIR image features representation & extraction multi-dimensional indexing how the word context is considered but without effective use of context in the problems of image management we shoe how context can be modeled in two situations .In CBIR namely the management of users query & the support of image interpretation in CBIR COBWEB (CBIR on the web) is a research & development project Co-financed by the ESPRIT programmed of the(EU COBWEB) aims to provide an innovative solution to the problem of the cost effectively filing & retrieving huge number of still images & allowing remote access to images databases via the internet . COBWEB is presented to offer advanced features for image analysis conceptual clustering human computer interfaces, image retrieval support for remote searches via internet. The goal was to create a system for providing solution to the problem image disturbed over the internet. it was a threefold project with
1. Development of effective algorithms for the automatic storing of the visual features of the images that can be used as means for retrieving similar images.
2. Creation of simple cross platform queries & retrieve images in the most the natural ways.
3. Development of a robust communication subsystems the guarantees satisfying retrieval times.
A survey was also carried out on a representative sample of UK libraries & museums listed in the Arils directory to investigate a range of issue surrounding the management of image collections. The survey found that all current operational images archives used text based indexing(CBIR [52],[53],[54]all of which deal primarily with work prior to the year 2000). These are comprehensive survey exits on the topic of CBIR . This CBIR survey analyzes and quantifies current progress & future prospects of images.

IMAGE DATABASE: Database of forest, landscape, water, flowers, art , works, satellite and medical imagery have been attracting more & more users in various professional fields for eg geography, medicine , architecture, advertising , designing desired images from huge & varied image databases is now a necessity its development that are in many large image database traditional methods of image indexing have

proven to be in sufficient, laborious & extremely time consuming. In CBIR each image that is stored in the database has its features extracted & compared to the features of the query images. In image database that we used in our project contains 68bits uncompressed bit maps Bleps that have been randomly selected from www. Image database is to share image datasets with researchers around the world. image database users such as graphics designers the ability to retrieve specific images is of marginal usefulness the role of images in stimulating creativity is little understood images located by chance may be just as careful in providing the designer with inspiration as those retrieval in response to specific queries. QBIC to display sets of images with underlying features in common searching the web for images in such a chaotic process that almost any advance on current technology is likely to be benefited . If we image database it is good because image database remains for long whenever we want we can use it is library. In this image database all types of images which is describe is stored in database in separate folders .In image database in one folder matched images is stored in one file and test images in one file difference images one file moments features retrieved images in file .so for research fields image database all over the world.

Moment's features: A texture on the local fourier transform has been developed to classify textures & segments images . The original image similar to color moments, we calculate the Ist & IInd moments of the characteristics maps which represents the color texture information of the original image. we known that probability distribution is uniquely characterized by its moments then the color distribution can be characterized by the moments FI(K) in feature extraction . The moments are calculated independently in each of the eight maps of every color channel for color we obtain 16 dimensional features & for grey scale images the feature dimension is only 16. The performance of the proposed feature is compared with that of RGB based & hsv based features as well as grey scale texture features. The grey scale features in terms of retrieval precision. The moments we extract from the characteristics maps are the roughest features. good experimental result certify that the eight characteristic maps do imply some potential properties of textures .The first order & second order moments as our characteristic maps features to capture image chrominance information each sub block the characteristic maps vector is normalized such that the sum of each component o's square is one . In the implementation we select N1/4 8 empirically & only extract color moments for the peripheral sub blocks rather than the sub blocks over the whole images this is because based on empirical knowledge .In the moments features we first take 50 images of the forest & represent in the form of no of images ten features of the images the we a set a path from a d:\'poornima_mphil\Forest\forest';.we mention sprintf & represent the image in bmp & for image we write as i after this frame 1 imread the image will be read we have compute the knowledge base from the forest1 to forest50 we have to represent frame2 in that rgb2gray color (frame1) then we make the imresize for images & fix the frame2 [128,128] then we have mention row, col=size for the frame then frame size become double for that we represent as F. then formula for moments features X=mean2(f);

In this moments features we should represents ten features in the form m1 to m10 we get result as 50x10 that is 50 images & 10 features of forest .

Test images with moments features: In this test images a moments features of the image of forest 101 this image is not present in the 50 images this is image different images it can be called as query images then in test features the result we get is 1x10 means one images & ten features of the test features if we want see the test image we have to mention as imshow then image will be shown on the screen & the result is the test 101 image of forest which is in the image database. test the images with other images of the forest of 50 images then the result we get in test image is 1x10. Compare the knowledge base

difference = moments features -test features, 50 images x10 features , features sum=50, 10 then we get result from the difference is 50images x10 features. In the moments features by visual we can find out the match or match the images out of 50 images the matched images 21 images is retrieved. this images is comparing with the test images the matched images are 21 images of the forest .

Co-occurrence features: Originally proposed by R.M. Haralick the co-occurence matrix feature representation of texture features explores the grey level spatial dependence of texture mathematical definition of the co-occurence matrix as follows.1. Given a position operator p[i,j] A[i][j] the number of times the points with grey level (intensity) g[i] occur p is position g[j] is the grey level c be the nxn matrix that is produced by dividing A with the total number of points pairs that satisfy p c[i][j] is a measure of the joint probability that a pair of poits satisfying p will have values g[j] p is operator i&j or i one position to the right & two below j . Co-occurence matrix is constructed based on the orientation & distance between image pixels. Then meaningful statistics are extracted from the matrix as the texture representation .In co-occurence matrix we have many features eg- energy, entropy, variance, correlation, mean, and contrast, inverse. In these Co-occurence matrix represents the spatial distribution & dependence of grey levels within a local area each(i,j) th entry in the matrix represents the probability of going from one pixel with grey level of i to another with grey level of j under predefined distance & angle for matrices sets of statistical measures are computed called features vectors we have proposed two slightly variant models to detect the camouflage through the second order texture parameters by extracting the GLC matrices for smaller blocks of the image than considering the entire image because a hidden content is expect3ed

to get revealed relatively easily in a smaller block than. when searching for it in a bigger frame Ist section- in the paper to detect camouflage it is necessary to work on smaller segments of the images for the texture analysis which values of pixels than the methods which just consider the grey values & distribution pattern of grey values of pixels in an image for the purpose of extracting occurence of pairs o f pixels contributing to specific combination of grey values literature supports a useful mathematical model cal ; led grey level co-occurence matrix(GLCM)on GLCM is given by haralicks .second sections- we present a brief coverage on GLCM & important texture feature parameters. we present in the third section two slightly variant models for decamouflageing computations we also present the results of some experimental studies to demonstrate the need & important to go for smaller blocks of the texture analysis .fourth section- the models & present the complete algorithms .fifth section- experimental results are presented .sixth section conclusions.

The Co-occurence matrix method of texture description is based on the repeated occurence of grey level configuration in the texture. This configuration varies rapidly with distance in the fine texture & slowly in coarse textures due to durations in repeatation of pattern of grey level configuration in the camouflage we are trying to make use of such disturbed texture as a clue for existence of defect which is camouflaged. the following illustration from is reproduced for better understanding of the method but we consider 4x4 image with 4gray levels to illustrate the construction of co-occurence matrix. the elements pQd(a,b0 represents the number of times of two pixels with each grey levels a&b appears with a separation of d pixels in the direction Q PO Q' (0,0)=4 for the image considered in fig 1.

In GLCM we have

1. **Energy:-**This measures the image homogeneity resulting in larger value for more homogenous texture. it is useful to examine power content in a certain frequency band ? ab p^2 Ø.d(a,b).

2**. Entropy**:- ? Ø, b p Ø,d(a,b)
Log p Ø ,d(a,b) it is the degree of diversity.

3**. Contrast**:-This will measure the amount of local variation in the image & is the opposite of homogeneity (when high pixel values are concentrating along the diagonal) mathematically contrast.
?a,b|a-b|^k p Ø,d(a,b)
K=1&

4**. Homogeniety** :- Homogeneity weights values by the inverse of the contrast weight with weights decreasing exponentially away from the diagonal it is defined as
? a,b p Ø,d(a,b)
1+(a-b)^2

5. **Correlation**:- This will analyze the linear dependency of grey levels of neighboring pixels it is typically high when the scale of local texture is larger than the distance.

?a,b (a,b) p Ø,d(a,b)
¬x ¬y
X=?$_a$ a ?$_o$ p Ø,d(a,b)
Y=?$_b$ b p Ø,d(a,b)
¬x = ?a(a- x)^2 ?$_b$p Ø,d(a,b)
¬y =?$_b$(b- x)^2 ?$_a$ p Ø,d(a,b)

The GLCM described here is used for a series of second order texture calculations Ist order texture measures are statistics calculated from original image values like variance & they do not consider pixel neighbor relationships second order measures probe the relationship between groups of pixel in the original image. The computations of co-occurrence matrix features often takes more times we try to compute third or higher order co-occurence matrix features which can provide better accuracy in comparison to a parameter of a lower order.

we suggest a simple method to compute p Ø,2(that is d=2) which enables the realization of third order co-occurence matrix by converting the, problem into two second order Co-occurrence matrix problems. The GLCM matrix is decomposed into 2 matrices

1. Containing column numbers 1,3, 5&2,4,6 respectively for Ø =0
2. containing row numbers 1,3,5&2,4,6 for Ø =90.
3. Containing both row & column number 1,3,5 & 2,4,6 respectively for Ø =135

these are illustrated in fig 2 using decomposed GLCMs computations are carried out aspire formed for d=1 we have not implemented the model because of the high computational timer requirements.

In co-occurence features we take number of images 15 which is matched images of forest which is selected from the 50 images. This 15 images some are similar & are near to the same images which is matched or retrieved with the help of test image of the forest 101 which not present in 50 images of the forest this 101 test image is different image of the forest . so we represent number of images 15 & 32 features the set path is from the d:\'poornima_mphil\Forest\forest'; compute the knowledge base from forest1 to forest15

We will set the image imresize frame2[120.120] a frame, image is represents as a frame, gray scale 256 it computes the co-features –mat- RGB & produces 8 features for each angle. We got the high value results so to minimize high value of results of images , we split the RGB separately like co-features-mat-R, co-features-mat-G , co-features-mat-B.

Then we will do summation of this co-features-mat-RBG= co-features-mat-R, co-features-mat-G , co-features-mat-B. we got correct value results of the color images.

In this co-occurence features 4 angles are consider total features are 8x4=32.

0^0,45^0,90^0,135^0. after this it display the (co-occurence matrices calculated); we write msiz energy, entropy, counter, hlp2, contrast, correlation, insertia, homogeneity , hlp, maxprobe, inverse, mu-y mu- x, sig-x, sig-y in the co-occurence fea

tures. all the 32 features put into one array called co-features we get the result as 15x32 15 images of forest from the moments features which is represented in the co-occurence matrix features 32 features is co-occurence features . In co-occurrence matrix

Test images with co-occurence matrix feature f1 imread it will the image forest 101 that is taken from the d:\' poornima_ mphil\Forest\forest'; the image will be in bmp. In this test images a co-occurence features of the image of forest 101 this image is not present in the 15 images this is image different images it can be called as query images then in test features We got the high value results so to minimize high value of results of images , we split the RGB separately like test-features-mat-R, test-features-mat -G ,test-features-mat B. Then we will do summation of this test-features-mat-RBG= test-features-mat-R, test-features-mat-G, test-features-mat-B. we got correct value results of the color images. the result we get is 1x32 means one images & thirty two features of the co-occurrence mat the test features if we want to see the test image we have to mention as imshow then image will be shown on the screen & the result is the test 101 image of forest which is in the image database. test the images with other images of the forest of 15 images then the result we get in test image is 1x32. compare the knowledge base difference = (co- features

-Mat-RGB)- (test-features-mat-RGB), sum=15, 32 then we get result from the difference is 15images x32 features.

In the co-features-mat by visual we can find out the match or match the images out of 15 images the matched images 6 images is retrieved. This images is comparing with the test images the matched images are 6 images of the forest.

Objectives: The objectives of the proposed study are:

To analyze and compare the state-of-the CBIR algorithms with accurately pruning of retrieved color images through Moments & GLCM based on color, texture, shape features.

- To propose novel CBIR algorithms based on Moments & GLCM methods which are efficient.
- To perform accurately pruning for CBIR experiments and analyze results to demonstrate the efficacy of the proposed algorithms.
- This novel approaches has encourages us and reveal the concept to accurately prune of results.
- This has portrayed an interesting results and attempted to pruned accurately Which are exactly relevant to query image

In the similar way query image shown in Figure 3.4. feature are also reduced its dimension.

The core work of proposed methodology is in computation of query image feature with knowledge base and retrieved the highly resemble image with appropriate threshold.

Hence the resultant images are characterized the strength of the proposed algorithms which is displayed in Figure 3.5.

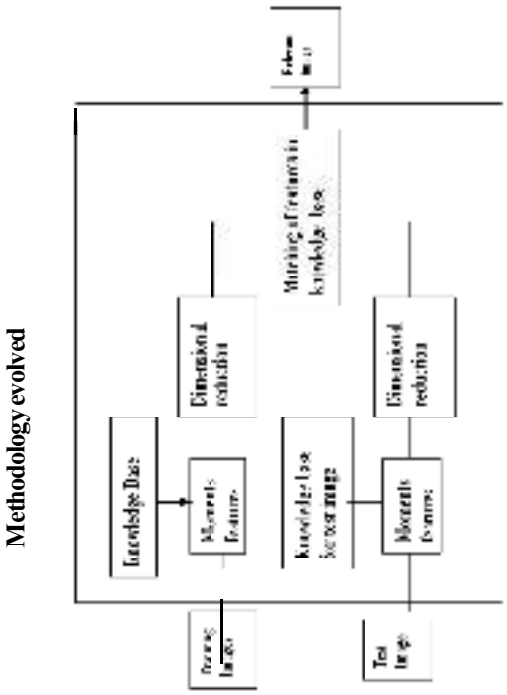


Figure4.2. for Gray level co-occurrence based features

Methodology Evolved

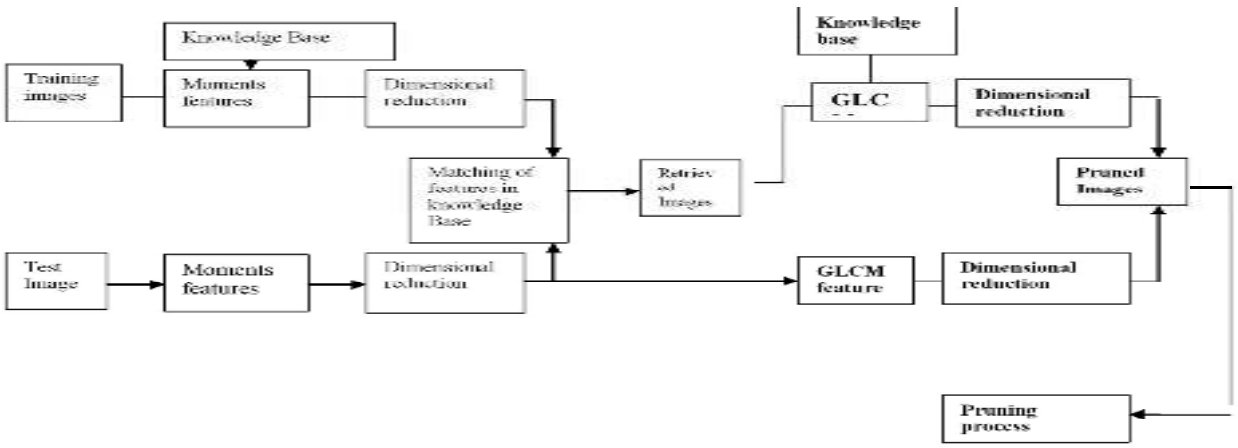


Figure.3.1. The Moment based feature extraction.

ALGORITHM

Algorithm.1:- Accurately retrieving of color images through Moments .
Input :- Color images of forest, Landscape, Water, Hills, Mountains etc.
Output :- Relevant to retrieved query images(Fifteen retrieved images).

Methods

1. Extracted the Moments features (up to fourteen orders)
2. Construct knowledge base using features extracted in step 1.
3. Extract the same number of features for query image.
4. Compare query images features with Knowledge base with some threshold. Ends.



Figure3.2. Input database images of the forest



Figure3.3. Input database images of the forest (continued)



Figure 3.4.Test Image



Figure3.5. Retrieved images of the forest

Experimental results:- The proposed system is tested on the image databases and the database includes 100 color forest images at the size of 150x256 and 256x150 pixels. They are from different classes of subjects, like cartoons, hills, flowers, land, water etc.

Perhaps the additional feature vector would lead to an improvement of the retrieval efficiency for most of the query images as well as better ordering of the relevant images in retrieval process. This can be achievable with help of GLCM feature.

Algorithms 2;- Accurately pruning of retrieved color images through GLCM

Input;- Color images , which are retrieved from moments based approach.

Output:- Pruned images which are exactly relevant to query image (one or two images).

Methods

1. Consider the Image size.
2. Compute the GLCM for d=1 and Ø= 45^0, 90^0, and 135^0
3. Compute the texture feature for database energy, entropy, counter, contrast, correlation, inertia, homogeneity , maxprobe, inverse.
4. Stored the extracted features in Knowledge base.
5. Extract the GLCM features for the test image as in the step 2 and 3.
6. Compare query image features with Knowledge base using appropriate threshold. Ends.

Feature extraction:- In this Grey level co-occurrence based features extracted for the matched images. We have taken 15 images which are obtained from the previous method (moments based feature).

In other words, large database inputted for moment based methodology. The matched image found as a result of moments feature method and subsequently matched with the same number of test features.

In GLCM, these 15 images are inputted and attempted to prune further with the help of co-occurrence feature like energy, entropy etc. The test image compare with the matched image using relevant threshold.



Figure 4.3. Input database images of the forest.



Figure.4.4. Input database images of the forest.

In this test images as shown in Figure 4.5. and Figure 3.4. the output of the proposed method is displayed in Figure 4.6.



Figure.4.5.Test Image.



Figure.4.6. Retrieved images of the forest.

Experimental results:- The proposed system was tested on the image databases; the database includes 15 color forest images at the size of 150x256 and 256x150 pixels. They were from different classes of subjects,
like cartoons, hills, flowers, land, water etc. The GLCM based approach pruned accurately which was intended to develop a system to filter further of moment based result

Conclusion: Perhaps the additional feature vector would lead to an improvement of the retrieval efficiency for most of the query images as well as better ordering of the relevant images in retrieval process. This can be achievable with help of GLCM feature.
Similarly GLCM method employed over resultant images which are obtained from the moments based feature approach.
In other words it is an attempt to prune further the images are emerged from the first approach.
This has portrayed an interesting results and attempted to pruned accurately which are exactly relevant to query image.

References

1. Arandjelovic.O and Zisserman .A, proceeding IEEE Computer society conference on computer vision and pattern recognition CVPR 05 1063-6919/05, pp.2, 2005.
2. Breiman.L, Friedman.J, Olshen.R, and Stone.C, Classification and Regression Trees, Chapman and Hall, 1993.
3. Bonet.J.De, and Viola.P, Structure driven image database retrieval, Proc. Of Neural Information processing systems, Vol.10, Denver, Co, 1997.
4. Barrett.W.A, A survey of face recognition algorithms and testing results, Systems and Computers, 1998.
5. Berg.T.L, Berg.A.C, Edwards.J, Maire.M, White.R, Y.W, The E.Learned Miller, and D.A. Forsyth, Name and faces in the news, CVPR, 2004.
6. Burges.C.J.C, A tutorial on support vector machines for pattern recognition, DMKD, 2(20, 1998).
7. Cristinacce.D, and Cootes, A multistage approach to facial feature detection, BMVC, 2004.
8. Cheng.Y, Mean shift, mode seeking, and clustering, PAMI, 17(8): 790-799, Augest 1995.
9. Chen.Y, Wang.J, and Krovetz.R, CLUE: Cluster based retrieval of images by unsupervised learning ,IP, 14(8):1187-1201, Augert 2005.
10. Dobie.M, Transley.R, A flexible architecture for content and concept based multimedia information Exploration, Challenge of image retrieval, New castle, 1998.
11. Duda.R, and Hart.P, Pattern Classification and Science Analysis, John Wiley and Sons, 1973.
12. Devroye.L, A Probabilistic theory of pattern recognition springer verlag ,1996.
13. Dempster.A, Laird.N, and Rubin.D, Maximum likelihood from incomplete Data via the EM algorithm, Roy.J, Statist, soc, Vol, B-39, 1997.
14. Everingham and Zisserman, Automated person identification in video, CIVR, 2004.
15. Eakins and Grahams, Content based image retrieval; Areport to the technology applications program, New castle, Image data research university of Northumbria, 1999.
16. Eakins.J.P, and Grahams.M.E, Evaluation of a trademark retrieval system, in 19th BCS IRSG Research Colloquium on information retrieval, Robert Gordon University, Aberdeen, electronic Workshops in Computing, 1997.
17. Flickner.M, Query by image and video content :The QBIC system, IEEE computer 28(9), 23-32, 1995.
18. Foskett.D.J, Thesaurus, Reading in information retrieval, Jones.K.S, and Willet, Morgan Kaufmann publishers:111-134, 1997.
19. Fitzgibbon and Zisserman, on affine invariant Clustering and automatic cast listing in movies, ECCV, 2002.
20. Felzenszwalb .P.F, and Huttenlocher.D, Pictorial structures for object recognition , IJCV,61910, 2005.
21. Ferrari.R.J, Analysis of Asymmetry in Mammograms via Directional Filtering with Gobar Wavelets, IELiE Transaction, on Medical imaging, Vol. 20, No.9, pp.953-964, September 2001.
22. Forsyth.D, Blei.D, and Jordan.M.L, Body plans, proceeding of IEEE conference on computer Vision and pattern Recognition, pages 678-685, 1997.
23. Gupta, The visage image search engine : An open frame work for Image management in storage and Retrieval for Image and video database IV.proc, SPIE 2670,pp.76-87, 1996.
24. Gray.R, Probability, Random processes, and Erodic properties, New York: Springer, Verlag, 1998.
25. Grgic.M, Grgic.S, Ghanbari.M, Application of Gabor Filters for Efficient Image Representation, Proceedings of the 8th international Workshop on system, Signals and Image processing, IWSSIP, Ihcharest, Romania, pp.43-46, 2001.
26. Gersho.A, and Gray.R, Vector Quantization and signal compression, Boston:Kluwer, 1992.
27. Gudivada .V.N, and Raghavan.V.V, Content based image retrieval systems IEEE computer 28(9), pp 18-22, 1995a.
28. Haralick.R.M, Shanmugam.K, and Dinstein.I, Texture feature for image classification, IEEE Transactions.SMC, Nov 1973.
29. Hu.M.K, Visual pattern recognition by moment invariants IRE transactions information Theory 8, 1962.
30. 30.Iqbal and Aggarwal, Applying perceptual grouping to content base image retrieval :Building images proc. IEEE CVPR, 99, pp 42-48, 1999.
31. .Zhou, rai, and huangs and M. R. Zachariah ... Proceedings of the Combustion Institute, 31**, 675**-683 (2007);
32. .Zhang et al 2003,
33. wang et al 2002,
34. csillagly et al 2000,
35. painter et al 2003,
36. schodr et al, A statistical approach to 3D object detection applied to faces and cars, PhD thesis, Robotics institute, Carnegie Mellon university, 2000
37. Ravela & manmatha, 1998b
38. .sudhir et al 1998,
39. saur et al , Automated analysis and annotation of bas

ketball video in storage and retrieval for image and video database V proc SPIE 3022, pp. 176-187, 1997
40. wactler et al 1996
41. Biedermen 1987
42. salton 1971,
43. price et al 1992,
44. chang 1997b ,
45. .rui et al 1998] .
46. Smith & chang 1997b,
47. Rui et al 1998
48. kata 1992
49. Wu et al , 1996 & ARTISAN from the university of Northumbia at New castle
50. UK[Eakins et al 1998
51. aigrain et al 2006
52. .ruie et al 1999
53. smeulders et al 2000
54. snock & worrying 2005

E.E.C.E:-5

DESIGN OF A WIDE BANDWIDTH RADIATING ELEMENT FOR SAR ANTENNA

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Abstract : In this paper a design of a microstrip wide bandwidth radiating element for Synthetic Aperture Radar (SAR) antenna at Ku band and design of an 8X8 array is reported. A microstrip stacked patch configuration is employed to provide the required bandwidth of 2GHz at Ku band. An 8X8 array using the stacked patch is designed, fabricated and measured to assess the performance.

1. Introduction: The commonly used antenna for SAR applications are slotted array, patch antenna and horn fed parabolic reflector. The type of antenna is decided based on factors such as bandwidth, efficiency, side lobe levels, weight, size and mounting aspects. Slotted array is popular because of its high power handling capability, but is limited by its narrow bandwidth. Parabolic reflectors have large volume. Microstrip radiators on the other hand are easy to manufacture, have low profile and techniques to achieve wide bandwidth can be employed. A wide bandwidth is essential in SAR application to enhance the imaging ability and target resolution capability.

1.1 Microstrip stacked patch and choice of substrate: The choice of radiating element for an array is based on the requirement of frequency bandwidth, good radiation patterns in E and H plane with low cross polarization levels and low mutual coupling for realizing low side lobe pattern. A microstrip stacked patch is considered owing to its broad bandwidth and radiation performance.

The choice of substrate is crucial to the radiating element design. The possibility of surface wave excitation exists with higher thickness and high dielectrics, smaller bandwidth and lower efficiencies results from higher dielectric constant material. Spurious radiation from feed line is also required to be avoided. Therefore a RT-Duroid 5880 dielectric substrate with dielectric constant 2.2 is used to realize the radiating element. Figure 1 illustrates the stacked microstrip patch.

Figure 1 illustrates the stacked microstrip patch

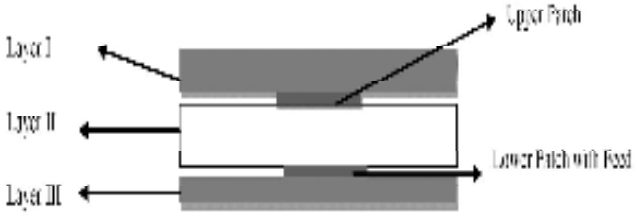


Fig 1. Microstrip Stacked Patch

The stacked patch is a multilayer configuration. The upper patch is electromagnetically coupled by the lower patch which also contains the microstrip feed. The upper patch is etched in a 20 mil substrate while the lower patch and feed is etched in a 10 mil substrate. In order to achieve the desired bandwidth, an air gap at layer II of 0.08λ is used between the two patch layers.

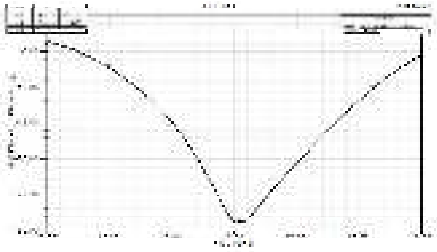


Fig 2 Simulated Reflection Coefficient

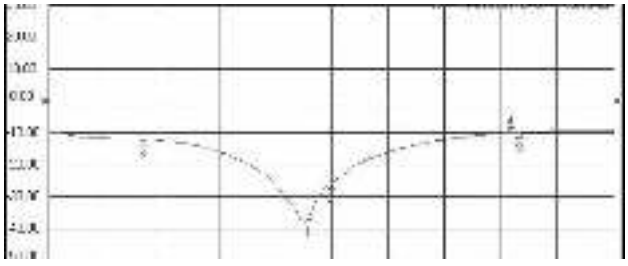


Fig 3 Measured Reflection Coefficients

2 Design of an 8X8 array

Feed radiation in microstrip array is an important issue that needs to be addressed and controlled by the antenna designer. Since the stacked patch microstrip radiating element reported in this paper consists of feed in Layer III which also consists of a patch, we have designed an 8X8 array with 27dB sidelobe level with Taylor nbar = 5.

A corporate feed network was designed; optimized and simulated using ADS 2006.The optimized power divider was integrated with the lower patch of the stacked microstrip configuration.

Figure 4 illustrates the 8X8 array and Fig 5 illustrates the measured reflection coefficient for the 8X8 array.

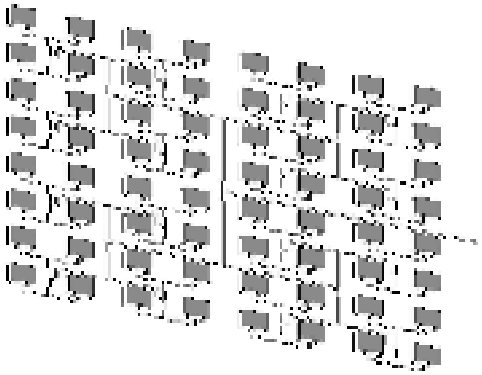
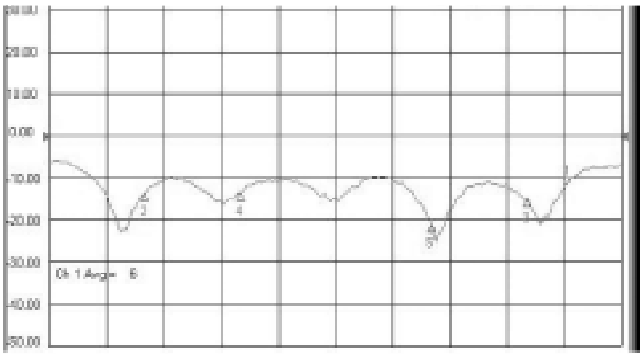


Fig 4 8X8 array



fo-1.0 GHz fo GHz fo+1.0 GHz

The radiation pattern was measured at the frequencies of interest and it was observed that the stacked microstrip patch configuration also satisfied the pattern bandwidth requirement. Figure 6 and 7 illustrates the measured E and H-radiation pattern at the centre frequency fo.

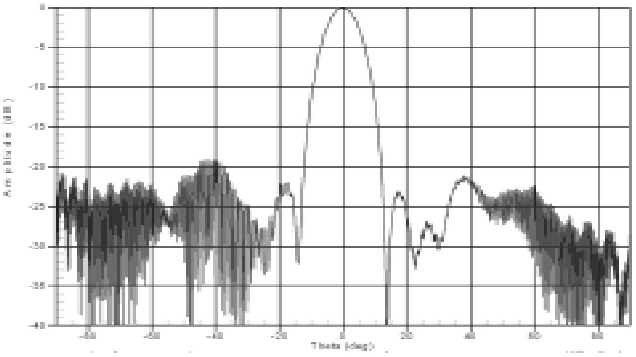


Fig. 6 E-plane pattern at the centre frequency

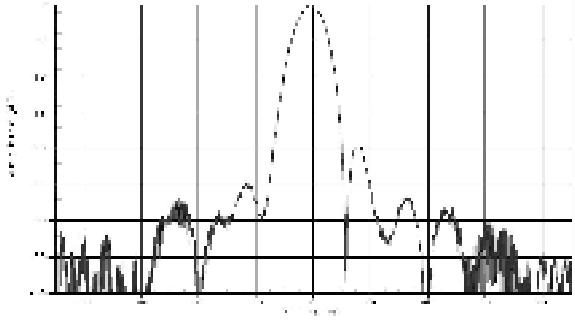


Fig.7 H-plane pattern at the centre frequency

Conclusion

It may be concluded that a stacked microstrip patch offers good impedance and pattern bandwidth and can be considered as potential wide bandwidth element. The wide bandwidth radiating element finds application in SAR antenna array where a wide bandwidth is one among one of the critical performance criteria.

Bibliography

1. R.Q. Lee, K.F. Lee, J. Bobinchak, 'Characteristics of a two-layer electromagnetically coupled rectangular patch antenna', *Electronics Letter,* 24th September 1987, Vol. 23, No. 20, pp 1070 – 1072

2. WenWen Chai, Xiaojaun Zhang, Jibang Liu, 'A novel wideband antenna design using U-slot', *PIERS Online,* 2007, Vol. 3, No. 7, pp 1067 – 1070

3. D.M Pozar, B. Kaufman, 'Increasing the bandwidth of a microstrip antenna by proximity coupling', *Electronics Letter,* 9th April 1987, Vol. 23, No. 8, pp 368 – 369

4. Wonkyu Choi, Yong Heui Cho, Cheol-Sik Pyo, Jae-Ick Choi, 'A high-gain microstrip patch array antenna using a superstrate layer', *ETRI Journal,* October 2003, Vol. 25, No. 5, pp 407-410

E.E.C.E:-6

AIRBORNE COMMUNICATION COMPUTER (ACC) – FAULT TOLERANT DESIGN APPROACH FOR UAV APPLICATIONS

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ABSTRACT: UAVs are considered as essential force multipliers in the defence strategy in every country. They are increasingly being used to carry out the high risk tasks of reconnaissance, surveillance and intelligence collection in combat situations other roles like monitoring of disaster sites and dangerous areas, search and rescue missions, patrolling of specified areas. In India, among the various Defence Research and Development Organisations (DRDO) Aeronautical Development Establishment (ADE) is tasked with the development of indigenous UAV systems for the armed forces. The various classes of ADE UAV's include Nishant-tactical UAVs, Lakshya - Aerial Target System, Rustom - Medium Altitude Long Endurance (MALE) UAVs . A typical UAV deployment architecture involves a user friendly Ground Control Station and the Unmanned aerial vehicle housed with sophisticated airborne processors to handle the communication, digital flight control and navigation as well as very reliable data links.

The Airborne Communication Computer (ACC) handles the communication between Ground Control Station and UAV. It also helps to communicate with the various avionics equipment on board the UAV including the Flight Control Computer (FCC). The commands to control the UAV will be received by the processor and validated for errors if any, and the response will be obtained. Similarly the telemetered information is sent to the Ground control Station. The Airborne Communication Computer (ACC) was based on the Motorola MPC 860 Communication Processor. The MPC 860 is a PowerPC architecture-based Quad Integrated Communications Controller (PowerQUICC). It is a versatile one-chip integrated 32 bit microprocessor and peripheral combination (dual core architecture) that can be used in high intensive communication applications.

Fault tolerant computing is the science of building computing systems that continue to operate satisfactorily even in the presence of faults. Incorporation of redundancy management techniques in Airborne Communication Computer (ACC) System will address the reliability issues giving good fault coverage, which is essential for a safety critical long endurance UAVs. A dual processor configuration has been used for ongoing MALE (Medium altitude Long Endurance) UAVs. This paper brings out in detail the challenges in building airborne Communication Computer, overall system architecture, implementation of various Hardware and software fault tolerant features. This paper also describes the reliability study that has been carried out on the realized system.

Keywords: ACC - Airborne Communication Computer, FCC - Flight Control Computer GCS- Ground Control Station LRU- Line Replaceable Unit

Introduction: UAV's are considered essential force multipliers in the defence strategy in every country. They are increasingly being used to carry out the high risk tasks of reconnaissance, surveillance and intelligence collection in combat situations. In India, among the various Defence Research and Development Organizations (DRDO) Aeronautical Development Establishment (ADE) is tasked with the development of indigenous UAV systems for the armed forces. The various classes of ADE UAV's include Nishant- tactical UAVs, Lakshya - Aerial Target System, Medium Altitude Long Endurance (MALE) UAVs. A typical UAV deployment architecture involves a user friendly Ground Control Station and the unmanned aerial vehicle housed with sophisticated airborne processors to handle the communication, digital flight control and navigation as well as very reliable data links. The overall architecture of the UAV systems shown in Figure 1.The ACC is an important subsystem of UAV which directly communicates from Ground Control Station (GCS).



Fig 1. UAV System Architecture

This paper brings out in detail the challenges in building airborne Communication Computer, overall system architecture, implementation of various Hardware and software fault tolerant features. This paper also describes the reliability study that has been carried out on the realized system.

2. Organization of the UAV Communication

The schematic of command / telemetry data flow is depicted in fig2. The commands originated from Air vehicle Operator (AVOP) for air vehicle operations, Electro Optic Payload operator for payload operations, are serialized using Ground communication processor and transmitted from Ground control Station over RF link. ACC is the first avionic subsystem that handles the entire communication. It has to carry out functions namely decoding and encoding as per telemetry standards. The ACC receives uplink command Stream in IRIG 106 format through the on-board RF packages at a fixed Clock rate . The ACC also gets data pertaining to Mission planning

/ Waypoint program in the same serial link. The uplink commands that are sent from GCS to the air vehicle can be classified as proportional commands, discrete commands and messages. Pitch, Roll, and Throttle are some of the proportional commands originating from the Airvehicle Operator command panel. . The commands activated will have its response in the actuators or sensors through Flight Control Computer.
The ACC as encoder is required to receive data from various on- board subsystems over different types of interfaces, serialize these data in IRIG 106 PCM format to transmit downlink for the operational telemetry which is required to display data information related to flight, navigation and payload information to GCS.

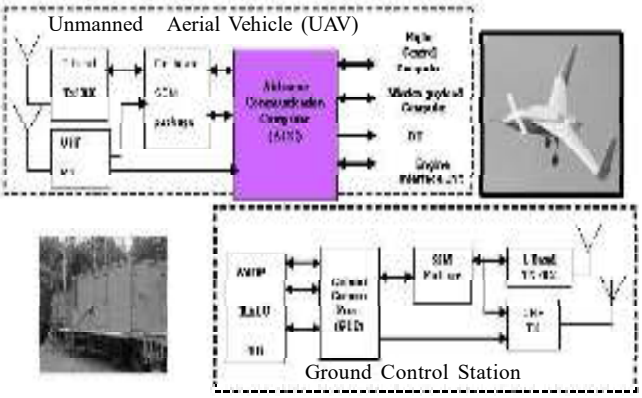


Fig 2. Schematic of Command Telemetry Data Flow

4. Challenges in Building Airborne Communication Computer (ACC):
The ever - increasing complexity and high performance communication requirements of avionics system have resulted in a enormous processing load on the Airborne processors. Designing Airborne Computer has always been a challenge. The system designer has to address issues related to performance, environmental conditions, packaging techniques to achieve less volume / weight and Reliability. The Airborne Communication Computer (ACC) meant for UAV's as a Hardware is expected to have long service life in a variety of hostile environments such as large temperature range of operation, high vibration, high humidity/salt conditions.

4.1 Functional Challenges:
- Dual channel Decoding to achieve redundant link during conventional take off and landing
- Identification of bi-sync words which is the sync word added along with data word at the beginning of every transmission frame from GCS
- Validation of link Status from UHF and C band links
- Error detection and correction capability
- Identifying the parameter based on the time sequence and distribution of the assembled data to required destinations like Flight Control Processor, Payload Processor etc
- Link loss detection and intimation to the other subsystems in the form of command loss.
- Health monitoring of the entire system at the background etc.

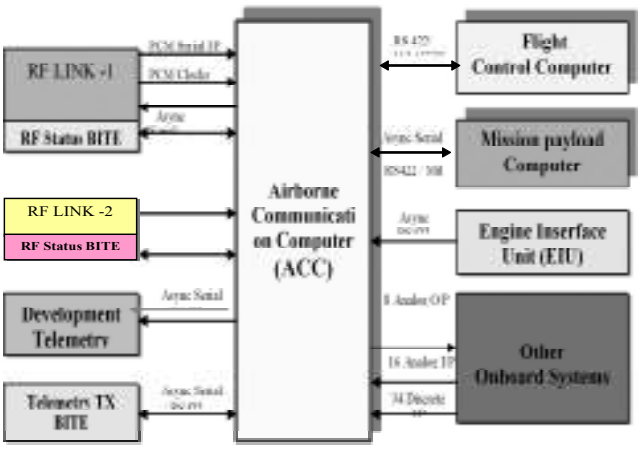


FIG 3 : ACC Interface with other LRUs

4.2 Interface Challenges: ACC should handle various types of interfaces like
Synchronous Serial Interface, Asynchronous Serial Interface, Analog input/Outputs, Digital Input/Output,
Dual Port RAM (DPRAM), Mil 1553B Interface .The block diagram of the ACC system interface with other LRUs is shown in Figure 3.

4.3 Communication Challenges
In UAV communication the error can happen if
- RF system failure occurs anytime during transmission
- Uplink and Downlink failure occurs independently
- In all the above error prone situations the UAV has to handle communication in much robust way with necessary Error coding techniques like Backward Error Correction (BEC) and Forward Error correction(FEC).

4.4 Hardware Technology Challenges for avionics systems:
Any avionic equipment fitted to aircraft has to meet a series of rigorous design constraints. Airworthiness and certification is one of the time consuming difficult aspects of building any avionics system. Avionics systems must be designed to be highly reliable with large MTBF (Mean time between failures) that will operate in different environments. Critical design considerations include selection of device to undergo hostile environment conditions, packaging issues to achieve less volume/weight. Temperature, Vibration and Electromagnetic Compatibility (EMC) as per MIL STD System Safety, Quality and Reliability are the factors to be viewed seriously. All these critical functional challenges, Interface challenges, communication challenges, necessitate a powerful ACC architecture which is a processor based system. The system being processor based, provides flexibility in link protocol for change of parameters such as clock rate, frame length, sync word, incorporation of error correction, addition/ deletion of channels etc. Many hardware functional modules and peripheral ICs form part of the ACC system.

6. Overview of ACC Architecture

The Block diagram of ACC based on MPC860 MPU is shown in fig (4). The ACC hardware incorporates 64 Mbit Flash EPROM for program storage, 4MB SRAM, QUAD Universal Asynchronous Receiver Transmitter (UART) , Analog to Digital Converters (ADC) , Digital to Analog Converter (DAC) and Discrete I/O devices and various level converters for interface with other LRUs on – board.

CPU: Heart of the ACC is the CPU MPC860 EN. It is highly integrated 32 bit RISC Architecture having powerful serial communication controller chipset. The on-chip oscillator of the MPC 860 generates various internal as well as external timing signals required for the processor functioning. The external oscillator input is 4 MHZ which is multiplied internally to generate 66 MHz frequency for MPU operation. It is a versatile one-chip integrated 32 bit microprocessor and peripheral combination (dual core architecture) so called Communication Processor Module (CPM).

CPM: The Communication Processor Module (CPM) offloads the core for low level protocols. The (CPM) itself is a 32 bit RISC and a program ROM. It has 4 Serial communication controllers (SCC), Serial management Controllers (SMC), Serial Peripheral Interface (SPI), and Inter Integrated circuit (I2C). The core and the CPM work together to handle all the protocols and they use dual port RAM as internal memory space for inter co-ordination. **Multi byte buffer reception** is more efficient and challenging method adopted to achieve reception. The on-chip QUICC achieves error free encoding and decoding to have error less response of the initiated commands to the flight control system otherwise the wrong commands will have repercussions on the UAV which is unacceptable. This method of reception is well exploited and implemented in UAV communication

Among the four Serial Communication Controller (SCC's), two are required to be used for uplink and downlink PCM channels (synchronous bisync protocol).The third SCC is being used to handle UHF uplink and downlink which is considered as redundant data link of UAV. Two SMCs on-chip CPU will be programmed in UART mode, to provide two full duplex serial interfaces with EO Payload system and Ground Console for testing. CPM block is in shown in fig 5.

6.1 ACC FEATURES:

- Back-Ground Debug(BDM) mode for Software Debugs
- On chip break points and check stop interrupt capability
- In-Circuit Downloads using BDM
- Flash (4MB) and RAM(1MB) for higher throughput
- Quad-UART with 64 byte TX and RX queue to simplify the processor of data acquisition task
- External Watchdog based on independent clock source
- Dedicated Analog and Discrete Wraps for Continuous Built in Test (BIT).
- Dedicated Discrete I/O for Continuous Built InT est. (CBIT).

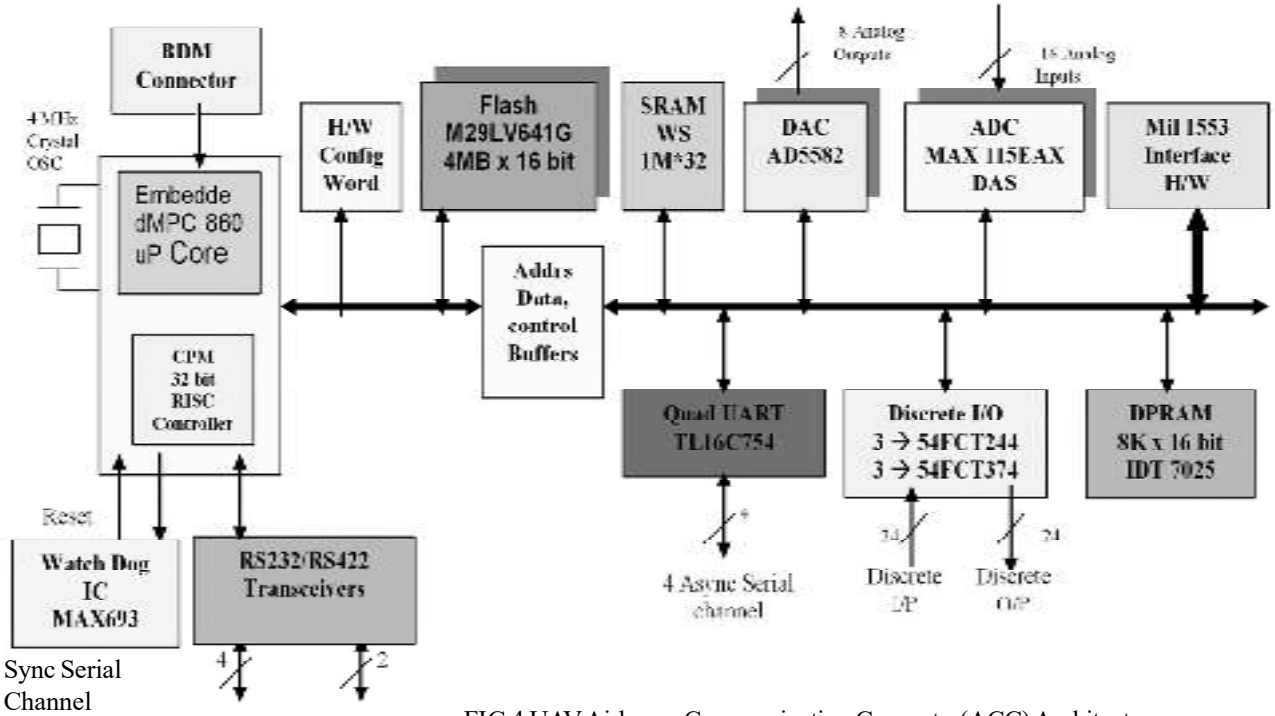


FIG 4 UAV Airborne Communication Computer(ACC) Architecture.

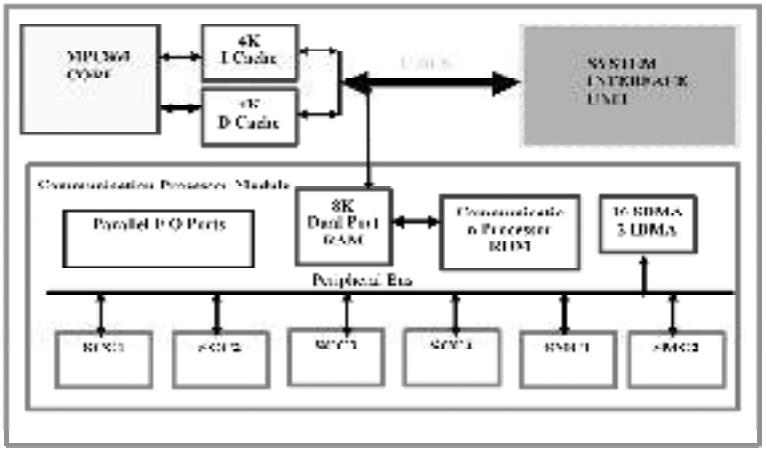


Fig 5 Block Diagram of CPM

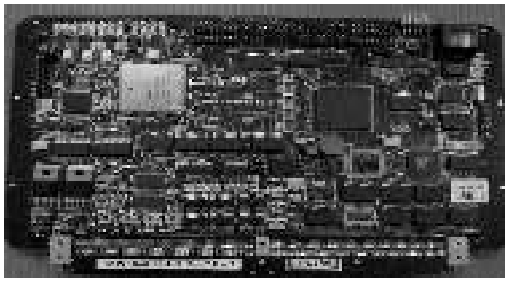
7. Hardware Realisation:

The challenges in Hardware design process includes finalisation of types of interfaces, Selection of Suitable Microprocessor and other peripheral devices to suit airborne need, Timing analysis of major peripherals with Processor, Driving capability analysis, Block Schematic level design and Detailed component level design , Validation of the design before layout and fabrication, Signal integrity analysis and finally fabrication and testing. The important factor in the processor based design is the Timing analysis where worst Case variation in timing is carried out for the major slow peripherals to match with high speed processor's Data Setup time and Hold time. In this design a detailed analysis has been carried out and accordingly wait states have been introduced.

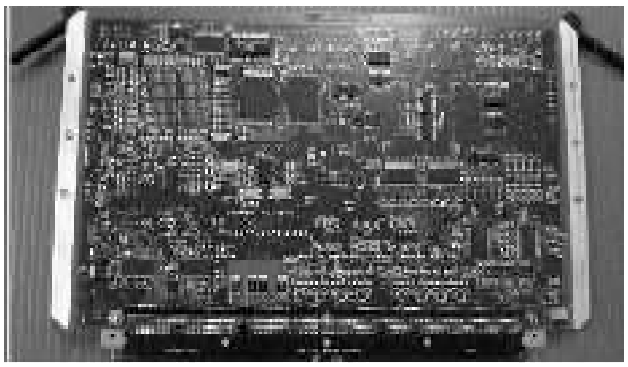
The challenges in software development includes Dual channel Decoding, Sync detection and healthy stream selection, Sub frame detection/ identification, checking the consistency of the data, error detection and correction capability, data decoding, Data distribution, Link loss Detection and intimation to other subsystems, Health monitoring of the entire system at the background etc.

The hardware software interface that facilitates communication between the components was developed using Code warrior Development Studio using the C language.

Taking into account of all requirements the hardware which is fully functional and meets the requirement is realized. The realized hardware is a 10 layer PCB of Size 208*138.5 mm with all SMD components densely populated on both the sides .



ACC TOP VIEW



ACC BOTTOM VIEW

8. FAULT TOLERANT BASED DESIGN FOR MALE UAV

Fault tolerant computing is the science of building computing systems that continue to operate satisfactorily in the presence of faults. Incorporation of redundancy management techniques and fault tolerance computing (FTC) implementation in ACC System will address the reliability issues giving good fault coverage, which is essential for a safety critical long endurance UAVs.

8.1 Definition of terminologies [2]:

- Fault: A defect in Hardware device or component for Ex. Short Circuit or broken wire
- Failure: The inability of a system or component to perform its required functions within specified performance requirements.
- MTBF: The expected or observed time between consecutive failures in a system

8.2 Fault tolerant Design Approaches:

To tolerate faults the system should have one of these capabilities.

1. Mechanism of detection & diagnosis of defects
2. Recovery techniques to restore the correct system after the fault is detected
3. Repair mechanisms to restore the correct system functionality for future computation.

4. Redundant Hardware usage is also one of the methods.

8.3 Fault Tolerant Multiprocessor (FTMP) configuration:
Many applications require very high availability but can tolerate an occasional error or
very short delays (on the order of a few seconds), while error recovery is taking place. Hardware designs for these systems are often considerably less expensive than those used for ultra dependable real-time computers. Computers of this type often use duplex designs. This is the approach named Fault Tolerant multiprocessor (FTMP) is followed in duplex ACC based system. The redundancy logics are realized in Interface card.
The FTMP is a computer architecture described as number of processor modules interconnected by redundant serial buses. The intended use of the FTMP is to support critical communication and control functions in air vehicles where reliability is ensured. To realize the multi-processor configuration two ACCs are realized in a single LRU with various handshaking between them by means of exchanging the health status with each other. The failure of ACC1 will make the ACC2 to be master and vice versa for long endurance situations.

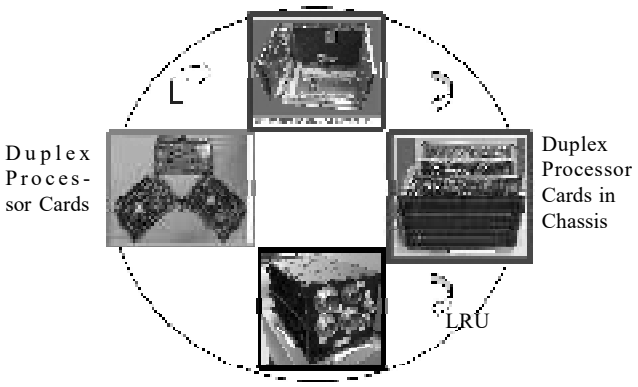


FIG 6 FTMP Architecture Based ACC LRU Realization

9. Reliability Study on the Realized Design:
One of the most difficult tasks in the design of a fault-tolerant machine is to verify that it will meet its reliability requirements. This has been carried out by creating number of failures and repeated tests.It is then necessary to determine how well the fault tolerance mechanisms work by fault simulations. The redundancy logics have been evaluated by giving the various fault stimuli and validated.

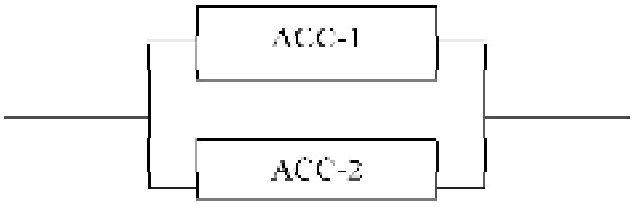


FIG 7 Parallel architecture

9.1 Reliability Measurement for adopted Parallel architecture based ACC System:

Redundancy is measured as $R(t) = e^{-\lambda t}$

where $\lambda = 1/MTBF$, is the Failures Per Million Flight Hours (FPMFH) and

't' is flight time in hours.

$$Q(t) = 1 - R(t)$$

The Unreliability (Q) is calculated considering the and parallel FTMF approach as below

R sys = 1- Q1* Q2
= 1- (1-R1) (1-R2)
= 1- (1-R)*(1-R) since R1=R2 in this case
MTBF= integral (1-(1-R)* (1-R))
= 3/2 MTBF(i) (MTBF of individual)

This clearly brings out that the MTBF of Parallel redundant system is increased by 1.5 times than non redundant system. Hence the FTMF based duplex system definitely improves the reliability than the simplex system

10. Conclusion: Fault-tolerance techniques are important for safety critical long endurance operations The Airborne Communication Computer (ACC) is an important element in UAV data link which needs to be operational till the end of the mission. Fault-tolerance of ACC is achieved by Hardware design techniques to create systems with improved reliability. This approach is well exploited in Long Endurance UAV applications. The duplex configuration based ACC improves the reliability by giving good fault coverage, which is essential for a safety critical long endurance UAVs.

Acknowledgements:
I am Thankful to Shri P.S. Krishnan Director, Distinguished Scientist ADE, and Bangalore for permission to publish this work. The technical discussions with Shri.G.Natarajan, Assoicate Director (AD) Shri.R.Mathaiyan, Shri.D.Bose, Shri Santos Kumar Singh Shri. K.Srikantha, were useful to publish this work.

References:

1. MPC 860 Power QUICC Family User's Manual
2. IEEE standard 610.12-1990 IEEE standards Glossary of Software Engineering
. IEEExplore.com
4. Fault Tolerant Computing Victor P.Nelson and Bill D.Carroll

E.E.C.E:-7

BRAIN GATE DESCRIPTION

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INRODUCTION: neuroprosthetic device known as Brain gate converts brain activity in to computer commands. A sensor is implanted on the brain, and electrodes are hooked up to wires that travel to a pedestal on the scalp. From there, a fiber optic cable carries that brain activity data to a near by computer.

The brain is "hardwired" with connections, which are made by billions of neurons that make electricity when ever they are simulated.The electrical patterns are called brain waves.Neurons act like the wires and gates in a computer.

Brain controls motor function.Motor neurons carry a signals from the central nervous system to the muscles,skin and glands of the body,while sensory neurons carry signals from those outer parts of the body to the central nervous system.

A technique called neurofeedback uses connecting sensors on the scalp to translate brain waves in to information a person can learn from.

The sensors register different frequencies of the signals produced in the brain.These changes in the brain wave patterns indicatr whether someone is concentrating or suppressing his impulses,or whether he is relaxed or tense.

* A brain –comput1er interface(BCI),some times called a direct neural interface or a brain-machine interface,is a direct communication pathway between a human or animal brain(or brain cell culture)and an external device.In one way BCIs,computer either accept commands from the brain or send signals to it(for example,to restore vision)but not both.Two-way BCIs would allow brains and external devices to exchange information in both diregtions but have yet to be successfully implanted in animals or humans.

* In this definition, the word brain means the brain or nervous system of an organile life form rather than the mind.computer means any processing or computational devices, from simple circuits to silicon chips .

* Brain gate is a brain implant system developed by a biotech company cyberkinetics in 2003 in conjunction with the department of neuroscience at brown university.The device was designed to help those who have lost control of their limps,or other bodily functions, such as patients with amyotrophic lateral sclerosis(ALS)or spinal cord injury. The computer chip,which was implanted in to the brain,monitors brain activity in the patient and converts the intention of the user in to the computer commands.

* Brain gate depends upon the cyberkinetics.In addition to real-time analysis of neurons patterns to relay movement,the brain gate array is also capable of recording electrical data for later analysis.A potential use of this feature would be for a neurologist to study seizure patterns in a patient with epilepsy.Brain gate is currently recruiting patients with a range of neuromuscular and neurodegenerative conditions for pilot clinical trials in united states.

BRAIN-COMPUTER INTERFACE (or) DIRED NEURAL INTERFACE.: A brain-computer interface (BCI),sometimes called a direct neural interface or a brain-machine interface,is a direct communication pathway between a human or animal brain and an external device.

In this definition, the word brai means the brain or nervous system of an organic life form rather than the mind.computer means any processing or computational device,from simple circuits to silicon chips.

Following years of animal expermentation,early working implants in humans now exist,designed to restore damaged hearing,sight and movement.

CLINICAL TRIALS: Partenering with leadind rehabilition centers in Boston ,Chicago and providence.

Cyberkinetics is currently recruiting patients to enroll ina pilot clinical trials of the neural interface system.

The braingate system is designed to provide a means for people with severe most impairement a new method to communicate with a computer directly with their investigational device,the brain gate system is only offered through the clinical commercially available.

The disclaimer in clinical trials are the U.S food and drug administration(FDA)has not approved the brain gate non interface system for general use

The brain gate system is an investigational device in the United states,and is uni status.

RESEARCH PRODUCT: Cyberkinetics neurotechnology systems provides turn-key solutions for neuroscience researchers invested in recording neural signals from populations of neurons over a long period of time. Their solutions include Multi electrode array ,the cerebus 128 channel data acquisition system,and a surgical training program.

A team of neuroscientists had implanted a chip in to the brain of a quadriplegic man,allowing him to control a computer has been able to check email and play computer games simply using thoughts. He can also turn lights on and off and control a television, all while talking and moving his head.

The chip called Brain gate,is being developed by Massachusetts-based neurotechnology company cyberkinetics.

Platform Technology: Neurons are cells that use a language of electrical impulses to communicate messages from the brain to the rest of the body. At Cyberkinetics, we have the technology to sense, transmit, analyze and apply the language of neurons. We are developing products to restore function, as well as to monitor, detect, and respond to a variety of neurological diseases and disor

ders.

Cyberkinetics offers a systems approach with a core technology to sense, transmit, analyze and apply the language of neurons in both short and long-term settings. Our platform technology is based on the results of several years of research and development at premier a institutions such as Brown University, the Massachusetts Institute of Technology University, and the University of Utah.

Sense: Cyberkinetics' unique technology is able to simultaneously sense the electrical a many individual neurons. Our sensor consists of a silicon array about the size of aspirin that contains one hundred electrodes, each thinner than a human hair. T implanted on the surface of the brain. In the BrainGate Neural Interface System is implanted in the area of the brain responsible for limb movement. In other aparry may be implanted in areas of the brain responsible for other body processes

Transmit and Analyze: The human brain is super computer with the ability to instantaneously process of information. Cyberkinetics' technology allows for an extensive amount of elec data to be transmitted from neurons in the brain to computers for analysis. In Brain Gate™ System, a bundle consisting of one hundred gold wires connects the pedestal which extends through the scalp. The pedestal is connected by an extert set of computers in which the data can be stored for offline analysis or analyze Signal processing software algorithms analyze the electrical activity of neurons and translate it into control signals for use in various computer based applications.

Brain Chip: Brain Gate offers the possibility of hitherto unimaginable levels of independence for the severely disabled. Although many are able to control computers with their eyes or tongue such techniques remain dependent on muscular function and require extensive training. The ultimate goal is to develop the Brain Gate System so that it can be linked to many useful devices, "said Donoghuc, who this month received an innovation award from Discover Magazine for his work on Brain Gate. " I his includes medical devices such as muscle stimulators, to give the physically disabled a significant improvement in their ability to interact with the world." The four-millimeter square chip, which is placed on the surface of the motor cortex area of the brain, contains 100 electrodes each thinner than a hair which detect neural electrical activity. The sensor is then connected to a computer via a small wire attached to a pedestal mounted on the skull. "We now have early evidence that a person unable to move their arms hands and legs can quickly gain control of a system which uses thoughts to control a computer and perform meaningful tasks. With additional development this may represent a significant breakthrough for people with severe disabilities". They have a research participant who is capable of controlling his environment by thought alone-something we have only found in science fiction so far," said triehs. They hope that the trial will continue as successfully as it has started and that all other candidates will have as great an experience as our first candidate did."

Communication with the body: Muscles in the body's limbs contain embedded sensors called muscle spindles that measure the length and speed of the muscles as they stretch and contract as you move other sensors in the skin respond to stretching and pressure. Even if paralysis or disease damages the part of the brain that process movement, the brain still makes neural signals. They're just not being sent to the arms, hands and legs.

A technique called neuro feedback uses connecting sensors on the scalp to translate brain waves in to information a person can learn from. The sensors register different frequencies of the signals produced in the brain. These changes in brain wave patterns indicate whether some one is concentrating or suppressing his impulses or whether he is relaxed or tense.

Features: Brain Gate is a brain implant system developed by the bio-tech company Cyber kinetics in 2003 in conjunction with the department of Neuroscience at Brown University. The device was designed to help those who have lost control of their limbs, or other bodily functions, such as patients with amyotrophic lateral sclerosis (ALS) or spinal cord injury. The computer chip, which is implanted into the brain, monitors brain activity in the patient and converts the intention of the user into computer commands.

Currently the chip uses 100 hair-thin electrodes that sense the electromagnetic signature of neurons firing in specific areas of the brain, for example, the area that controls arm movement. The activity is translated into electrically charged signals and are then sent and decoded using a program, which can move either a robotic arm or a computer cursor. According to the Cyberkinetics' website, three patients have been implanted with the Brain Gate system. The company has confirmed that one patient (Matt Nagle) has a spinal cord injury, whilst another has advanced ALS.

Advantages: The brain crate system is based on cyber kinetics platform technology to sense, transmit analyze and apply the language of neurons.

The Brain Gate Neural Interface System is being designed to one day allow the interface with a computer and / or even faster than, what is possible with the hands of a person. The Brain Gate System may offer substantial improvement over existing technologies.

Currently available assistive device has significant limitations for both the pers and caregiver. For example, even simple switches must be adjusted frequent that can be time consuming. In addition, these devices are often obtrusive and user from being able to simultaneously use the device and at the same time contact or carry on conversations with others.

Potential advantages of the Brain Gate System over other

muscle driven or brain computer interface approaches include : its potential to interface with a compute weeks or months of training; its potential to be used in an interactive environment user's ability to operate the device is not affected by their speech, eye movement noise; and the ability to provide significantly more usefulness and utility than other approaches by connecting directly to the part of the brain that controls hand gestures.

Disadvantages: The U.S. Food and Drug Administration (FDA) has not approved the Brain Gate Non Interface System for general use.

The Brain Gate System is an investigational device in the United States, and is status (Investigational Device Exemption). In the United States, this investigate can only be used in pre-marketing clinical trials approved by the FDA.

Conclusion: Cyber kinetics is further developing the Brain Gate system to potentially provide I movement to people with severe motor disabilities. The goal of this development would be to allow these individuals to one day use their own arms and hands are movement developments are currently at the research stage and are not available with the existing Brain Gate System. In addition Cyber kinetics is developing product for robotic control, such as a thought-controlled wheel chair.

In the future, the Brain Gate System could be used by those individuals whose in severe. Next generation products may be able to provide an individual with the control device that allow breathing, bladder and bowel movements.

BIBLIOGRAPHY

1. WWW.CYBERKINETICS. COM
2. WWW.USCLA.COM
3. WWW.GOOGLE.COM
4. WWW.BIOMEDBROWN.COM

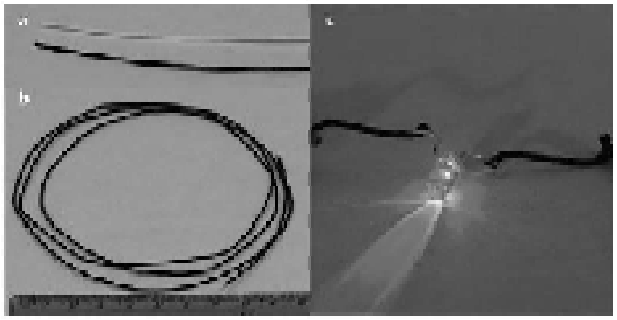
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E-TEXTILES

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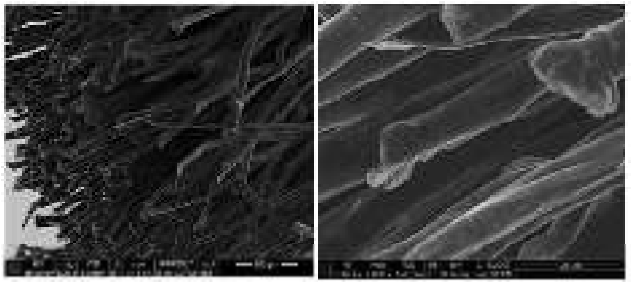
INTRODUCTION: Electronics textile or e textile belongs to the category of newly emerging discipline in the field of research which combines specialists in respective discipline of information technology, Microsystems, materials and textiles. The emphasis of this upcoming area is aimed at developing the enabling technologies and fabrication techniques for the economical production of large area and conformable information systems which are estimated to have multiple applications in both consumer electronics and military industries E-Textiles are most likely to generate a considerable body of research which will have far reaching implications in our everyday life, consumer market and multiple applications .It requires remote sensing, processing and actuation. E-Textile will throw new challenges for hardware and software system developers due to its unique and individualistic requirements. Small electronic devices like PDAs and cell phones have made significant contribution in changing our day-to-day life for the past few years. Electronics textile or e- textile aims by establishing a routine structure in textiles by using standard printed wiring board. The emphasis of e-textile will be on creating a woven textile with embedded copper wires which will provide the usual wear comfort and at the same time.

TECHNOLOGY BEHIND E-TEXTILES: Nanotechnology e-textiles for biomonitoring and wearable electronics *(Nanowerk Spotlight)*. If current research is an indicator, wearable electronics will go far beyond just very small electronic devices or wearable, flexible computers. Not only will these devices be embedded in textile substrates but an electronics device or system could ultimately become the fabric itself. Electronic textiles (e-textiles) will allow the design and production of a new generation of garments with distributed sensors and electronic functions. Such e-textiles will have the revolutionary ability to sense, act, store, emit, and biomedical monitoring functions or new man-machine interfaces while ideally leveraging an existing low-cost textile manufacturing infrastructure. Early e-textiles were bulky and not very user friendly garments, full of wires and sensors, and they were not suitable for mass production. But as researchers have started to make transistors in yarn form, public funding for this field increased (see for instance the European project PROETEX), advances in nanotechnology promise to dramatically advance the development of futuristic electronic textiles. Point in case is a recent research report that proposes to make conductive, carbon nanotube-modified cotton yarn. This would offer a uniquely simple yet remarkably functional solution for smart textiles close in feel and handling to normal fabric yet with many parameters exceeding existing solutions. Although attempts have been made to fabricate nanotube yarns or impregnate fabric fibers with nanotubes, the vast majority of the studies on textile modification with nanomaterials were carried with nanoparticles" Dr. Nicholas Kotov tells Nanowerk. "There were various reasons for adding metal and semiconductor nanoparticles to fabrics such as fashionably glittering colors, antimicrobial function, UV protection, wrinkle resistance, and anti-odor function." In contrast, Kotov and his team developed a method to coat regular cotton yarns with single-walled and multi-walled carbon nanotubes (CNT) and polyelectrolytes. The scientists point out that their process provides a fast, simple, robust, low-cost, and readily scalable process for making e-textiles.



Photographs of CNT-cotton yarn. (a) Comparison of the original and surface modified yarn.

(b) 1 meter long piece as made. (c) Demonstration of LED emission with the current passing through the yarn. (Reprinted with permission from American Chemical Society) "The proof-of-principle CNT-cotton yarns that we fabricated showed high electrical conductivities as well as some functionality due to biological modification of internanotube tunneling junctions" explains Kotov. "When our CNT-cotton yarn incorporated antialbumin, it became an e-textile biosensor that quantitatively and selectively detected albumin, the essential protein in blood. The same sensing approach can easily be extended to many other proteins and bimolecular." Kotov, a Professor in the Department of Chemical Engineering at the University of Michigan, worked with members of his group and colleagues from UMichigan's Departments of Materials Science and Biomedical Engineering as well as from Prof. Chuanlai Axe's group at Jiangnan University in Wuxi, China.). In their very simple process, the researchers repeatedly dipped a regular cotton thread in a CNT dispersion and then let it dry. After several repetitive dips, the cotton thread became conductive, with a resistivity as low as 20 Ù/cm (a level low enough that it would allow for convenient sensing applications that may not require any additional electronics or converters). Interestingly, once the adsorbed CNT-cotton threads were dried, it was impossible to remove the adsorbed CNTs from the fibers by exposure to solvents, heat, or a combination of both. "We found that the incorporation of CNTs into the cotton yarn was much more efficient than their adsorption into carbon fibers, which was tried elsewhere" explains Bong Sup Shim, a PhD student in Kotov's group and first author of the above paper. "This could be a result of the efficient interaction of polyelectrolyte's with cotton and other natural polysaccharide and cellulose-based materials, such as paper, which is well known in industry. Additionally, the flexibility of the CNTs allowed them to conform to the surface of the cotton fibers." The scientists point out that polyelectrolytes are essential for the stability of the CNT coatings on fibers and they are also essential for comfortable wearing because they are hydrophilic.



SEM images of CNT coated cotton yarns. (Images: Bong Sup Shim) He believes that further development of this CNT-cotton material could lead to several useful applications:

Reversible sensing schemes for relevant biological compounds markers; Various sensors for body functions including monitoring of degree of contusion/blast damage (of great interest to the project's funder, the Air Force); and multiplexed sensing of five to six analytes with yarns modified in different ways. "We also might add that energy harvesting materials and fabrics with charge storage capabilities become a possibility for the fabrics described here" says Kotov. The latter goal could be the most challenging but nevertheless suitable for the nanotube-cotton composite because of the nature of CNTs, the fairly high conductivity obtained, and super capacitor properties of carbon nanotubes. Future aspects of this research will deal with incorporating reversibility in the sensing mechanism and developing virtually permanent coatings of carbon nanotubes on cotton and other fabrics. One issue the research team is very well aware of are toxicological concerns surrounding CNTs. Although their extensive cell-culture data indicates that the solid CNT-polymer composites are largely benign, they nevertheless emphasize the need to further investigate the long-term contact between skin and nanotubes with a few chips running at few megahertz.

E-Textile Component Communication: The communication between the different components of an e-textile depends on the level of complexity of these components. Different components can exist in such a system, for example, sensors, actuators, and processing nodes. The fabric implementation after a set of novel issues that is different from regular systems. The relative distance between sensors and processing nodes is variable and this variation can render a sensor useless to a specific node at a given time or extremely useful at another (line of sight detection, for example).

Processing Node - Sensor Communication: Node to sensor communication depends on the level of sophistication of the sensor. As an example a passive microphone sends its values at all times. A smarter sensor would provide its data when queried and go into a sleeping mode between requests. On the other hand, a component can be in range to sense or communicate, or far enough to be dormant. The distance between sensor and processor is also affected by the physical exibility of the fabric, for example, a sensor that is 10 cm away from a processing node at a specific point in time is not guar

anteed to be there if the textile changes shape.

Processing Node - Processing Node Communication, Token Grid Network

The communication network needed in an e-textile system should be easily implemented in a fabric backplane, communicate inner network information, provide scalability, and after fault-tolerance. In an e-textile system, the number of the nodes to be connected would not be known a priori and that number is expected to change throughout the lifetime of the system. Several network schemes can be applied such as hypercube or tree-type architectures. The node degree, number of connections at the node, increases linearly with an increase in the dimension of a hypercube. Given the node degree in fabric, this renders architectures similar to the hypercube unsuitable for e-textiles. Tree-type architecture relies heavily on specific nodes for connections between different branches, which does not map well to the faulty environments of e-textile applications. The degree, fault-tolerance, and reasonable scalability of the token grid are the primary attractive features. A token traversing the network can be used to keep information about the topology and the state of the nodes, another benefit of the token grid X Y layout of a fabric facilitating its implementation on a fabric backplane. According to Terence Todd, communication networks used for LAN (Local Areal Networks) are usually based on linear technologies, buses or rings for example .These network an easy and economical solution to the networking problem. The downside is the throughput limit imposed by the speed of communication in the physical media. The performance of these networks does not scale with the number of nodes. The token grid network introduced a solution to these problems including a fault-tolerant scheme for node failures. In addition, the token can be used to transport information about each node in the ring. The bisection bandwidth of a unidirectional ring is BW (BW: bandwidth of the communication link).

Each node in the token grid is connected to two token rings. Figure 2.1 shows a schematic of such a grid with four row rings and four column rings. This architecture others a significant advantage in throughput as compared to common rings or bus networks. The throughput of this network architecture increases with the number of nodes. This increase in throughput is a significant benefit to systems for which the number of nodes on the grid is not known.

Application

· **Mapper Garment**

The mapper garment tracks the motion of the user through a structure by monitoring the user's body position, the user's movement, and the distance of the user from surrounding obstacles. Such a garment would allow users to be given directions in a building, maintenance workers to be automatically shown blueprints for their current room, or users to automatically map existing structures. The user's body position is measured by a set of piezoelectric strips woven into the clothing; by measuring the deformation along tens of strips, the physical configuration of the user's body can be detected wearable paper. The user's activity, such as walking up stairs, climbing a ladder, walking on a flatsurface, can be be detected. The user's movement rate can be measured by a small set of discrete accelerometers as well as a digital compass attached to the garment. The distance from obstacles is measured using ultrasonic signals. An array of approximately ten ultrasonic transmitters, also piezoelectric strips, are distributed around the garment to periodically send signals in each direction a similar number of receiver piezoelectric strips are used to detect the reflected signals, allowing time-off light to be measured. The primary challenge in this application is interfacing to a large number of sensors and actuators in are liable fashion. Simply attaching the leads of every sensor/actuator to a single processing unit and power supply would not meet the design goal of a durable e-textile. In the event of a tear in the fabric, single leads running to one collection point could lead to significant rather than graceful degradation in performance; in addition, the potentially long leads required would cause degradation in analog signal quality unless significant amplification is applied leading to larger power consumption. The garment needs multiple points at which analog data is converted to digital data; these conversion units, likely in the microcontroller or DSP class, would need to communicate within a fault tolerant network. The sample rate at each conversion point is very low (10/sec-100/sec) for the body position sensors and moderate (100,000/sec) for the occasional ultrasonic reception. Once the data has been converted to a digital format, low power data transmission and coding techniques can be applied. By carefully managing which sensors and processing units are active, the power requirements of the system can be reduced. For example, the computation of body position can be accomplished with varying numbers of sensors depending on the number and type of positions amongst which the garment is trying to distinguish [cite]. By selecting sensors from around the garment according to local available power, power use can be balanced across the e-textile. When determining the location of a wall, the garment must activate a transmitter in the direction desired and then sample a receiver for the return signal. This will accurately compute the distance, but gives no information on the direction in which it is located. To compute direction, the location of the transmitter on the body, the position of that part of the body relative to the torso, and the direction in which the user's torso is pointing must be known. The location of the transmitter should be known from the manufacturing process and the digital compass can provide the torso direction. A number of techniques are available for determining the location of one part of the e-textile with respect to other parts of the e-textile; in this garment, the body position is available and acoustic beam forming could be used to determine the location of all of the ultrasonic transceiver with respect to one another. To accurately compute

body position requires the analysis of samples from a large set of sensors that have been collected at several processing elements. Due to its nature [cite], the analysis is best done at a single processing element. To initialize the collection of the data, the processing element would send out a query to selected elements such as "give me your current reading" or "give me your reading every100ms." In both cases, some timestamp should be applied to both the query and the replies, though high accuracy is not required in this particular application.

· **Beam forming Array:** The beam forming array textile gathers data from a large array of acoustic sensors and analyzes this data to determine the direction of an acoustic emitter (e.g., a moving vehicle or a human voice). Through the use of acoustic beam forming algorithms [cite], a set of three acoustic sensors can identify the direction of a single emitter if the sensors and the emitter are all in the same plane. Identifying the direction of multiple emitters and/or working in three dimensions requires data from more acoustic sensors. Further, given noise and potential miscalibrations in the acoustic data, the use of redundant acoustic sensors is advisable. if the fabric is large enough, then not only the direction, but also the location of an emitter can be found. Like the mapper garment, for reasons of robustness, the large numbers of sensors are not all handled by one conversion/processing node; The fabric is sprinkled with many communicating processing nodes as shown in Figure 2.1 It is important to note that each acoustic sensor must know its location precisely with respect to the other sensors; small errors in sensor location result in increasingly larger errors as the distance to the emitter increases. Although this is not a wearable textile, it is flexible and thus subject to movement; at minimum, the initial position of each acoustic sensor must be computed. In contrast to the mapper garment, the positions of each sensor must be known quite accurately. To accomplish this, the textile is augmented with speakers that are physically co-located with a subset of the acoustic sensors; by systematically activating the speakers, the distances between the microphones can be determined. Once enough distances are known, the relative positions of all of the microphones can be computed. The frequency, direction, and distance of a potential target all affect the optimal selection of subsetof sensors on which to perform beam forming. Because beam forming is fairly computationally demanding, it would be wasteful of resources, including power, to collect and analyze the data from the entire set of acoustic sensors. An efficient strategy, therefore, is to have a small active set of sensors look for emitters while the rest of the sensors sleep to conserve power. Upon the tentative identification of an emitter's characteristics along with an assessment of remaining power at processing nodes, an optimal set of sensors can be activated. Once a set of sensors is selected, the time series data from those sensors must be collected at single processor where the beam forming algorithm is to be run. If multiple beams are formed (as in then the direction and intensity data must be combined at a single node; this is much less demanding of communication resources than the exchange of time series data. It is expected that some nodes along potential routes may be asleep, others out of power, and some broken; routes must be found in spite of these drawbacks. In addition, time series data from different nodes must be synchronized if small.

· **Communication:** As the case study application analysis shows, the processing elements in the textile require low power, Fault-tolerant communication. At the application level, the addressing scheme used in e-textiles for most applications should resemble schemes proposed for distributed sensor networks [cites] more than it resembles TCP/IP. In the garment mapper, the natural method of addressing an ultrasonic Transmitter is to address a location on the user's body, e.g., "a sensor on the left arm." In the Beam forming application, the sensors are selected based on their physical location, e.g., a time series from a sensor approximately five feet to my left. "The routing of data in an e-textile may be a completely unique networking situation". The underlying Physical connections (wires) are connected in a two-dimensional interconnection pattern that, absent faults, does not change. This two-dimensional structure is embedded in three-dimensional space and Because of the flexibility of the fabric, that embedding will change over time. Thus, the route from node at o node B does not change, absent faults in the network. The node "five feet to your left" will change, however, as the fabric changes shape. Note that in the case of wearable, the embedding relative to the Body is more or less constant; the sleeve of your shirt generally stays on your arm in the same Orientation. The embedding of a non-wearable is subject to more change. Achieving "node A to node B" connectivity, and to some extent addressing parts of the body, is a relatively simple task that can rely on traditional networking approaches. Providing the application programmer with a service in three dimensional spaces that efficiently uses the underlying connectivity is more challenging. The proposed service must be robust not only to permanent and transient faults, but also tolerant of sleeping nodes. The route that a message travels must, obviously, be adjusted to account for faults in the network. Message routing should avoid waking intermediate sleeping nodes/switches, but when necessary, must be capable of awakening nodes. For example, the beam forming array is, under normal operating conditions, expected to run the beam forming algorithm two percent of the time and even during Errors in time can lead to large errors in the computed results.

Future scope and conclusion: Based on this analysis, as well as a consideration of e-textiles as a whole, a set of services was identified that is common to many e textile applications. Three services that have aspects unique to e-textiles were identified and discussed in detail. Implementation of these services on e-textiles will require the development of new or modified algorithms for routing, location determination, and

task assignment. The implementation of these services will allow for practical performance results to be gathered. Assessing the quality of this and other implementations will require the establishment of benchmarks appropriate for e-textiles.

Bibliography

1. M. Jones, T. Martin, and Z. Nakad, A Service Backplane for" E-Textile Applications," Workshop on Modeling, Analysis, and Middleware Support for Electronic Textiles (MAMSET), October 2002.

2. E.R. Post, M. Orth, P.R. Russo, and N. Gershenfeld, Embroidery Design and fabrication of textile-based computing," IBM Systems Journal, Vol. 39, Nos. 3&4, 2000.

3. WWW.GOOGLE.COM

4. www.pubmed.com.

THEME 7

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C.G.G.A.E.E.B.E:-1

TROPHIC STATE INDEX IN CONSERVATION OF LAKES OF MYSORE

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INTRODUCTION: Various methods are employed to determine the trophic state of water bodies. They usually include productivity measures. A simple and easily determined index is that of Carlson(1977). Ir requires the estimation of only three parameters. The algal biomass in the form of Chlorophyll a (CA), Total Phosphorous (TP) and Secchi disc depth transparency (SD). Chlorophyll a is given highest priority because it is the most accurate of the three in the prediction of algal biomass. Four fresh water lakes of Mysore were selected for the present study. The Carlson's Trophic State Index was calculated and based on the values; measures of conservation of these lakes have been suggested.

MATERIALS AND METHODS: Mysore is situated in the Southern part of the Deccan Peninsular forming the Southern district of Karnataka State. The four lakes; Hadhinaru lake, Kalale lake, Shetty kerelake and Yennehole lake are situated at a distant apart and are economically important. Water samples for the analysis were collected during the summer months. Secchi depth transparency (SD) was taken at the study site by an 8" diameter disc. The maximum depth at which SD can be seen when lowered into the water was noted and measured. Total Phosphorous was analyzed by the method prescribed in 4500E: APHA(1995);Chlorophyll a (CA) was estimated by acetone method and measured using a spectrophotometer. Absorbance was recorded at 630 and 660 nm(APHA 1995). The Trophic State Index of Carlson(1977) was calculated using the following formulae.

a. TSI for Chlorophyll a(CA)= 9.81 in Chlorophyll a +30.6

b. TSI for Secchi depth (meters (SD) = 60 –14.41 in Secchi depth

c. C TSI for Total Phosphorous (TP) = 14.42 in Total phosphorous +4.15

Where TSI is Trophic State index and "in" is natural logarithm.

Carlson's Trophic State Index (CTSI)={TSI(TP)+TSI(CA) +TSI(SD)}/3

TP and CA are in micrograms/liter; SD transparency in meters. A value of CTSI between 40 and 50 is usually associated with mesotrophy(moderate productivity), index values greater than 50 are associated with eutrophy(highly productive) while values less than 50 are associated with oligotrophy(low productivity).

RESULTS AND DISCUSSION

The range of the trophic state index values is presented in Table 1, which also explains the trophic status of the related water body.

Table 1 TSI values and: Carlson's Trophic State Index

TSI values	Trophic status of the water body
Below 30	Classic oligotrophy, clear water, oxygen through out the year in the hypolimnion, salmon fishes in deep waters
30 to 40	Deeper lakes still exhibit classic oligotrophy, but some shallow lakes become anoxic in the hypolimnion during summer
40 to 50	Water moderately clear, but increasing probability of anoxia in hypolimnion during summer
50 to 60	Lower boundary of classical eutrophy. Decreased transparency, anoxic hypolimnion during summer, macro phytic problems evident, only warm water fishes can survive.
60 to 70	Dominance of blue green algae, algal scum probable, extensive macrophytic problems
70 to 80	Heavy algal blooms possible through out summer, dense macrophytic beds, limitation of light penetration; hypereutrophic
80 to 100	Algal scum dominant, summer fish kills frequent, reduction in macrophytic growth. Dominance of rough and undesirable fish.

The calculated Carlson's Trophic State index for the lakes of Mysore is presented in Table 2; their attributes and conservation strategies are presented in Table 3.

Table 2: Calculated Carlson's Trophic State Index for Lakes of mysore(December 2008 to May 2009)

No	Lake	SD	CA	TP	TSI(SD)	TSI(CA)	TSI(TP)	CTSI	Trophic State
1	Hadhinaru lake	49	70	290	4	72	86	54	Classic Eutrophy
2	Kalale lake	29	118	187	12	77	80	56	Classical Eutrophy
3	Shettykere lake	28	85	508	12	74	94	60	Eutrophy
4	Yennehole lake	26	120	1025	13	99	104	72	Hypereutrophic

TP-Total Phosphorous µg/l;CA-Chlorophyll a µg/l;SD Secchi Depth in meters, TSI-Trophic State Index; CTSI-Carlson's Trophic State Index.

Table 3; Trophic state of lakes , their attributes and Conservation Strategies

No	Lake	CTSI	Trophy	Attributes and Conservation
1	Hadhinaru lake	54	Classic Eutrophy	Water moderately clear, increasing probability of hypolimnotic anoxia during summer, water colour often changes and fish population de crease. Manual clearing of algal biomass and hydrophytes may be useful
2	Kalale lake	56	Classical eutrophy	
3	Shetty kere lake	60	Eutrophic	Anoxic hypolimnetic and macrophytic problems, removal of hydro phytes is very essential
4	Yennehole lake	72	Hypereutrophic	Algal scum develops emitting foul smell, reduced water transparency; huge fish kills due to lack of Oxygen. Difficult to conserve; use of ammonia nitrifiers is advantegous

Any trophic state index gains value when it can be correlated with specific events within a water body. The CTSI values in Hadhinaru Lake and Kalale Lake range between 54 and 56 and can be classified as classical eutrophy. The water in them is moderately clear, with increasing probability of hypolimnitic anoxia during summer; the color of the water often changes and fish population decreases. Both lakes can be conserved by manual clearing of algal biomass and hydrophytes.

Shetty kere lake has a CTSI value of 60 and is categorized as eutrophic. Anoxic hypolimnetic and macrophytic problems are common which mayd to further deteroriation of the lake water. Removal of hydrophytes and macrophytes may help in conservation of the lake. Yennehole lake has a CTSI value of 72 and is classified as hypereutrophic. Algal scum develops and the water emits a foul smell, water transparency becomes considerably reduced and mass fish kill due to lack of oxygen becomes quite evident. It is difficult to conserve such lakes. Use of ammonia nitrifiers may be an important aspect in conservation of this lake.

Phosphorous is commonly the growth-limiting nutrient of algae (Horne and Goldman, 1994) and therefore it is the most commonly measured nutrient in lakes. Chlorophyll a is an estimation of algae on surface waters. Algal biomass is closely related to chlorophyll a and with an increase in chlorophyll a the lakes becomes more eutrophic. The Secchi disc used to measure the transparency of water is a function of the density of varying algal population and other suspended solids (Hesikary,1985). Human activity often influences the lake by increasing plant nutrients, mainly phosphorous (Harper,1992) which causes over enrichment. This has a direct influence on the production of algal blooms. Also eutrophication can cause depletion of dissolved oxygen as a result of bacterial respiration during break down of dead algal biomass. A major strength of the CTSI are only the three simple parameters that can be used to identify certain conditions in a lake that are related to algal biomass and eutrophication.

CONCLUSION: CTSI is an important aspect of lake survey. It can measure trophy wherein biomass is involved. Chlorophyll a can be used as a primary index for trophic state classification and the index can be used as a basic teaching tool in eutophication studies. As per the index Yennehole lake is highly polluted with rich algal biomass, while Hadhinarulake is least polluted with a rich algal biodiversity.

REFERENCES

Carlson R E 1977 A trophic state index for lakes. Limnology & Oceanography *Limnology and Oceanography* 22(2):361-369

Carlson R E 1980 More complication in the Chlorophyll a-Secchi disc relationship *Limnology and Oceanography* 25:378-382.

Harper D 1992 Eutrophication of fresh waters. Chapman & Hill London

Heiskary S A 1985 Trophic state of Minnesota Lakes *MQCA Roseville*

Horne A J and G R Goldman 1994 Limnology 2nd Edition Mc. Graw Hill, New York

Naumann E 1929 The scope of chief problems of regional limnology. *Int. Review Ges. Hydrobiol* 21:423.

Steffanson C , I Rose and Nvoelz 2001 Trophic state index measurements for sixSterns Country Lakes during June-September 2001. Reports to Sterns Country. *Environmental Pub*. Pp.14.

C.G.G.A.E.E.B.E:-2

"POLLEN AS BIOINDICATORS OF VEHICULAR POLLUTION"

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ABSTRACT: With rapid urbanization and industrialization, air pollution has reached alarming proportions throughout the World. Motor vehicle exhaust is undoubtedly one of the most important sources of air pollution in urban areas leading to deterioration in the quality of air. The present study deals with the use of pollen as bio-indicators of vehicular air pollution in the city of Mysore, Karnataka State, India. Effects of air pollutants on pollen germination percent and pollen tube length in two tree species *Delonix regia* Rafin and *Peltophorum inerme* Naves ,growing at one of the busiest traffic intersections-K.R. circle were studied. Pollen of the two species showed a significant reduction in the viability of pollen, delay in the onset of germination and reduction in the pollen tube length compared to pollen samples collected from tree species growing 20kms away from the city. The air pollutants monitored at K. R. circle showed a negative correlation with the percent pollen germination and pollen tube length in both the tree species. The present study have shown the possibility of using pollen as a simple and reliable biomonitoring tool as they provide essential information on the biological impact of air pollution. They can be used as a complementary monitoring tool in addition to the routine physico chemical methods of monitoring air pollutants.

INTRODUCTION: Air pollution may be defined as an atmosphere condition in which various substances are present at concentrations high enough above their normal ambient levels to produce a measurable effect on people, animals and vegetation or materials. Air pollution is essentially an urban phenomenon. With rapid urbanization and industrialization, air pollution has reached alarming proportions throughout the world. Motor vehicle exhaust is undoubtedly one of the most important sources of air pollution leading to deterioration in the air quality particularly in metropolitan cities. Vehicle exhaust has become a major cause of public concern as they pose health hazards not only to human beings, but also damage vegetation and buildings. The most common pollutants emitted from auto exhaust are hydrocarbons, benzene, carbon monoxide, sulphur dioxide, oxides of nitrogen, ozone and suspended particulate matter. Out of these, suspended particulate matter is of major concern as it constitutes about 50% of the total air pollution load and is also the main culprit for a number of severe respiratory diseases found in urbanities.

A number of steps have been under taken to curb the menace of air pollution. Tree plantation to mitigate urban air pollution is one of the unique, cost effective and eco-friendly approaches. Road side trees, being stationary are constantly exposed to the emissions from the vehicles in metropolitan cities. Different trees vary in their susceptibility to air pollutants, and can be categorized as tolerant and sensitive species. The tolerant species can serve as pollution sinks while the sensitive species serve as indicators of air pollution.

Use of higher plants for monitoring air pollution is a recent development in our country. Plant response to air pollution varies widely. Four broad categories of plant response can be used as indicators namely floristic composition, morphology, mineral composition and physiology and biochemical aspects.

Pollen germination and pollen tube growth are well known to be sensitive indicators of atmospheric pollution. Pollen have a great advantage in biomonitoring of air pollution as they can be obtained in abundant quantities and can be stored in viable condition for sufficient period of time for use throughout the year. The technique is simple and offers an attractive possibility of quick synoptic measurement of air pollution levels. The response time of pollen grain is within hours and there is no great need to maintain aseptic conditions in routine investigations. They are relatively more sensitive as compared to leaves or any other plant organ. Moreover biomonitoring with pollen grains can be easily accomplished with simple equipment.

The present investigation aims at studying the effect of pollutants on the pollen germination and pollen tube growth of two roadside trees growing at one of the busiest traffic intersections of Mysore city namely K.R. circle. The city of Mysore has witnessed a phenomenal increase in traffic population from a mere 6333 in 1970 to more than 4,00,000 in 2008. Increased emissions from the vehicles adversely affect the road side vegetation. The following trees growing at K.R. circle were selected for pollen analysis: *Delonix regia* Rafin *Peltophorum inerme* Naves.The two tree species growing at Mahadevapura situated 20 kms from Mysore served as control since there are no movements of traffic at this region.

MATERIALS AND METHODS: Ambient air quality monitoring data at K.R. circle, one of the busiest traffic intersections of Mysore city was obtained from Pollution Control Board, Mysore (KSPCB). Monitoring was done at K.R. circle for major pollutants namely SPM, SO2 and NO2 using high volume air sampler.

In-vitro Germination studies: Pollen samples from unopened flower buds and opened flowers were collected from two tree species both at control (Mahadevapura) and polluted areas (K.R. circle) during flowering season (April, May and June) for a period of two years. The collected pollen was used to test pollen viability and to culture the pollen.

Pollen viability test:: Fluorochromatic Reaction (FCR) Test was done to assess the viability of pollen of the two tree species following the method of Heslop-Harrison (1970). The

pollen grains that fluoresce brightly were considered viable. Photomicrographs were taken with a fluorescent microscope.

In-vitro germination test: Pollen was cultured using Brewbaker & Kwack's medium (1963). To culture the pollen, hanging drop culture method was followed (Shivanna and Rangaswamy, 1992).

The responses of cultured pollen grains were assessed as per cent pollen germination and average pollen tube length. Pollen grains from ten arbitrarily selected microscopic fields were scored for germination. Per cent pollen germination was calculated using the formula number of pollen grains germinated / total number of pollen grains in the field × 100 The length of the pollen tubes in ten microscopic fields was measured with an ocular micrometer. Mean tube length was calculated using the formula Total length of all pollen tubes (in units of ocular micrometer) / Total number of pollen tubes measured from all fields The values were expressed in µm. The average results from three sets were recorded.

RESULTS AND DISCUSSIONS

Ambient air quality monitoring: Air quality monitoring data for pollutants SPM, SO2 and NOx at K.R. circle is presented in the Table 1. The data was obtained from Karnataka State Pollution Control Board (KSPCB) Mysore, for the month of April, May and June for a period of 2 years. The data showed that SPM ,SO2 and NOx concentrations were within the permissible limits prescribed by CPCB, New Delhi.

Table1: Ambient air quality monitoring data for pollutants at KR circle

	April	May	June
SPM (µg/m³)	296.11	241.42	222.54
SO2 (µg/m³)	80.61	84.09	75.62
NOx (µg/m³)	119.4	114.18	99.99

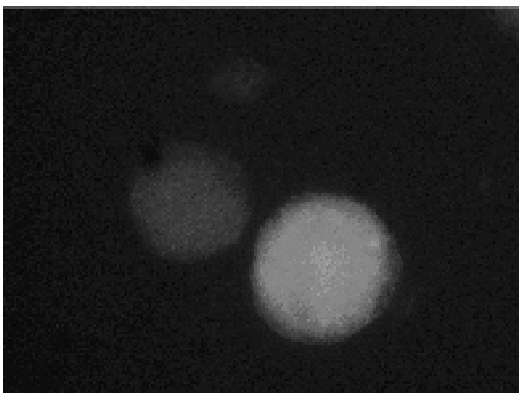
Invitro germination studies: For invitro germination studies pollen samples of the two tree species from control and polluted area (K.R. circle) were collected and used for testing the pollen viability, Per cent pollen germination and pollen tube length.

In the present investigation the Fluorescein diacetate (FDA) test was used to test the pollen viability. The viability results of pollen from control and polluted areas are represented in the Table 2. Pollen that fluoresce brightly when seen under fluorescent microscope was considered viable (Fig.1 a & b). It is clear from the study that the pollen from polluted area showed decrease in the pollen viability in the two species studied.

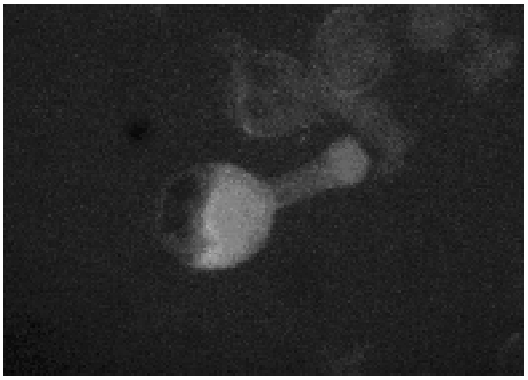
Table 2: Effect of vehicular pollution on per cent pollen viability of two tree species

	Control (%)	Polluted (%)
Delonix regia	92	60
Peltophorum inerme	85	74

Figs.1 a&b: Photomicrographs of pollen stained with FDA

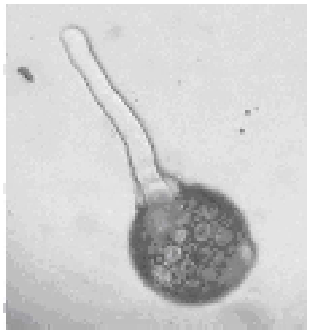


a. P. inerme

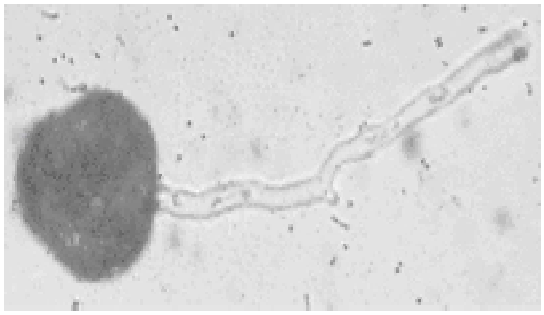


b. *D. regia*

Photomicrographs of pollen cultured in Brewbaker and Kwack's medium following the hanging drop culture method is shown in Figs.2 a-b.



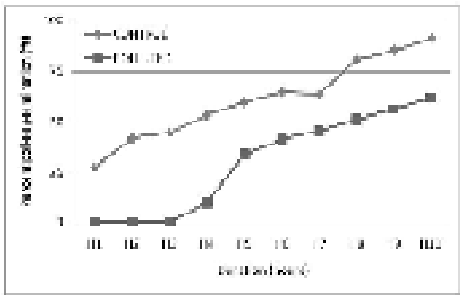
a. *P. inerme*



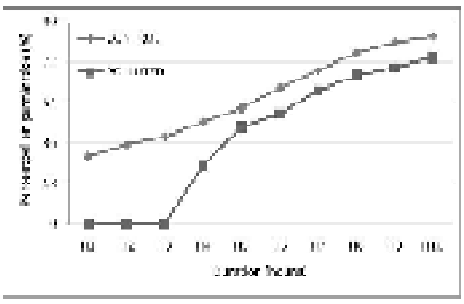
b. *D. regia*

The results of per cent germination of the two tree species from control and polluted area is depicted in Fig.3a-b.
Pollen collected from control area showed germination after one hour of culturing in the two tree species. However pollen collected from polluted area germinated after three hours of culturing in the two species. The per cent pollen germination in the two tree species from polluted area showed significant variation compared to pollen from control area.

Fig.3a-b: Effect of pollutants on the percent pollen germination of two tree species growing at control and polluted areas



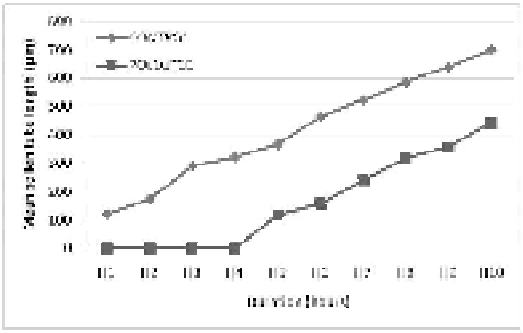
a. D. regia



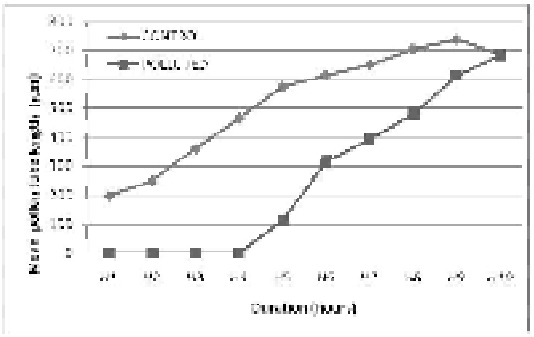
b. *P. inerme*

The mean length of pollen tube in the two tree species of polluted and control area is shown in Fig.4a-b. There was a significant reduction in the length of pollen tube in pollen of polluted area as compared to control area pollen in the two tree species.

Fig.4a-b: Effect of pollutants on the mean pollen tube length in the two tree species growing at polluted and control areas



a. P. inerme



b. *D. regia*

Correlation between the pollutants SPM, SO2 and NOx and per cent pollen germination and pollen tube length has been calculated only for polluted area (Table 3a & b). A negative correlation was observed between the pollutants and per cent germination and tube growth in the two tree species. These results clearly indicate that the pollutants in the ambient air have brought about inhibition in the rate of pollen germination and length of pollen tube. Similar inhibition in the rate of pollen germination and pollen tube growth was observed by Salgare and Rane (1988, a & b), Salgare and Sebastian (1987, 1988) and Salgare and Palathingal at different locations of Bombay in tree species exposed to industrial pollution.

Table. 3a. Correlation between pollutants and per cent pollen germination of two tree species

	SO2	NOx	SPM
D. regia	-.392	-.777*	-.728*
P. inerme	-.517	-.784*	-.989**

Table. 3b. Correlation between pollutants and mean pollen tube length of two tree species

	SO2	**NOx**	**SPM**
D. regia	**-.564**	**-.829****	**-.776***
P. inerme	**-.563**	**-.829****	**-.778***

** Correlation is significant at the 0.01 level (2 tailed)
* Correlation is significant at the 0.05 level (2 tailed)

The present investigation has shown the possibility of using pollen as bioindicators of air pollution. Numerous studies have been devoted to the impact of air pollutants on pollen but only a few works are available on the use of pollen to evaluate atmospheric pollution. Pollen used as bioindicators does not indicate levels of pollutants, but it measures their biological impact and can therefore provide information on the potential adverse effects of pollutants on living organisms. This direct assessment of risk by bioindicators methods is of greater importance compared to the physico- chemical methods. However plant bioindication methods will never be a substitute to physico- chemical methods for air pollution studies, but they constitute complementary methods as they provide essential information on biological impact of

pollutants.

REFERENCES

Bhattacharya, A.K. 1994. Efficacy of tree species towards gaseous pollutants and its significance in air pollution control by plantation of pollution resistant trees. *Indian Forester*.**120 (8):** 658-659.

Brewbaker, J.L. and Kwack, B.H. 1963: The essential role of Calciun ion in pollen germination and pollen tube growth. *Amer. J. Bot.* **50**, 859-865.

Budharaja, A. and Agarwal, S.K. 1993. Air pollution tolerance indices of some planted trees in urban area of Kota with references to automobile pollution. *Acta Ecologica.* **15(1):** 62-72.

Carreras, H.A., Canas, M.S. and Pignata, M.L. 1996. Difference in responses to urban air pollutants by *Ligustrum lucidum* AIT. and *Ligustrum lucidum* AIT. F. Tricolor (Rehd.) Rehd. *Environ. Poll*. **93(2):** 211-218.

Chattopadhyay, S.P. 1996. Leaf surface effects of air pollution on certain tree species in Calcutta. *Ad. Plant Sc.* **9(1):**1-14.

Heslop-Harrison. J. and Heslop-Harrison, Y. 1970. Evaluation of pollen viability by enzymatically induced fluorescence; intracellular hydrolysis of fluorescein diacetate *Stain Technology*. **Vol. 45:**115-120.

Kamalakar, J.K. 1992. Responses of plants to auto-exhaust pollution. *Acta Botanica Indica.* **20(1):**84-88.

Salgare, S.A. and Iyer, M.P. 1991. Effects of auto-exhaust pollution on the micromorphology of some weeds. In: *Automobile Pollution* (ed. Agarwal,S.K.) Ashish Publishing House, New Delhi, 119-134.

Salgare, S.A. and Sebastian, K.J. 1987. Effects of industrial pollution (from Andheri) on pollen germination and tube growth of successive flowers of *Cassia siamea* Lamk. *Proc. 5th* All India Sym. Palyno., held at Bot. Inst. Sci., Nagpur. 43.

Salgare, S.A. and. Sebastian , K.J. 1988. Effects of industrial pollution (from Andheri) on pollen germination and tube growth of successive flowers of *Catharanthus roseus* (L) G. Don. *Proc. 2nd nat. Sym. Eco. Toxixo.,* held at Dept. Zoo. Annamalai Uni. Abst. No. 107.

Salgare, S.A. and Nath, P. 1991. Effects of auto-exhaust pollution at Bandra (East) on the growth performance of some plants-1 (Monsoon Collection). *New Agriculture*. **2(1):** 43-48.

Salgare, S.A. and Rane, S. 1998 a: Effects of industrial pollution (from Lalbaug) pollen germination and tube growth of successive flowers of Plumeria acutifolia poir. *Proc. Nat. Sym. Envi. Sci. Toxico.,* held at Dept. Zoo., M.J.K. (P.G.) College, Bihar Univ. Bettiah.

Salgare, S.A. and Rane, S. 1998 b: Effects of industrial pollution (from Lalbaug) pollen germination and tube growth of successive flowers of Plumeria acutifolia poir. *Proc. Nat. Sym. Envi. Sci. Toxico.,* held at Dept. Zoo., M.J.K. (P.G.) College, Bihar Univ. Bettiah.

Salgare, S.A. and Sabita, S. 1991. Effect of auto-exhaust pollution at Western Express Highway near National Park, Borivali (East) on micrcomorpology of some weeds (1 harvest) 1. *Biosphere.* **3(1):** 8-18.

Shivanna, K.R. and Rangaswamy, N.S. 1993. *Pollen Biology*. A laboratory Manual. Narosa Publishing House, Delhi.

Singh, N., Yunus, M., Srivastava, K., Singh, S.M., Pandey, V., Misra, J. and Ahmad, K.J. 1995. Monitoring of auto-exhaust pollution by road side plants. *Environ. Monitor. Assess.* **34(1):** 13-25.

C.G.G.A.E.E.B.E:-3

SCREENING OF BACTERIA ISOLATED FROM EARTHWORM BURROW WALL SOIL OF *LAMPITO MAURITII* FOR DEGRADING ENZYMES

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Abstract: Degradation of plant cell wall polysaccharides is of major importance in the food and feed, beverage, textile, and paper and pulp industries, as well as in several other industrial production processes. Bacteria produce a wide range of cell wall-degrading enzymes which include pectinases, ligninases, cellulases and amylases. These enzymes are also essential in the decay of dead plant material and thus assist in recycling carbon compounds in the biosphere. The role of earthworm in litter decomposition is well documented. They have evolved a mutualistic relationship with microorganisms in order to exploit soil organic matter reserves. Forty two bacterial isolates isolated from burrow wall soil samples of the earthworm *Lampito mauritii* were screened for pectinolytic, lignolytic, cellullolytic and amylolytic activity. 39.02%, 41.46%, 95.12% and 97.56% of bacteria showed positive for pectinolytic, lignolytic, cellullolytic and amylolytic activity respectively. The number of Gram +ve cocci and Gram –ve rods were more compared the Gram +ve rods and Gram-ve cocobacilli. Cellulase and amylase producing bacteria was screened by their hydrolyzing capacity. The enzyme activity of cellulase and amylase was estimated by Dinitrosalicylic acid method. Effect of pH and temperature on the activity of these enzymes was also studied. High enzymatic activity was seen in bacteria isolated from burrow wall soil sample compared to control soil.

Introduction: Degradation of plant cell wall polysaccharides is of major importance in the food and feed, beverage, textile, and paper and pulp industries, as well as in several other

industrial production processes. In the natural environment, both bacteria and the enzyme they produce play as significant part in biodegradation. Bacteria produce a wide range of cell wall-degrading enzymes which include pectinases, ligninases, cellulases and amylases. These enzymes are also essential in the decay of dead plant material and thus assist in recycling carbon compounds in the biosphere. Enzymes facilitate the phase of metabolism in which complex compounds are broken into simpler ones. Enzyme activities have been used widely as an index of soil fertility or ecosystem status because they are involved in the biological transformations of native and foreign compounds in soils (Tate, 2000). It is necessary to determine the relationships between microbial populations and enzymatic activity during organic matter decomposition; further, it is also important to quantify the amount of extracellular enzyme activity. The role of earthworms as keystone animal group regulating activities of soil microorganisms, plant growth and interactions within soil communities has been extensively investigated. The viability of using earthworms as a treatment or management technique for numerous organic waste streams has been investigated by a number of workers (Hand, 1988; Logsdon, 1994; Madan, 1988; Singh, 2002). Hence, the environmentally acceptable vermicomposting technology using earthworms can very well be adopted for converting waste into wealth.

To exploit the organic resources available in the litter and soil, the microorganisms mutually associate with macroorganisms like earthworms. Microorganisms are able to perform any chemical transformation during the decomposition of organic materials but their activity is highly dependent on macroorganisms. (Prakash, 2008). Micro and macroorganisms are constantly in contact. Free soil microorganisms find suitable conditions for their activity in the anterior part of the earthworm gut and as well in worm casts and burrows. Burrows are important microhabitats which contribute to the high microbial diversity in mineral soil. The micro environment associated with the walls of earthworm burrow may be substantially different from soil only a few millimeters away. Earthworm burrow walls harbour distinctive communities of soil animals and protozoa, nematodes and micro arthropods which presumably control microbial activity in there microhabitats (Hamilton and Stillman 1989, Anderson and Bohlen 1998). Thus earthworm associated microhabitats may contribute to the maintenance of soil fauna diversity.

Bacteria exhibit great diversity in their physiological activities. The energy necessary for carrying on cell activity and the building materials needed for the formation of new cells during multiplication is secured in a variety of ways. The acquisition of energy and materials, in turn, is related in large measure to the different enzymes produced by various bacteria. The knowledge of bacteria and the enzymes they produce would lead to better understanding of how earthworms and microorganisms interact during organic matter decomposition.

There are about 3000 species of earthworms distributed all over world and about 384 species are reported in India (Julka, 1986). *Lampito mauritii* is a widely distributed earthworm in India occupying a unique position and reported from different agro-ecosystems. It has a length of 72-152 mm, diameter of 3.5- 5.5mm and 126-179 segments. Colour dorsally is greyish, brownish or yellowish with a purplish tinge at the anterior end. Its ability to withstand a wide range of temperature, soil moisture content , adaptability to coexist with a wide range of other species of earthworms, the wide choice of food niches explain its large distribution (Kale 1997).

Burrows as a source of microorganisms producing enzymes

Earthworms important to plant litter decomposition and fertility of soil; breakdown large soil particles and leaf litter increasing the availability of organic matter for microbial degradation. Earthworm burrows are microhabitats which contribute to the high microbial diversity in mineral soil. High microbial biomass and activity in earthworm burrow walls were recorded in a range of field and lab studies. (Loquet et al., 1977) Earthworm casts had higher numbers of cellulolytic aerobes and hemicellulolytic, amylolytic, nitrifying and denitrifying bacteria than the soil in which they lived (Bhatnakar, 1975; Loquet et al., 1977). A mucosal substance rich in proteins lines the wall of the burrows which serve as an energy source for microbes. The concentration of nitrifying microbes has been observed to be 40% higher in burrows than in rest of soil.

Cellulase: Cellulase is widely distributed throughout the biosphere and refers to a class of enzymes produced chiefly by fungi, actinomycetes, gliding bacteria like *myxobacteria*, true bacteria and protozoa. Cellulases are a family of enzymatic proteins which hydrolyze cellulose polymers to smaller oligosaccharides, cellobiose and glucose. Cellulase breaks down the complex molecule of cellulose into more digestible components of single and multiple sugars like glucose. This is the same glucose which our body metabolizes in order to live, but can't digest it in the form of cellulose (Emert *et al.,* 1974; Whitaker, 1971). Cellulose-degrading enzymes have therefore to be located on the surface of the cell wall or released extracellularly. Extracellular or exocellular enzymes are those that are completely dissociated from the cell and found free in the surrounding medium. This enzyme is produced by several microorganisms, commonly by bacteria and fungi (Bahkali, 1996; Magnelli and Forchiassin, 1999; Shin et al., 2000; Immanuel et al., 2006). Celluloytic property of bacterial species like *Pseudomonas*, *Cellulomonas*, *Bacillus, Micrococcus*, *Cellovibrio* and *Sporosphytophaga* spp. were also reported (Nakamura and Kappamura, 1982; Immanuel et al., 2006). Cellulase-producing bacteria have been isolated from a wide variety of sources such as composting heaps, decaying plant material from forestry or agricultural waste, the faeces of ruminants such as cows, soil and organic matter, and extreme environments like hot-springs. Complete degra-

dation of cellulose requires this system which consists of set of three soluble enzymes acting synergistically with different specificities: endoglucanases, cellobiohydrolases and beta glucosidase

Noncomplexed cellulase systems are typical of cellulose degrading bacteria. Bacteria produce these freely diffusible extracellular cellulase enzyme systems that act together in the conversion of cellulose to glucose (Lynd et al., 2003).

Amylase: Amylases are of the most important enzymes used in biotechnology (Burhan et al., 2003). Their use includes hydrolysis of starch to yield glucose syrup, amylase-rich flour and in the formation of dextrin during baking in food industries. Furthermore, in the textile industry, amylases are used for removal of starch sizing and as additives in detergents (Shaw et al., 1995; FAO, 2001). Plants and some bacteria also produce amylase. As diastase, amylase was the first enzyme to be discovered and isolated by Anselme Payen in 1833.

α-amylases are calcium metalloenzymes, completely unable to function in the absence of calcium. By acting at random locations along the starch chain, α-amylase breaks down long-chain carbohydrates, ultimately yielding maltotriose and maltose from amylose, or maltose, glucose and "limit dextrin" from amylopectin. Because it can act anywhere on the substrate, α-amylase tends to be faster-acting than β-amylase. α-amylase is also found in plants, fungi (ascomycetes and basidiomycetes) and bacteria (*Bacillus*). α amylase can be produced as an extracellular enzyme by microorganisms (Murao et al., 1978;Rose,1980). First such discovery was made in 1946 when α amylase was found to be produced by* Bacillus polymyxa *and later by another Bacillus species identified as* Bacillus cereus *var. mycoides (Takasaki, 1976). Other amylolytic enzymes can also be obtainable in Bacillus strains (Ohdan et al., 2000; Prescott et al., 2002)

β-amylase is also synthesized by bacteria, fungi, and plants. Working from the non-reducing end, β-amylase catalyzes the hydrolysis of the second α-1,4 glycosidic bond, cleaving off two glucose units (maltose) at a time.

γ-Amylase in addition to cleaving the last α (1-4) glycosidic linkages at the nonreducing end of amylose and amylopectin, yielding glucose, will also cleave α (1-6) glycosidic linkages. Unlike the other forms of amylase, γ-amylase is most efficient in acidic environments and has an optimum pH of 3.

Pectinases: Pectinolytic enzymes are primarily produced in nature by saprophytes and plant pathogens (bacteria and fungi) for degradation of plant cell walls. This group of enzymes has been classified into a larger family of carbohydrate-degrading enzymes. Pectinases are endo-acting hydrolytic enzymes that digest pectate (non-methoxylated polygalacturonic acid) into oligogalacturonic acids. Pectin substances are primary constituents of the middle lamellae or tissues constituent located between individual cells and are the structural elements of the primary wall. The pectin carbohydrates are complex polysaccharides composed mainly of galacturonic acid units bound to one another in a long chain linked by alpha-1,4-glycosidic bonds in linear chains. The pectic substances are of 4 types: Protopectin, Pectin, Pectinic acid, Pectic acid

The variety of enzymes produced by pectinolytic bacteria reflects the complexity of pectin. Pectinases can be classified according to their preferential substrate, pectin or polygalacturonate (PGA), and their reaction mechanism ([Beta]-elimination or hydrolysis). Endo-pectinases cut the polymer at random sites within the chain to give a mixture of oligomers, while exo-pectinases attack the reducing end of the polymer and produce only dimmers. Examples for pectinolytic bacteria include *Arthrobacter*, *Pseudomonas* and *Bacillus*.

Lignin: Lignin is the most abundant aromatic polymer in nature. It is synthesized by higher plants, reaching levels of 20-30% of the dry weight of woody tissue. Next to cellulose, it is the second most abundant compound in plant biomass and a partial decay of lignin provides numerous aromatic monomers such as ferulic and vanillic acids. Isolation and identification of environmental friendly bacteria for lignin degradation becomes essential, because all the previous researches concentrated on using fungal treatments. The importance of ligninolytic bacteria has been raised, because lignin-degrading bacteria have wider tolerance of temperature, pH and oxygen. Studies on incidence of cellulolytic and lignolytic organisms in earthworm worked soils showed that symbiotic microflora of worms are involved in lignin degradation (Kale, 1991). Lignolytic Bacteria include *Pseudomonas, Micrococcus, Arthrobacter, Flavobacterium* and *Xanthomonas.*

The present study attempts to screen cellulolytic, amylolytic, pectinolytic and lignolytic bacteria from burrow walls of *Lampito mauritii.*

Material and methods: Twenty three bacterial isolates from burrow walls of *Lampito mauritii* and 17 bacterial isolates from control soils were screened for degrading enzymes viz., pectin, lignin, cellulase and amylase.

Screening for Pectinolytic and lignolytic bacteria: The 40 isolates were grown pectin and lignin hydrolysis media. Growth of the media was taken as positive result.

Screening for amylolytic bacteria: Starch Agar media was used to demonstrate the hydrolytic activity of amylase. The media was inoculated with the bacterial isolates and incubated at 37º C for 2 days. The plates were flooded with Lugol's Iodine. A clear zone of hydrolysis indicated starch degradation. **Screening for cellulolytic bacteria**

Qualitative test used for screening cellulolytic bacteria was done by Congo red test (Teather et al., 1982). The use of Congo red as an indicator for β- D – glucan degradation in an agar medium provides the basis for rapid and sensitive screening test for cellulolytic bacteria. Cellulolytic bacteria were screened by point inoculating isolates on to the minimal cellulose agar and incubating for 24 hours at 30 ºC. Cellulolytic

organisms' produces a clear zone around the colonies due to the digestion of Carboxymethyl Cellulose (CMC) by the extracellular enzyme called cellulase. Congo red shows a strong interaction with polysaccharides and the zone around the growth of inoculum shows a clear zone, if the organism produces extra cellular cellulase. These enzymes cleave CMC polysaccharides to simpler monomers like glucose which do not give complex with the Congored and therefore remain colorless. 1MNacl was flooded after adding Congo red to intensify the dye – glucan color complex. The clearing zone size and colony diameter of these isolates was measured after incubation at 30 ºC.

Calculation of HC (Hydrolyzing Capacity) value for amylase and cellulase

At the end of the incubation period, the diameter of each colony and the clear zone was measured. HC value on media was indexed as the diameter of the of the colony plus the clear zone around it divided by the diameter of the colony (Hankin and Anagnostakis, 1977; Hendricks et al., 1995; Reese et al., 1950).

Isolates showing a good HC value was selected for study of amylase and cellulase activity.

Estimation of Amylase and CMCase (carboxymethylcellulase) activity by Dinitrosalicylic acid (DNS) method.

The positive cellulolytic and amylolytic isolates which showed zone of clearance during screening were further used for estimation of cellulase and amylase activity. The individual cellulase (Endoglucanases) and amylase was measured by DNS method. The enzyme activity was be determined experimentally by allowing the enzyme to interact with its substrate for a given period of time. Both the compounds are colorless and can not be estimated directly. However they can be converted to colored product by specific chemical reactions. The sugar content is tested with DNS reagent, a yellow color compound. The DNS reagent forms orange- yellow in alkaline medium on boiling which is due to the reduction of 3,5-dinitrosalicylic acid to 3 amino 5-nitro salicylic acids which can be read at 540 nm. Dinitrosalicylic acid reagent developed by (Sumner, 1921, 1944) is composed of dinitrosalicylicacid, phenol, sodium sulphite and 1% sodium hydroxide. The mixture is heated for 5 minutes. Rochelle salt is added to prevent the reagent from dissolving oxygen and as a color stabilizer. A standard graph is prepared for estimation of unknown value. The substrate used for study of enzymatic activity of cellulase was 1% Carboxymethylcellulose prepared in 0.1M of citrate-phosphate buffer; pH 5.8. Maltose (0.5%) was used as the substrate for amylase activity.

Extraction of enzyme from bacterial isolates

Each isolate was inoculated in 20ml minimal cellulose broth and incubated in the shaker incubator 200rpm for 24hours at 30°C till optical density reached 1.5. 1ml of the above broth was inoculated in 100ml of minimal broth containing 1%CMC and incubated in shaker incubator at 200rpm for 24hours at 30°C. The culture was then centrifuged at 2500rpm. The supernatant was used as a source of crude enzyme extract for the enzyme assays.

Estimating bacterial cellulase activity

1ml of bacterial enzyme extract was taken in a test tube containing 2ml of 1% CMC dissolved in 100ml of 0.1M citrate buffer of pH5.8.The reaction mixture was then incubated at 50°C for 60 minutes for bacterial cellulase. 1ml of DNS reagent was added to arrest the enzyme action. The tubes were kept in boiling water bath for 5 minutes. 1 ml of 40% sodium potassium tartarate was added when the tubes were warm and allowed to cool to room temperature. The amount of reducing sugar (glucose) from CMC through cellulolytic activity was measured at 540nm. A standard graph was prepared and cellulase activity calculated.

Effect of temperature of amylase activity

Six selected bacterial isolates showing high cellulase activity and 3 isolates showing high amylase activity were used to estimate enzyme activity over a temperature range of 20ºC , 30ºC and 40ºC using DNS method.

The 3 isolates of amylolytic bacteria NAUS P-II 39(A), NALS P-3 10^{-3}, SCAKK US P-I(3) identified as gram positive rods were inoculated into 50ml starch broth separately and incubated for 24 hours in shaker incubator at 30º at the speed of 200 rpm. Overnight culture (1% at OD 1.5) was inoculated in 100ml of sterile starch broth and incubated in shaker incubator at speed of 200rpm for 24hours at 30°C. 100 ml of starch medium was inoculated as above and incubated at different temperatures 20°C, 30°C, 40°C respectively. 1ml of the above broth was taken as the crude enzyme extract for characterizing amylase using DNS method.

Effect of temperature of cellulase activity

The 6 isolates SCAKK USP-I, SCAKK USP-I(3), SCAKK LS-5 P-III, SCAKK US-7 P-III, NAUS P-III, NALS 10^{-5}39(F)P-2 showing high CMCase activity was used to estimate total cellulase activity at temperature range of 20°C, 30°C, 40°C using DNS method. The minimal cellulose broth of 10 ml was sterilized and inoculated with the cellulolytic bacteria and incubated for 24 hours in shaker incubator at 30°C at the speed of 200rpm. Over night culture (1%at OD 1.5) was inoculated in 100ml of sterile minimal broth and incubated at speed of 200 rpm for 24 hrs at 30°C. 100 ml of minimal cellulose medium was inoculated as above and incubated at different temperatures 20°C, 30°C and 40°C respectively. 1ml of the above broth was taken as the crude enzyme extract for characterizing cellulase using DNS method.

Results and discussion

Among the 40 bacteria screened 23 of them was from earthworm burrow wall soil sample and 17 of them were isolated from the control soil. Off the total bacteria screened for Pectinase, Lignin, Cellulase and Amylase, 39.02% and 41.46% showed positive for degradation of pectin and lignin respectively, 95.12% showed positive for the production of enzyme cellulase and 97.56% showed positive for the production of

the enzyme amylase (Graph 1).

All the 23 bacterial isolates from earthworm burrow wall soil screened showed positive for the enzyme cellulose and amylase (Graph 2). Whereas among the isolates from the control soil 94.1% and 88.2 % of them showed positive for the production of cellulose of amylase respectively. 43.04% of isolates from burrow wall soil were observed to be positive for degradation of pectin and 43.04% for degradation of lignin. In the control soil isolates 31.05% of them showed positive for degradation of pectin and 36.8% showed positive for degradation of lignin.

Bacteria, in particular, deserve to be studied for ligninolytic potential because of their immense environmental adaptability and biochemical versatility (Chandra 2007). Several bacterial strains were found to degrade lignin [Chandra 2007, Ball, 1989, Nishimura, 2006). Lignin induced peroxidases, both extracellular and cell-associated, was identified and characterized in *Streptomyces spp*. Perestelo *et al.* [9] and Morii *et al.* [17] have studied lignin degradation with unicellular bacteria. Bacteria isolated from compost soil, viz. *Azotobacter*, *Bacillus megaterium* and *Serratia marcescens*, were capable of decolourizing, or solubilizing lignin (Morii 1995).

Among the 40 bacterial isolates tested for HC value, the highest HC value for cellulase of 4.52mm was shown by NAUS P-II39 (A) (Graph 3) an isolate from the burrow wall soil sample. Other isolates from burrow wall soil sample showed the high HC value include- SCAKK USP-II (4.11mm) SCAKK LS P-III (3.95mm) NALS P (I3.83mm), SCAKK LCP-I (3.8mm) and SCAKK US7P-III (3.72mm). The rest of the isolates showed the HC value ranging between 2mm and 4mm. Very few isolates from control soil showed high levels of cellulase activity.

Similarly, the highest HC value for Amylase was seen from an isolate from the burrow wall soil sample viz., NALS P-3 10^{-5}(5.28mm). The rest of the isolates showed the HC value between 1mm-3mm. The mean zone of amylolytic activity for the isolates ranged between 2.1 mm for *B. subtilis* and 1.1 mm for *B. pumilus* isolated from a cassava waste dumpsite (Oyeleke, 2009)

13 bacterial isolates which showed high HC values were used for further enzyme assay for Amylase (Graph 4). Almost all isolates from burrow wall soil showed high enzyme activity with the highest of 0.096IU/ml by isolate SCAKK P-I(3). Other isolated showed a range from 0.03 to 0.05 IU/ML. Two isolates from control soil also showed high activity viz., NAUC (3) P-II (0.106 IU/ml) and NAUC P-III (0.041 IU/ml).

Among 40 isolates, 17 bacterial isolates from burrow wall soil that showed high HC value were tested for cellulase Activity (Graph 5). Most of the isolates showed high enzyme activity with the highest of 0.427IU/ml by sample soil SCAKK US P-1. Other isolates showed a range from 0.1 to 0.35IU/ml.

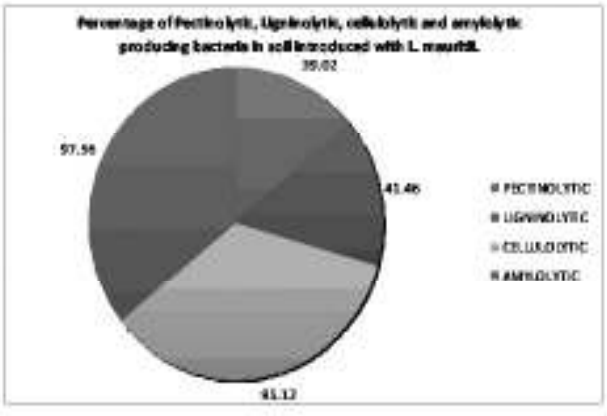
The enzyme activity at different temperature show that the maximum cellulase activity for all the isolates was at 30°C after 72 hrs. All isolates showed decreased enzyme activity at 40° C. (Graph 7 and 8). Isolate SCAKKUS P I (3) showed the highest production of both cellulase (0.381) and amylase (0.346) at 30 °C.

The capacity to breakdown cellulose, starch, pectin or lignin is a character distributed among a wide variety of aerobic, facultative aerobic, anaerobic bacteria and fungi. Microorganisms are largely responsible for organic matter decomposition, but earthworms may also affect rates of decomposition directly by feeding on and digesting organic matter, or indirectly affect them through microbial interactions, basically involving stimulation or depression of the microflora biomass and activity. Products of cellulose degradation are made available as carbon and nitrogen sources for either cellulolytic organisms, or other microbes living in the environment where cellulose is being degraded (Perez *et al.,* 2002). There are reports showing cellulolytic activity in the gut of earthworm which are of microbial origin (Jose, 2006; Claude Lattaud *et al.,* 1999). It is therefore assumed that earthworm sphere is a source of cellulose degrading bacteria.

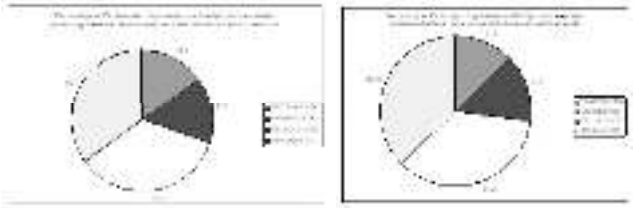
The natural sources of cellulose degradation vary which is investigated by different investigators. For example, 37.5% of Antarctic isolates were screened to be positive for Congo red test isolated from swab, wall scrapings or small slivers of wood taken from 15 sites around the interior of the cape Evans hut (Shona *et al.,* 2006). A total of 23.45% of cellulolytic fungi was isolated from infected materials and soils (Bose, 1963). 44.44% of cellulolytic fungi were isolated from the barrio highlands, Sarawak (Abdul *et al.,* 1999) and 62.5% of cellulolytic fungi were isolated from various locations within sayab substation, Kinabalu Park (Abdul *et al.,* 1998).

Further studies on optimising the conditions for enzyme production will undoubtedly lead to an improvement of enzymatic activity. These extracellular enzymes are widely applied in agriculture, food and beverage industries and textile industries. There is also a great potential for genetic manipulation of these isolates to increase the production of the enzymes which can lead to the increased enzyme activity.

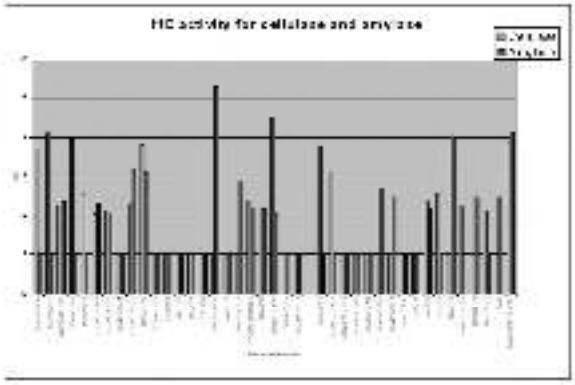
Graph 1: Percentage of pectin, Lignin, Cellulase and Amylase producing bacteria in soil introduced with L. mauritii



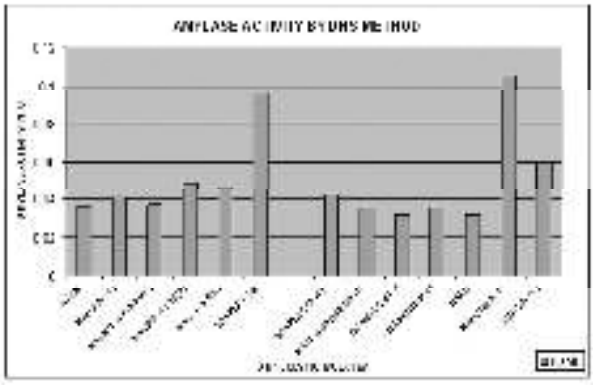
Graph 2- Percentage of pectin, Lignin degrading and Cellulase & Amylase producing bacteria in burrow wall soil and control soil introduced with *L. mauritii*



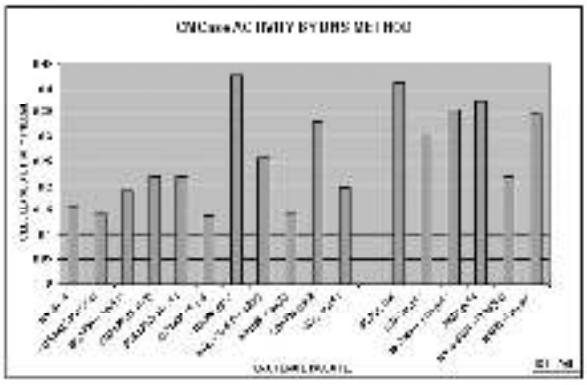
Graph 3- HC Value of Cellulase and Amylase produced by bacteria isolated from control and soil sample introduced with Lampito (45 days).



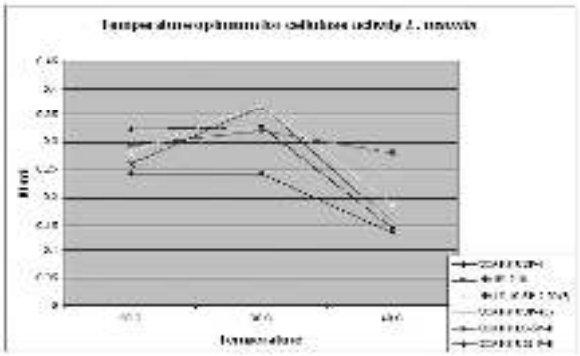
Graph 4- Activity of enzyme Amylase by DNS method



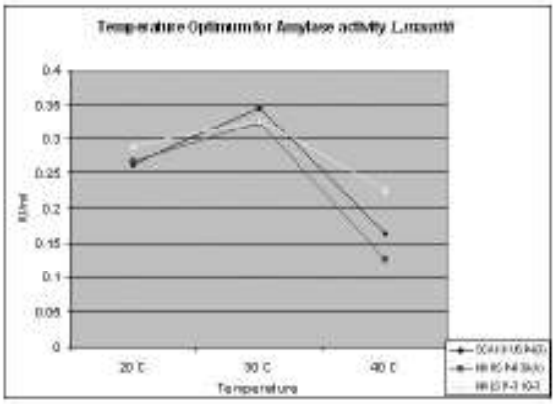
Graph 5- Activity of enzyme cellulase by DNS method



Graph 7- Temperature optimum for cellulase activity



Graph 8- Temperature optimum for amylase activity



REFERENCES

1. Abdul Jalil Kader and Othman Omar. 1998. Isolation of cellulolytic fungi from sayab-kinabalu park sahib. Review of biodiversity and environmental conservation. Article II.

2. Abouzeid, A.M., Reddy.1986. Direct fermentation of potato syarchj to ethanol by co cultures of Aspergillus niger and Saccharomyces cerevisiae. Appl. Environ.Microbiol. 52:1055-1059

3. Abouzeid, A.M., 1997. Production and characterization of an extracellular ά-amylase enzyme from Aspergillus fiavus. Microbiol. 89:55-66

4. Akpan-zeid, A.M., 1997. Production and characterization of an extracellular ά-amylase enzyme from Aspergillus flavus.MIcrobios. 89:55-66

5. Anderson, O. R., Bohlen, P. J. 1998. Abundance and diversity of *gymnamoebae* associated with earthworms (*L. terristris*) middens in the north eastern U.S.forest. *Soil biology and biochemistry*, 30:1213-1216

6. Hankin, L. and Anagnostakis, S>L.1977. Solid media containing carboxymethyl cellulose to detect Cx cellulase activity of microorganisms.J.Gen.Microbio.,98;109-115

7. Barne,A.J.2006.The location of organic matter in soil matrix affects growth rates of Aporrectodea rosea.(poster)

8. Bailey.M.J.1988. A note on the use to DNS for determining the products of enzymatic reactions. Appl.Microbiol. Biotechnology.29;494-496

9. Ball, A.S., W.B Betts and A.G. McCarthy, 1989. Degradation of lignin-related compounds by Actinomycetes. Appl. Environ. Microbiol., 55: 1642-1646
10. Bernfeld, P.1951. Enzymes of starch degradation and synthesis.In "Advances in Enzymology" (ed.Nord FF). Interscience Publications inc.New York. pp.379-424
11. Bernfeld, P.1955. Amylase, ά and β. Methods Enzymol. 1:149-1589
12. Bergman, F.W., Abe, J., Hizukurji, S.1988. Selection of microorganism's whicvh produces raw starch degradation amylase.Appl.Microbiol. Biotechnol. 27:443-446
13. Bhatnagar, T. 1975. Lombriciens ET humification; un aspect nouveau de I´incorporation microbienna d´azote induite par les vers de terre, in.k.gilbertus, o.reisinger, a. mourey, and j. a cancela da fonseca. Biodegration et humification. piersson, sarruguenmines ; 169-182
14. Bohlen,P.J and R.W.Parmelee,D.A.Mccartney and C.A.Edwards.1997.Earthworm effects on carbon nad nitrogen dynamics of surface litter in corn agrosystem S. Ecological applications(in press)
15. Burhan, A.,Nisa, U.,Gokhan, C., Omer, C., S Ashabil, A., and Osman,G.2003.Enzymatic properties of a novel thermophilic,alkaline and chelator resistant amylase from an alkalophilic Bacillus sp. Isolate ANT-6.Process Biochemistry,38,1397-1403.
16. Chandra, R., A. Raj, H.J. Purohit and A. Kapley, 2007. Characterisation and optimization of three potential aerobic bacterial strains for Kraft lignin degradation from pulp paper waste. Chemosphere, 67: 839-846.
17. Coleman, G., Elliott, W.H.,1962. Studies on ά-amylase formation by Bacillus subtilis., Biochem. J., 83:256-263
18. Coronado. M., Vargas, C., Hofemeister, J., Ventosa, A., Nieto, J.J.2000. Production and biochemical characterization of a ά-amylase from the moderate halophile Halomonas meridiana. FEMS Microbiol. Lett. 183:67-71
19. Claude Lattaud,Philippe Mora,Marta Garvin,Sylvain Locati and Corinne Rouland.1999.Enzymatic digestive capabilities in giophagos earthworms- origin and activities of cellulolytic enzymes.Pedobiologia,43;842-850
20. Edwards, C.A. and J.R. and lofty.1977.Biology of earthworm Chapman and Hall. London
21. Edwards, C.A. Bohlen, P.J...1996. The Biology and Ecology of Earthworms.3rd ed.London; Chapman and Hall.
22. Fang, A.., and Demain, A.L., 1989. A new chemically-defined medium for RAc-certified strains of B.subtilis., Appl. Microbiol Biotech. 19:301-305
23. Fogarty, W.M., Kelly, C.T. 1979. Developments in microbial extracellular enzymes. In: Wiseman A, editor. Topics in enzyme and Fermentation biotechnology 3:45-108
24. Friendrich, J., Cimerman. A., and Perdih, A.1987. Mixed culture of Aspergillus awamori and Trichoderma ressi for bioconversion of apple distillery waste. Appl.Microbiol,Biotechnol. 26: 299-305
25. FAO. (2001). Review: Enzyme Applications for Agro-Processing in Development Countries. An Inventory of Current and Potential
26. Hoffman, R.M, wood, T.M. 1985. Isolation and partial characterization of a mutant penicillium for the saccharification of straw. Biotechnol. Bioeng, 27:81-85.
27. Hand P, Hayes WA, Frankland JC, Satchell JE. The Vermicomposting of cow slurry. Pedobiologia, 1988; 31,199-209
28. Hamilton, W. E. and Sillman.1989. Influence of earthworm middens on the distribution of soil micro arthropods. *Biology and fertility of soils*, 8: 279-284.
29. Hattori F 1984. Japan Payent No 1203977, Japan Kokai Tokyo. Koho. 51-44652
30. Hendrix,P.f.1995.Earthworm Ecology and Biogeography in North America.Boca Raton(FL);Lewis publishers
31. Henry, R.J., Chiamori,N.1960. Clin. Chem.6:434, also in henry,R.J.Clin.Chem.471.
32. Howell, S.F.and Sumner,J.B.1935. A method for determination of sacchrase activity.J.Biol.Chem.108:51-54
33. Immanuel, G.*R.* Dhanusha, P.Prema and A. Palavesam 2006.Effect of different growth parameters on endoglucanase enzyme activity by bacteria isolated from coir retting effluents of estuarine environment. *International Journal of Environmental Science and Technology.*
34. Jamuna, R., Radhakrishna SV.1992. Continuous synthesis of thermostable ά-amylase by Baciilus cells immobilized in calcium alginate. Enzyme Microbiol. Technol. 14: 36-41
35. Julka, J. M., Dash, R. C., Senapathi, B. K. and Mishra, P.C.1986. Earthworms resources of India Proc. Nat. Sem. Org. waste utilization, Vermicomp, part B: verms and Vermicomposting. 1-7.
36. Jin, F, X., Shi, Y., Zhang, C., 1990. Isolation of new thermophilic aerobic bacteria which produces thermostable ά-amylase., J.Gen.Appl.Microbiol.36:415-424
37. Kale, 1997. Earthworms and Soil. Proc. Nat. Acad. Sci. India, 67 (B), Spl. Issue
38. Kale RD, Kubra B, Sreenivasa MN, Vinayak K, Bagyaraj DJ, Veeresh GK, Rajagopal D, Vikratamath CA. Incidence of cellulolytic and lignolytic *organisms in* earthworms worked soils. Advances in management and conservation of soil faunna Proceedings of the 10th International soil Zoology Coilequium, held at Bangalore, India, 1991; Aug 7 - 13, 1988, 599-603.
39. Khoo, S.L, Amirul, A.A, Kamaruzaman M, Nazalan N, Azizan M.N.1994. Purification and characterization of ά-amylase from Aspergillus flavus. Folia Microbiol. 39:392-398s
40. Kingspohn K, Bader J, Kruse PV, Schugerl K 1993. Utilization of potato pulp from potato starch processing. Proc. Biochem. 28: 91-98. Aiyer 1529
41. Lin, L.L., Tsau, M.R., and Chu, W.S.1996. Biotehnol.Appl.Biochem. 24:101-107
42. Long-LiuLin, Charng-CherngChyua, and Wen-Hwei Hsu.1998. Apl.Biochem.28:61-68

43. Lonsane BK, Ramesh MV.1990. Production of Bacteria thermostable ά-amylase by solid-state fermentation. A potential tool for achieving economy in enzyme production and starch hydrolysis.Adv.Appl. Microbiol.35: 1-55
44. Lynch, J.M.1988. The terrestrial environment, In J. M: 103-131
45. Logsdon G. World wide progress in vermicomposting. Biocycle 1994; 35(10), 63-5.
46. Lynd, L. R., Weimer, P. J., Van Zyl, W. H and Pretorius, I. S. 2002. Microbial cellulose utilization; Fundamentals and Biotechnology. *Mol.Biol.Rev*, 66: 506-577
47. .Mctigue, M.A., Kelly, C.T., Doyle, E.M., and Fogarty, W.M.1995. The alkaline amylase of the alkalophilic Bacillus sp. IMD 370. Enzyme and Microbial Technology,17, 570-573
48. Madan M, Sharma S, Bisaria R, Bhamidimarri R. Recycling of organic wastes through vermicomposting and mushroom cultivation. Alternative waste treatment systems 1988;132-141.
49. Madsen, G.B., Norman, B.E., and Slott, S.1973. A new heat stable bacterial amylase and its use in high temperature starch liquefaction. Die Starke. 25:304-308
50. Mackay,R.J.,and K.E.Kersey.1985.A preliminary study of aquatic insect communities and leaf decomposition in acid streams near Dorset,Ontario.Hydrobiologia,122:3-11
51. Miller, G.L.1959. Use of dinitrosalicylic acid for determination of sugars. Anal.Chem.31:425-428
52. Mitchell DA, Lonsane BK 1990. In: General principles of Solid State fermentation, Monogram, ed by Doelle HW, Rolz C. Publication of Oxford London.
53. Morii, H., K. Nakamiya and S. Kinoshita, 1995. Isolation of lignin decolourising bacterium. J. Ferment. Bioeng., 80: 296-299.

C.G.G.A.E.E.B.E:-4

STUDY OF PLANT GROWTH PROMOTING RHIZOBACTERIA FROM BURROW WALL SOIL OF *LAMPITO MAURITII*

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Microbial biomass is a small but labile component of soil organic matter and plays an important role in cycling of nutrient elements. Hence its role in plant nutrition under different ecosystem conditions has assumed greater significance. One group of microorganisms which are beneficial to plant growth is bacteria referred to as Plant Growth Promoting Rhizobacteria or PGPR. The PGPR's are associated with many, if not all plant species and are commonly present in many environments. These improve plant growth by nitrogen fixation through symbiotic and asymbiotic or associative nitrogen fixing process and growth hormone production. Their effect on plant growth may be neutral, deleterious or beneficial. Earthworms the dominant macrofauna in the soil are important to plant litter decomposition and fertility. By modifying decomposition processes and soil structure, they function as driving factors of the soil microbial community. Mucus secreted through the earthworm's cuticle is often found on burrow walls. These burrow walls contain proteins making the lining rich in organic matter, microorganisms and available plant nutrient. The presence of PGPRs in the burrow wall soil would hence gain significance. This study has been undertaken to isolate and characterize PGPR's occurring in the burrow wall of the Earthworm – *Lampito mauritii*, a widely distributed earthworm in India, reported from different agro-ecosystems. PGPRs were isolated using different media like YEMA, PIA, PVK, Ashby's media, Jensen's media, Ammonification media, Nitrate media and Kleigler media. *Psuedomonas*, *Rhizobium* and *Azotobacter* sps dominated among the PGPRs isolated. Indole Acetic Acid and Siderophore production by the isolated bacteria was also studied.

INTRODUCTION: Plant growth promoting rhizobacteria (PGPRs) are root colonizing microorganisms which are known to fix atmospheric molecular nitrogen through symbiotic and asymbiotic or associative nitrogen fixing process. PGPRs can influence plant growth and development directly or indirectly. The beneficial effects of plant growth promoting rhizobacteria (PGPR) have been attributed to biological N_2 fixation (Boddy *et al.* 1995; Meunchang *et al.* 2004) and production of phyto-hormones that promote root development and proliferation resulting in more efficient uptake of water and nutrients (Jacoud *et al.* 1999). These bacteria belong to the genera *Azotobacter, Azospirillum, Bacillus, Arthrobacter, Enterobacter, Pseudomonas, Alcaligenes, Klebsiella* and *Serratia* (Dobereiner, 1992).

PGPRs may directly facilitate the proliferation of their plant hosts in a number of ways which include synthesis of siderophores which can provide iron to plants, various phytohormones, including auxins and cytokinins, provide mechanisms for the solubilization of minerals such as phosphorus and synthesize enzymes that can modulate plant growth and development (Davison, J. 1988). Brown et al. (2000) differentiated five different mechanisms by which earthworms may enhance plant performance: (i) nutrient release in the rhizosphere, (ii) changes in soil hydraulic properties, (iii) pest control, (iv) enhancement of mutualistic microorganisms and (iv) hormone-like effects.

Earthworms have been described as being one of the main

groups of soil engineers in tropical and temperate ecosystems because they change the structural properties of soil and thus influence soil microorganisms, soil organic matter regulation and plant growth (Lavelle et al., 1992; Lavelle, 1997). They act on soil structures through (i) the creation of burrows which facilitate water and gas transport, (ii) the incorporation of litter into the soil, the mixing of soil minerals and organic material and the breaking down of SOM and (iii) the ejection of surface and/or subsurface casts (Brown et al., 2000). Earthworm breakdown larger soil particles and leaf litter which increases the availability of organic matter for microbial degradation, they also promote macro aggregate formation by depositing casts rich in glycoproteins, polysaccharides, bacteria and clay (Edwards *et al.,* 1996).

There are about 3000 species of earthworms distributed all over world and about 384 species are reported in India (Julka, 1986). They live mostly in horizontal burrows, selecting food from the soil, often feeding on organic materials on or just under the soil surface, deposit casts within their burrows or in other spaces within the soil. The burrows they create facilitate water and gas transport (Zhang, H., and S. Schraeder.1993), by mixing soil minerals with organic material (Hendriksen, 1991) and by comminuting and incorporating litter into the soil and thereby creating macro aggregates. It was only recently that scientists have started to describe the earthworms 'sphere' or drilosphere where earthworms influence the soil which in turn influences the soil microbial biomass. The term 'drilosphere' was originally coined by Bouche in 1975 to describe the zone 2mm thick around earthworm burrow walls, but Lavelle expanded its meaning to include all soil including microbial and invertebrate populations affected by earthworm activities. Hence drilosphere includes externally produced structures (middens, burrows, diapause chambers, surface and below ground casts), the earthworm surface in contact with the soil and the internal microenvironment of the earthworm gut. The drilosphere is the part of the soil influenced by earthworm secretions and casting (Wanda *et al.,* 1999).

Based on feeding behavior, three categories of earthworms have been recognized i.e.; epigeic, endogeic and anecic (Lee, 1985). Epigeic worms are typically small, darkly pigmented, manure worm. These species reside in leaf litter layers under the bark of decaying logs or decaying organic matter and feed on fresh organic matter and consume decomposing litter. Endogeic worms are larger; less pigmented to unpigmented and have longer lifespan. Endogeics resides in extensive burrows in the mineral soil horizons and and consume large quantity of soil concentrating organic matter or at the soil-litter interface. Anecic worms are the largest and longest earthworms living in all strata of soil. Anecics inhabit a permanent or semi permanent deep vertical burrows into the deep mineral layers of the soil. They drag organic matter from the soil surface into their burrows for food which open at the soil surface and emerge at night to consume relatively fresh plant detritus on the surface. They consume more soil and decaying litter from the surface.

Lampito mauritii is the widely distributed earthworm in India and occupies a unique position, reported from different agro-ecosystems. It has a length of 72-152 mm, diameter of 3.5- 5.5 mm and 126-179 segments. Color dorsally is greyish, brownish or yellowish with purplish tinge at the anterior end. Its ability to withstand a wide range of temperature, soil moisture content, adaptability to coexist with a wide range of other species of earthworms, the wide choice of food niches explain its large distribution (Kale 1997).

Burrows are important microhabitats which contribute to the high microbial diversity in mineral soil. The micro environment associated with the walls of earthworm burrow may be substantially different from soil only a few millimeters away. Earth worm burrow walls harbor distinctive communities of soil animals and protozoa, nematodes and micro arthropods which presumably control microbial activity in there microhabitats (Hamilton and Stillman 1989, Anderson and Bohlen 1998). Thus earthworm associated microhabitats may contribute to the maintenance of soil fauna diversity.

The microbial population distribution interacts with the burrow system by way of active and passive transport. Microorganisms are washed down and along the burrow walls when water flows intensively in vertical burrows; they are transported into the gut of earthworms and deposited at the place where earthworms casts.

Barois and Lavelle (1986) first proposed the hypothesis that earthworm and soil microflora have developed a mutualistic relationship in order to exploit soil organic matter reserves. Earthworm reduces pool sizes of surface litter (Bohlen *et al.,* 1997) and makes a way for microbial degradation of organic matter. Earthworm activity has been reported to speed rates of plant litter decomposition, increase nutrient transformation and plant nutrient uptake, improve soil aggregation and porosity and enhance water infiltration and solute transport (Satchell, 1983; Lee, 1985; Hendrix, 1995; Edwards and Bohlen, 1996; Lavelle *et al.,* 1999).

It has been well-documented in recent years, that soil microorganisms produce significant amounts of hormones and plant growth regulators which can influence plant growth. Interactions between earthworms and microorganisms, in the degradation and stabilization of organic wastes, can increase the potential production of plant growth regulators, since this process increases microbial diversity, populations and activity, by several orders of magnitude.

Just like Plant Growth Promoting Rhizobacteria are known to be activated by root exudates, soil bacteria stimulated by earthworm mucus could act on plant physiology by emitting phytohormones in the soil, which induces modifications of root system morphology and/or systemic resistance to parasites.

Currently, there are many bacterial genera that include PGPR among them, revealing a high diversity in this group. A dis-

cussion of some of the most abundant genera of PGPR follows:

Diazotrophic PGPR - Free nitrogen-fixing bacteria were probably the first rhizobacteria used to promote plant growth. *Azospirillum* strains have been isolated and used ever since the 1970s (Steenhoudt et al 2000). This genus has been studied widely; the study by Bashan et al. 2004 being the most recent one reporting the latest advances in physiology, molecular characteristics and agricultural applications of this genus. Other bacterial genera capable of nitrogen fixation that is probably responsible for growth promotion effect, are *Azoarcus sp., Burkholderia sp., Gluconacetobacter diazotrophicus, Herbaspirillum sp., Azotobacter sp* and *Paenibacillus (Bacillus) polymyxa* (Vessey2003).

Bacillus- Members of Bacillus species are able to form endospores and hence survive under adverse conditions; some species are diazotrophs such as *Bacillus subtilis* (Timmusk 1999), whereas others have different PGPR capacities, as many reports on their growth promoting activity reveal (Kokalis-Burelle, Probanza 2002).

Gram negative soil bacteria- Among Gram-negative soil bacteria*, Pseudomonas* is the most abundant genus and the PGPR activity of some of these strains has been known for many years, resulting in a broad knowledge of the mechanisms involved (Lucas García, 2004, Patten, 2002 Gutiérrez Mañero 2003). The ecological diversity of this genus is enormous, since individual species have been isolated from a number of plant species in different soils throughout the world. *Pseudomonas* strains show high versatility in their metabolic capacity. Antibiotics, siderophores or hydrogen cyanide are among the metabolites generally released by these strains (Charest, 2005). These metabolites strongly affect the environment, both because they inhibit growth of other deleterious microorganisms and because they increase nutrient availability for the plant. They secrete pyoverdin (fluorescein), a fluorescent yellow-green siderophore (Meyer JM et al, 2002). Certain *Pseudomonas* species may also produce additional types of siderophore, such as pyocyanin by *Pseudomonas aeruginosa* (Lau et al , 2004) and thioquinolobactin by *Pseudomonas fluorescens* (Matthijs S, et al 2007).

Rhizobia- *Rhizobium* well known for their beneficial symbiotic atmospheric nitrogen fixing symbiosis with legumes has an excellent potential to be used as PGPR with non legumes in a nonspecific relationship (Antoun *et al*., 1998). They form an endosymbiotic nitrogen fixing association with roots of legumes. Here the bacteria converts atmospheric nitrogen to ammonia and then provides organic nitrogenous compounds such as glutamine or ureides to the plant. (Sawada H, Kuykendall LD, Young JM 2003). It is well known that a number of individual species may release plant growth regulators, siderophores and hydrogen cyanide or may increase phosphate availability, thereby improving plant nutrition (Antoun, 1998). *Agrobacterium* is closely related to *Rhizobium.*

Ammonifying bacteria- These bacteria are significant for the biological process of ammonifcation. Soil bacteria decompose organic nitrogen forms in soil to the ammonium form. In soils NH_3 is rapidly converted to NH_4^+ when hydrogen ions are plentiful.

Phosphate solubilising bacteria: These bacteria were significant in converting the insoluble complex form of phosphate into simple soluble form to increase the yield. Only a few numbers of bacteria are present in the soils which solubilise phosphate. Microorganisms produce acids that form soluble phosphate from insoluble phosphate.

IAA production by bacteria : Indole-3-acetic acid, also known as IAA, probably the most important plant auxin is a heterocyclic compound that is a phytohormone. The molecule is derived from indole, containing a carboxymethyl group (acetic acid). IAA has many different effects with subsequent results for plant growth and development. Some of the IAA producing micro organisms include *Acitobacter xylinum, Arthrobacter citreus, Bacillus cereus, Pseudomonas aeruginosa, Xamthomonas maltophilia***,** *Rhizobium leguminosarum, Rhizobium japonicum* and *Azospirillum.*

Siderophore production by bacteria: Iron is required by aerobic bacteria and other living organisms for a variety of biochemical reactions in the cell. Although iron is the fourth most abundant element in the earth's crust, it is not readily available to bacteria. Most of the aerobic organisms have developed an efficient means for solublizing and transporting iron. The mechanism involves the role of low molecular weight organic compounds that have ability to chelate iron and transport it across the cell. These compounds are called Siderophores. In the natural environment, PGPRs produce siderophores to acquire iron. Some PGPRs can also utilize iron from heterologous siderophores produced by neighboring microorganisms (R.M Muragappan, et al. 2006).

The many different types of siderophores can generally be classified into two structural groups, hydroxamates and catecholate compounds. Despite their structural differences, all form an octahedral complex with six binding coordinates for Fe^{3+}.The wide variety of siderophores may be due to evolutionary pressures placed on microbes to produce structurally different siderophores which cannot be transported by other microbes' specific active transport systems, or in the case of pathogens deactivated by the host organism

The present study was being undertaken to isolate and characterize PGPR's occurring in the burrow wall of the Earthworm – *Lampito mauritii* using selective media. Indole Acetic Acid and Siderophore production by the isolated bacteria was also studied.

MATERIALS AND METHODS

Collection of Earthworms : A natural plot was identified for collection of earthworms. About one square meter plot was

cleared off surface plant growth and the area sprayed with 1% jaggery solution to attract the underlying earthworm population. After 48 hours the spot was dug and the earthworms were collected for use in the laboratory. To adapt them to laboratory conditions the earthworms were released into glass troughs having a layer of garden soil and a top layer of humus, prepared by mixing garden soil and leaf litter for a period of two months.

Experimental set up : The sample material was generated in the laboratory by maintaining earthworms in chambers with a dimension of 30 cm x 40 cm and width of 10 cm in two sets. The chambers were filled with air dried soil and moistened to maintain 60% level before releasing earthworms. About three fourth of the chamber was filled with this soil. The top one third of the chamber was filled with humus. Ten adult earthworms were released.

Sample collection: Soil sample was collected by destructive method with sterile spatula by carving the inside lining of the burrows. Sampling was carried out at 30 days and 45 days interval. Samples were collected from the top 15 cm and lower 30 cm region. Control sample was collected from a region away from the burrows.

Isolation of PGPRs on different media : PGPR's were isolated using the following media

- YEMA medium for *Rhizobium* and *Agrobacterium*
- Pseudomonas isolation agar (PIA) medium for *Pseudomonas*
- Kleigler medium for Enteric bacilli
- Nitrate medium and Ammonification medium
- Ashby's and Jensen's medium for *Azotobacter* and
- Picovskaya (PVK) medium for Phosphate solubilising bacteria

1g soil samples of Lower control (30/45 days), Lower burrow wall soil (sample) (30/45 days), Upper control (30/45 days) and Upper burrow wall soil (30/45 days), was serially diluted. The dilution of 10^{-6} was plated on to the different selective media. Kleigler and Peusodomonas Isolation Agar (PIA) were observed after 24hrs of incubation whereas the rest of the media's were observed after 2-3 days for the growth of colonies.

The isolates were identified based on colony characteristics and Gram staining.

***Rhizobium* and *Agrobacterium* on YEMA medium :** *Rhizobium* colonies are round varying from flat to doomed and even conical shape having smooth margins. In sub-surfaces they are typically lens shaped. They form white, translucent, glistening, elevated and comparatively small colonies.

Agrobacaterium colonies are very similar to *Rhizobium* but have unique capability to take up congo red when grown on YEMA. They appear as dark pink colonies. On Gram staining, both the organisms appear as Gram negative rods.

***Pseudomonas* on PIA medium:** The colonies appear as round with smooth margin, producing fluorescence of blue, green and yellow. On Gram staining, they appear as Gram negative rods.

Isolation of Enteric bacilli on Kleigler medium: The colonies appeared flat or slightly convex with irregular edges and ground-glass appearance. On Gram staining, Gram negative rods are observed. Further biochemical test were carried out to distinguish between lactose and non-lactose fermenters. The isolates were non-lactose fermenters.

Isolation of *Azotobacter* on Ashby's and Jensen media: The colonies on both media appear white, transparent and watery. They are round, doom like with smooth surface and margin. On Gram staining, Gram negative rods can be observed

Isolation of Ammonifying bacteria : White, brown colonies with slimy surface were observed. On Gram staining, both Gram negative rods and Gram positive rods in chain with central spores are observed.

Isolation of denitrifiers of Nitrate medium: The colonies are observed to be brown, white and translucent with rhizoid and smooth margin. On Gram staining, organisms are observed to be both Gram negative rods and Gram positive rods.

Isolation of Phosphate Solubilising Bacteia on Picovskaya medium : Colonies are varying in colors from pink, white, orange to yellow. They have both smooth and wavy margins. On Gram staining, organisms observed were both Gram positive and Gram negative rods.

Isolation of *Azospirillum* on Nitrogen free Malate medium
The growth of the organism can be confirmed by the colour change in the medium from green to blue which is due to the change in the pH of the medium from acidic to neutral to alkaline. White pellicle formation of 2-4 mm below the surface of the medium. Gram negative vibriod bacteria can be observed on staining.

Quantitative analysis of IAA production by PGPR's: Indole acetic acid (IAA) produced by isolates from each media was assayed colorimetrically using ferric chloride – perchloric acid reagent ($FeCl_3$- $HClO_4$) in 1:50 ratio (Gordon Weber 1951). This method estimates the quantities of indole compounds produced by bacteria in the medium containing precursor L-tryptophan. The isolates were grown on Luria- Bertani (LB) broth medium consisting of Tryptone, yeast extract, 5; NaCl, 5. The pH was adjusted to 7.5 with 1N NaOH before autoclaving. The culture inoculated with isolates was incubated at a 30°C temperature for 24 hrs in rotary shaker (120 rpm). 1.5 ml bacterial culture was centrifuged at 2,000 rpm for 5 minutes. One milliliter of the supernatant was added to 2ml $FeCl_3$- $HClO_4$ reagent. After 25 minutes the absorbance was read in UV-spectrophotometer at 530 nm. The amount of IAA produced per milliliter culture was estimated using a standard curve. A

pink colour develops when a mineral acid is added to a solution containing indole acetic acid in the presence of ferric chloride. Since Beer's law is not followed at high concentrations of IAA, absorbencies obtained are converted to IAA concentration by a standard curve. (William T. Frankenberger, et al.1995).

Study of Siderophore production: Isolates were grown in the glucose aspergine medium and incubated in a rotary incubator at 37° C 150 rpm for 72 hours. The culture was centrifuged at 2000 rpm for 5 minutes. The cell free supernatant was examined for absorption spectrum between 200- 600 nm using UV visible spectrophotometer. The peak at which the siderophore is produced was determined by plotting the graph.

RESULTS

Total count on various media: The total count of various bacteria isolated in different selective media is shown in Table 1. *Azotobacter* was isolated from all the soil samples using Jenson and Ashby's media. Both in the lower and the upper earthworm burrow wall soil an increase in the *Azotobacter* count was seen compared to the control soil. The 45 days burrow wall soil both upper (4.7×10^7) and lower (2.4×10^7) showed an increased count of *Azotobacter* compared to the control (lower- 1.886×10^7, upper –5.3×10^6). In the 30 days soil sample (lower -1.7×10^7 , upper - 4.1×10^7) also an increased count of *Azotobacter* was observed when compared to control soil (lower- 7.3×10^6, upper – 2.6×10^7). The highest count of *Azotobacter* on Ashby's media was observed in 45 days upper earthworm burrow wall soil (4.7×10^7) with a highly significant increase compared to control.

The highest number of *Azotobacter* (on Jensen's media) count was seen in 30 days lower burrow wall sample (1.9×10^9), an increase compared to lower control soil (1.0×10^9). *Azotobacter* count was less in both 30 days upper control and sample soil. In the 45 days sample the highest count of *Azotobacter* was seen in upper burrow wall soil sample (1.3×10^9) again an increase compared to control soil (7.0×10^8). Where as in the lower burrow wall the number of *Azotobacter* decreased (6.7×10^8) compared to control soil (1.0×10^9).

30 days earthworm burrow wall soil sample showed higher number of *Enteric bacilli* than that of the 45 days burrow wall soil sample. In 30 days sample, upper control soil sample had the least number of *Enteric bacilli* (1.9×10^7) and the lower control soil sample had the maximum (6.0×10^7). In the lower burrow wall soil sample there is a decrease in the *Enteric bacilli* count when compared to the control soil after 30 days incubation.

The 30 days burrow wall soil sample was richer in *Rhizobium* than that of 45 days sample. A high *Rhizobium* count was observed in 30 day samples with the maximum CFU seen in the upper burrow wall soil sample (8.2×10^7). Both in the upper and lower burrow wall soil sample an increase in the *Rhizobium* count was observed compared to control soil. The *Agrobacterium* count was much lower compared to *Rhizobium* in all 30 days samples though an increase in the count was seen in the burrow wall soil sample (upper-1.2×10^7, lower-1.6×10^7) compared to control soil (upper-9.3×10^6, lower-1.0×10^7). In the 45 days sample the *Agrobacterium* count has remained the same as in 30 days in the lower burrow wall soil (1.6×10^7) but has increased in the upper burrow wall soil (3.6×10^7). Also this sample shows the highest count and a significant increase in *Agrobacterium* count.

A high count of *Pseudomonas* was observed in the lower control soil samples of both the 30 day (2.1×10^9) and 45 day (3.9×10^9) soil compared to that of the lower burrow wall soil sample (1.3×10^7) in 30 day and (7.0×10^8) in 45 day. The reverse of this was observed in upper burrow wall soil samples in 30 day (2.0×10^9) and in 45 day (3.6×10^9) which has a higher count of *Pseudomonas* than in the upper control soil samples in 30 day (6.7×10^8) and 45 day (1.3×10^9).

The presence of denitrifying bacteria all the soil samples was similar to *Pseudomonas* though in lesser number. In 30 day soil sample the least count of denitrifying bacteria was seen in upper control (4.133×10^7) with an increase in upper earthworm burrow wall soil (9.5×10^7). A higher count was observed in lower control soil (6.5×10^8) compared to lower burrow wall soil (1.8×10^8). In 45 day soil, a small increase in the count of denitrifying bacteria in the burrow wall soil (upper-1.22×10^8, lower-1.8×10^8) was seen compared to their controls (upper-5.133×10^7, lower-5.4×10^7).

IAA production: Graph1 depicts the results of IAA produced by various isolates. Among the 8 Azotobacter isolate from Jenson media and Ashby's media analyzed, the isolate from 30 days upper control soil sample showed maximum production of IAA (40.08mg/ml), closely followed by 30 days lower burrow wall soil sample (38.72mg/ml) upper sample-16.88mg/ml; lower control-8.5/ml and 45 day soil, upper sample - 7.303mg/ml; lower sample - 12.39mg/ml and in Ashby's media 30 days lower sample showed maximum IAA production (34.03mg/ml), followed by 45 days upper sample, (21.77 mg/ml).

The isolate from control showed less IAA production compared to isolates from the sample except for upper control 30 days samples Denitrifiers isolated from the burrow wall soil showed IAA production in the range of 6.29mg/ml- 27.47mg/ml. Denitrifiers from 30 days lower burrow wall soil sample showed maximum production of IAA (27.47mg/ml), followed by 45 days upper burrow wall soil sample (10.51mg/ml), the 30 day lower sample isolate showed the highest production of IAA. *Pseudomonas* isolated from 45 days upper burrow wall soil sample showed maximum IAA production (34.43mg/ml). All *Pseudomonas* isolates produced a good amount of IAA with the isolates from burrow wall sample being on the higher side. *Enteric bacilli* isolated from 30 days lower burrow wall soil isolate showed maximum production of IAA (24.99mg/ml), followed by 30 days upper burrow wall soil sample (21.97mg/ml). *Rhizobium* isolate from 30 days lower

sample showed maximum production of IAA (41.74mg/ml), followed by 30 days lower control and least is seen in 45 days lower sample. Among phosphate solublising bacterial isolates, the isolate from 45 days upper control soil (17.54mg/ml) showed maximum production of IAA, followed by 30 days upper burrow wall soil (8.1mg/ml), 45days lower control (7.37mg/ml), lower burrow wall soil (7.23 mg/ml) and least in 30days upper control (6.83 mg/ml).

Siderophore production: All isolates from sample showed a peak between 240nm – 300nm indicating the presence of catecholates type of siderophore. Pseudomonas showed a peak at both 240nm and 450nm indicating the production of mixed type of siderophore that is both hydroxamates (450 nm) and catecholates (240 nm) type. Graph 2- 8

DISCUSSION : With new possibilities being opened up concerning the application of beneficial bacteria to the soil for the promotion of plant growth and the biological control of soil-borne pathogens and the large scale release of genetically engineered bacteria to the environment facing a number of regulatory hurdles, the need to isolate and select superior, naturally occurring PGPRs continue to be of interest. Making use of their beneficial effects requires detailed knowledge on the diversity of PGPR.

The main aim of present investigation was to screen for efficient PGPR strains from earthworm burrow wall soil of *Lampito mauritii.* The stains isolated include *Psuedomonas, Azotobacter, Bacillus, Rhizobium, Agrobacterium, denitrifiers and ammonifiers. Species of Azospirillum* were not isolated from any of the samples studied. All organisms except *Enteric bacilli* isolated showed an increase in total count in the burrow wall samples. A significant decrease in the *Enteric bacilli* count is seen after 45 days incubation. An increase in *Pseudomonas* count was observed in the upper burrow wall sample compared to control soil both in 30 and 45 days trials whereas in the lower samples the contrary was observed. All burrow wall soil samples showed an increase in the denitrifying bacterial count compared to control except the 30 day lower sample where a lesser number of denitrifying bacteria was observed.

Both *Azotobacter* and denitrifiers isolated from lower burrow wall soil sample produced maximum concentration of IAA than control. The range of IAA production by *Pseudomonas* isolates from upper burrow wall soil was very high with an increase in IAA production from isolates in the burrow wall soil samples of both 30 day and 45 day. This can be attributed to the influence of the earthworm. Though the enteric bacilli count has decreased the isolates from the burrow wall sample showed high IAA production. *Rhizobium* isolated from the lower burrow wall soil sample produced maximum concentration of IAA. Most of the isolates from 30 days lower sample showed maximum production of IAA.

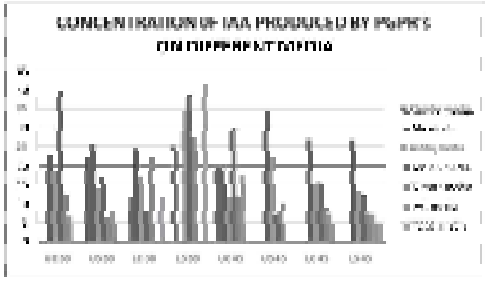
Our results of siderophore production show that all isolated produced catecholates type of siderophore showing a peak in the range of 220- 250nm. However, isolates of *Pseudomonas* produced mixed type of siderophore, both hydroxamates (450 nm) and catecholates (240 nm) type. Mayer and Abdullah (1978) have reported mixed type of siderophores (hydroxamates and catecholate) produced by *Pseudomonas.* Marianne Huyer 1988 have reported the production of the catechol siderophores when *Azotobacter vinelandii* was grown in the presence of low levels of iron.

We conclude that studies conducted to provide a deeper insight into this system will be of great interest to microbial ecology and will be crucial in obtaining specialized microorganisms, which can be used to solve various environmental problems.

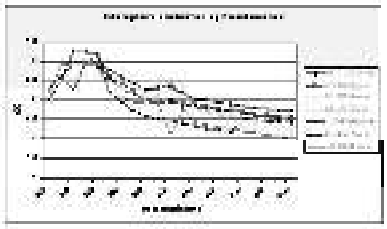
TABLE 1: **The count of various bacteria isolated in different selective media**

SAMPLE (cfu/ml)	*Rhizobium*	*Pseudo monas*	*Azotobacter* on Jenson Media	*Azotobacter* on Ashby's Media	*Denirtfiers*	*Enteric bacilli*	*PO4 solubilising bacteria*	Ammonification Media
LC(30d)	$2.86x10^7$	$2.15x10^9$	$1.01x10^9$	$2,46x10^7$	$9.53x10^8$	$7.33x10^7$	$1.46x10^7$	$4.20x10^7$
LS(30d)	$6.46x10^7$	$7.10x10^8$	$1.99x10^9$	$4.46x10^7$	$1.88x10^8$	$5,40x10^7$	$8.13x10^7$	$7.46x10^7$
UC(30d)	$5.93x10^7$	$1.34x10^9$	$1.20x10^8$	$1.22x10^8$	$4.13x10^7$	$3.13x10^7$	$1.05x10^8$	$5.86x10^7$
US(30d)	$9.86x10^7$	$2.06x10^9$	$4.66x10^7$	$9.46x10^7$	$9.53x10^7$	$1.17x10^8$	$2.06x10^8$	$8.13x10^7$
LC(45d)	$3.60x10^7$	$3.90x10^9$	$1.08x10^9$	$1.02x10^8$	$5.40x10^7$	$2.53x10^7$	$2,30x10^9$	$3.33x10^7$
LS(45d)	$2.86x10^7$	$1.03x10^9$	$6.76x10^8$	$3.53x10^7$	$1.81x10^8$	$9.66x10^7$	$4.01x10^9$	$3.33x10^7$
UC(45d)	$2.4x10^7$	$1.33x10^9$	$7.03x10^8$	$7.60x10^7$	$5.13x10^7$	$5.60x10^7$	$4.65x10^9$	$6.86x10^7$
US(45d)	$6.0x10^7$	$3.66x10^9$	$1.34x10^9$	$1.01x10^8$	$1.22x10^8$	$2.93x10^7$	$8.06x10^7$	$4.93x10^7$

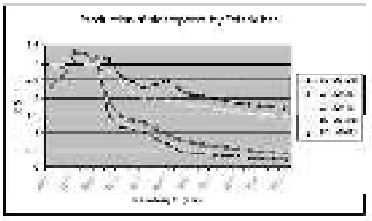
Graph 1



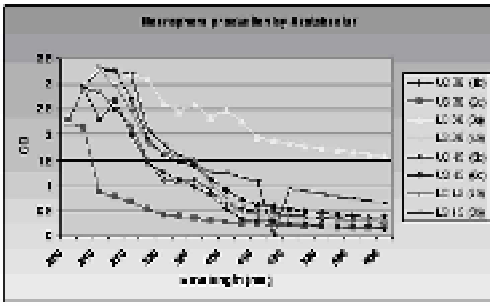
Graph 2: Production of siderophore by Pseudomonas isolated on PIA medium



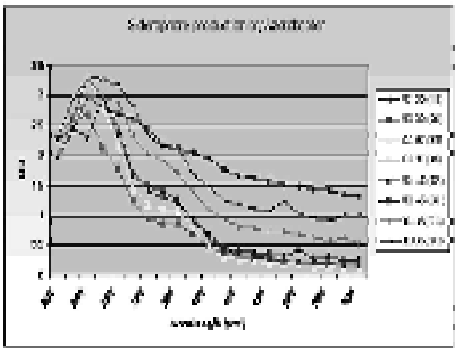
Graph 3: Production of siderophore by Enteric bacilli isolated on Kleigler medium



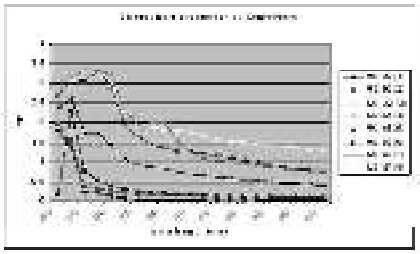
Graph 4': Production of siderophore by Azotobacter isolated on Ashby's medium



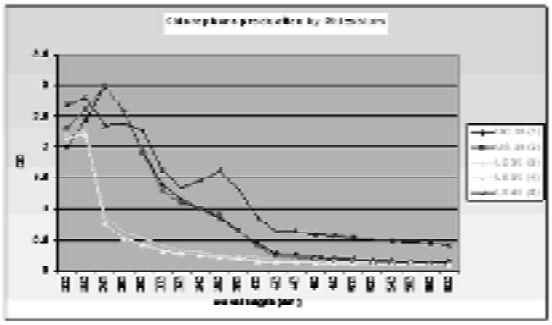
Graph 5: Production of siderophore by Azotobacter isolated on Jensen medium



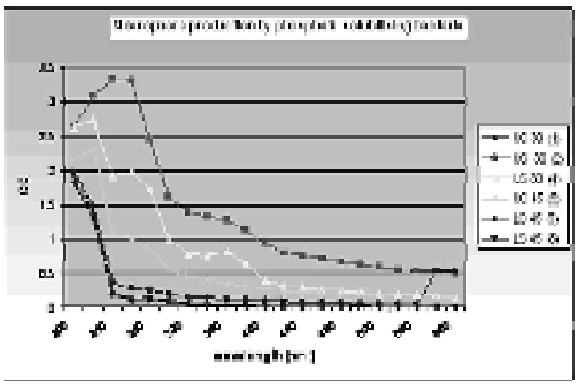
Graph 6: Production of siderophore by Denirtfiers isolated on nitrate medium



Graph 7: Production of siderophore by Rhizobium isolated on YEMA media



Graph 8: Production of siderophore by PO4 solubilising bacteria isolated on PVK medium



REFERENCES:

1. Allison, F. E. 1947. Azotobacter inoculation of crops. I. Historical Soil Sci. 64:413-429.
2. Anderson, O. R., Bohlen, P. J. 1998. Abundance and diversity of *gymnamoebae* associated with earthworms (*L. terristris*) middens in the north eastern U.S.forest. *Soil biology and biochemistry*, 30:1213-1216.
3. Antoun, H., Beauchamp, C.J., Goussard, N., Chabot, R. and Lalande, R. (1998) Plant and Soil, 204, 57–67.
4. Antoun *et al*., 1998 Field and Greenhouse Trials Performed with Phosphate Solubilizing Bacteria and Fungi -Hani Antoun Microbial Ecology Springer New York.
5. Barois, I., and P. Lavelle. 1986. Changes in respiration rate and some physicochemical properties of a tropical soil during transit through *Pontoscolex corethrurus* (Glossoscolecidae, Oligochaeta). Soil Biol. Bichem. 18: 539–541.
6. Baakza, A., B.P, Dave and H.C. Dube, 2004. Chemical nature, ligand denticity and quantification of fungal siderophores. Ind. J. Exp. Biol., 42:96-105.
7. Bashan, Y., Holguin, G. and de Bashan,L.E. (2004) Canadian Journal ofMicrobiology, 50, 521–577.
8. Bhatnagar, T. 1975. Lombriciens et humification;un aspect nouveau de I'incorporation microbienna d'azote induite par les vers de terre.in.k.gilbertus, o.reisinger,a.mourey, and j.a.cancela da fonseca. Biodegradation et humification. piersson,

sarruguemines: 169-182.
9. Bialek K, Michalczuk L, Cohen JD 1992 Auxin biosynthesis during seed germination in *Phaseolus vulgaris*. Plant Physiol.
10. Boddey, R.M. & Co-workers. 1995. Biological nitrogen fixation associated with sugar cane and rice:contributions and prospects for improvement. Plant Soil 174, 195-209.
11. Bohlen, P. J and R. W. Parmelee, D. A. Mccartney and C. A. Edwards. 1997. Earthworm effects on carbon and nitrogen dynamics of surface litter in corn agrosystem S. Ecological applications(in press)
12. Brown, G.G., Barois, I., Lavelle, P., 2000. Regulation of soil organic matter dynamics and microbial activity in the drilosphere and the role of interactions with other edaphic functional domains. Eur. J. Soil Biol. 36, 177–198.
13. Charest, M.H., Beauchamp, C.J. and Antoun, H. (2005) FEMS Microbiology Ecology, 52, 219–227.
14. Chet, I. and J. Inbar. 1994. Biological control of fungal pathogens. Appl. Biochem. Biotechnol. 48: 37-43.
15. Davison, J. 1988. Plant beneficial bacteria. Bio/Technology. 6: 282-286
16. Dobereiner, J. 1992. History and new prospectives of diazotrophs in association with non-leguminous plants. Symbiosis. 13:1-13.
17. Dowling, D.N. and F. O'. Gara. 1994. Metabolites of Pseudomonas involved in the biocontrol of plant disease. Trends Biotechnol. 12: 133-141.
18. Edwards, C. A. and P. J. Bohlen. 1996. The Biology and Ecology of Earthworms 3rd ed. London: Chapman and Hall
19. Edwards, C. A. and J. R. Lofty. 1980. Effects of earthworm inoculation upon the root growth of direct drilled cereals.*J.Appl.Ecol.*17: 533-543.
20. Frankenberger, Jr. W. T. and. M. Arshad. 1995. Phytohormones in Soils: Microbial production and function. Marcel Dekker, New York.
21. Gh. Abbas Akbari, Seyyed Mehdi Arab, H.A. Alikhani, I. Allahabadi and M.H. Arzanesh 2007. Isolation and selection of Indigenous Azospirillum spp. and the IAA of Superior Strains Effects on Wheat Roots. World Journal of Agricultural Sciences 3 (4): 523-529.
22. S. A. Gordon and Robert P. Weber October 4, 1951 Colorimetric Estimation Of Indole Acetic Acid
23. Gutiérrez Mañero, F.J., Probanza, A., Ramos, B., Colón Flores, J.J. and Lucas García, J.A. (2003) Journal of Plant Nutrition, 26 (5), 1101–1115.
24. Hamilton, W. E. and Sillman.1989. Influence of earthworm middens on the distribution of soil micro arthropods. *Biology and fertility of soils*, 8: 279-284.
25. Hendriksen, N. B.1991. Gut load and food retention in the earthworm *Lumbricus festivus* and *L. castaneus*: a field study. *Biology and fertility of soils,* 11: 170-173.
26. Hendrix, P. F. 1995. Earthworm Ecology and Biogeography in North America. Boca Raton (FL): Lewis publishers.
27. Herbert E. Johnson and Donald G. Crosby 1973, "Indole-3-acetic Acid", *Org. Synth.*, http://www.orgsyn.org, *Coll. Vol.* 5: 654
28. Hyodo, H. 1991. Stress / wound ethylene. In: The Plant Hormone Ethylene.
29. Jacobson M. B. 1991. Ethylene in root growth and development. In: The Plant Hormone
30. Jacoud, C. & Co-workers. 1999. Initiation of root growth stimulation by Azospirillum lipoferum CRT1 during maize seed germination. Can. J. Microbiol. 45, 339-342.
31. JM Sawada H, Kuykendall LD, Young 2003. "Changing concepts in the systematics of bacterial nitrogen-fixing legume symbionts". *J. Gen. Appl. Microbiol.* 49 (3): 155–79.
32. Johanna Santamaría[1] and Gary A. Toranzos-2002. Environmental Microbiology Laboratory,
33. Julka, J. M., Dash, R. C., Senapathi, B. K. and Mishra, P.C.1986. Earthworms resources of India Proc. Nat. Sem. Org. waste utilization, Vermicomp, part B: verms and Vermicomposting. 1-7. Department of Biology, University of Puerto Rico, P.O. Box 23360, 00931, San Juan, Puerto Rico,
34. Kale., 1997. Earthworms and Soil. Proc. Nat. Acad. Sci. India, 67 (B), Spl. Issue
35. Kloepper, J. W., R. Lifshitz and M. N. Schorth.1988. Pseudomonas inoculants to benefit plant production. ISI Atlas Sci: Anim. Pl. Sci. XX: 60-64.
36. Kokalis-Burelle, N., Vavrina, C.S., Roskopf, E.N. and Shelby, R.A. 2002 Plant and Soil, 238, 257–266.
37. Kok-Gan Chan 2009 Exochelin Production in *Mycobacterium neoaurum Int. J. Mol. Sci.* www.mdpi.com/journal/ijms.
38. Lau GW, Hassett DJ, Ran H, Kong F 2004. "The role of pyocyanin in Pseudomonas aeruginosa infection". *Trends in molecular medicine* 10 (12): 599–606.
39. Lavelle, P., 1997. Faunal activities and soil processes: adaptive strategies that determine ecosystem function. Adv. Ecol. Res. 27, 93–132.
40. Lavelle, P, Brussaard., L, Hendrix P. 1999. Earthworm Management in Tropical Agroecosystems.New York: CABI Publishing.
41. Lavelle, P., Blanchart, E., Martin, A., Spain, A.V., Martin, S., 1992. Impact of soil fauna on the properties of soils in the humid tropics. Myths and Science of Soils of the tropics. Soil Science Society of America and American Society of Agronomy, Special publication no. 29, Madison, 157–185.
42. Lee, K. E. 1985. Earthworms: their ecology and relationships with soils and land use. Sydney, Australia. Academic Press: 411.
43. Lucas García, J.A., Domenech, J., Santamaría, C., Camacho, M., Daza, A. and Gutiérrez Mañero, F.J. (2004) Environmental and Experimental Botany, 52 (3), 239–251.

44. Marianne Huyer and William J. Page, 1988 "Zn^{2+} Increases Siderophore Production in *Azotobacter vinelandii"* Appl Environ Microbiol, 54(11): 2625–2631).

45. Matthijs S, Tehrani KA, Laus G, Jackson RW, Cooper RM, Cornelis P 2007. "Thioquinolobactin, a Pseudomonas siderophore with antifungal and anti-Pythium activity". *Environ. Microbiol.* 9 (2): 425–34.
46. Matoo, A. K. and J. C. Suttle. In: CRC Press, Boca Raton, Ethylene FL. p: 65-80. FL. p: 159-181.
47. Meunchang, S. & Co-workers. 2004. Phylogenetic and physiological characterization of indigenous Azospirillum isolates in Thailand. Soil Sci. Plant Nutr. 50, 413-421.
48. Meyer JM, Geoffroy VA, Baida N, *et al.* (2002). "Siderophore typing, a powerful tool for the identification of fluorescent and nonfluorescent pseudomonads". *Appl. Environ. Microbiol.* 68 (6): 2745–53.
49. Muhammad Ashfaq Anjum, Muhammad Rafique Sajjad, Naseem Akhtar, Muhammad Amjad Qureshi, Arshad Iqbal, Abdul Rehman Jami and Mahmud-ul-Hasan 2007 Response of cotton to plant growth promoting rhizobacteria (pgpr) inoculation under different levels of nitrogen J. Agric. Res., , 45(2). 135.
50. O'Sullivan D.J.; O'Gara, F. Traits of fluorescent *Pseudomonas* spp. involved in suppression of plant root pathogens. *Microbiol. Rev.* 1992, *56*, 662–676.
51. Patten, C.L. and Glick, B.R. (2002) Applied and Environmental Microbiology, 68, 3795– 3801.
52. Probanza, A., Lucas García, J.A., Ruiz Palomino, M., Ramos, B. and Gutiérrez Mañero, F.J. (2002) Applied Soil Ecology, 20, 75–84.
53. Rashid, A., M. Aslam, A. Iqbal, A. R. Jami and M. R. Sajjad., 1999. Use of bacterial biofertilizers for improving crop productivity. Proc. Symp. Integrated Plant Nutrition Management. NARC, Islamabad. P.88-104. Sci. Vol.18:69-80.
54. R. Majima and T. Hoshino 1925. "Synthetische Versuche in der Indol-Gruppe, VI.: Eine neue Synthese von beta-Indolyl-alkylaminen". *Berichte der deutschen chemischen Gesellschaft* 58: 2042.
55. R.M Muragappan, S. Rekha and R. Thirumurugan (2006) "Characterization and quantification of siderophores produced by *Aeromonas hydrophilia* isolated from *Cyprinus carpio.* Pakistan Journal of Biological Sciences 9 (3): 437-440
56. Satchell, J.E. 1967. Lumbricidae. In: *Soil Biology,* Eds. A Burges and F. Raw. Academic Press, London: 259-232.
57. Sawada H, Kuykendall LD, Young JM (2003). "Changing concepts in the systematics of bacterial nitrogen-fixing legume symbionts". *J. Gen. Appl. Microbiol.* 49 (3):
58. O. Steenhoudt · V. Keijers · Y. Okon · J. Vanderleyden F.A. Janssens December 2000 Laboratory of Genetics, Identification and characterization of a periplasmic nitrate reductase in Azospirillum brasilense Sp245
59. Timmusk, S., Nicander, B., Granhall, U. and Tillberg, E. 1999 Soil Biology & Biochemistry, 31, 1847–1852.
60. Vessey, J.K. (2003) Plant and Soil, 255, 571–586.
61. Wanda Williams Collins, et al. 1999. Biodiversity in Agroecosystems, Page 20.
62. William T. Frankenberger, Muhammad Arshad - 1995 - Technology & Engineering - 503 pages
63. www.indiaagronet.com/indiaagronet/.../azotobacter.html
64. www.lifesciences.napier.ac.uk/teaching/env/Pcycle.html
65. www.microbiologyprocedure.com/.../factors-affecting-nitrogenase-activity.html
66. www.textbookofbacteriology.net/pseudomonas.html
67. Zhang, H., and S. Schraeder.1993. Earthworm effects on selected physical and chemical properties of soil aggregates. *Biology and fertility of soils*, 15: 229-234.

THEME 8

SOCIO-ECONOMIC SCIENCES INCLUDING ENCONOMICS POLITICS HISTORY COMMERCE & MANAGEMENT (KAUTILYIYAM)

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S.E.E.P.H.C.M:-1

AWARENESS AMONGST MARRIED AND UNMARRIED INDIAN WOMEN REGARDING CONSANGUINEOUS MARRIAGE: COMPARISON OF EDUCATIONAL, GEOGRAPHICAL, ECONOMICAL AND SOCIAL FACTORS

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INTRODUCTION: Any modern human civilization continues to be bound within family boundaries. Consanguineous marriages are common and are traditionally favoured in most of the Asian and African countries. Various reasons budding from social and economical factors create unique practices within a society and one such familial-social factor is the issue concerned with consanguineous marriage. The word consanguineous is derived from two Latin words "con" meaning shared and "sanguis" meaning blood. Consanguinity describes a relationship between two people who share an ancestor, or share blood. Such marriages are favoured by different populations usually bound to traditional customs, beliefs and to keep property in united form within the family. Consanguineous marriages are strongly favoured in some societies within human population. Globally, the most common form of consanguineous union contracted is between first cousins (Bittles & Neel, 1994; Bittles, 2001). For example, consanguineous marriages are prevalent in Middle East countries, Pakistan, Bangladesh, Sri Lanka and within India it is reported to be high in muslim community and hindu community in southern parts of India. Dravidian Hindus of South India strongly favour marriages between first cousins of the type mother's brother's children or uncle-niece marriages particularly in the states of Andhra Pradesh, Karnataka and Tamil Nadu. In Arab Muslim communities, first cousin unions between a man and his father's brother's daughter are preferred. In southern Asia, Buddhism sanctions marriage between first cousins, as does the Zoroastrian/Parsi tradition.

As per Bittles & Neel (1994), close to 50% of marriages in parts of Saudi Arabia and Pakistan are reported to be consanguineous. A reported survey by National Family Health Survey, India, in the year 1992-93 suggested that the average percentage of consanguineous marriages in India was 11.9%, with the highest percentage (30.8%) reported from Andhra Pradesh and least (0.5%) reported from Mizoram.

Not all societies favor consanguineous marriages. For example, in Christian community, the Orthodox churches prohibit consanguineous marriage; the Roman Catholic Church requires Diocesan permission for marriages between first cousins, and the Protestant denominations permit marriages up to and including first cousin unions (Bittles, 2001). Aryan Hindus of northern India prohibit marriage between biological kin for approximately seven generations on the male side and five generations on the female side (Kapadia, 1958). The Sikh religion forbids consanguineous marriage, although some minority Sikh groups appear to exercise flexibility in the observance of this proscription.

Among the major populations so far studied for consanguineous related issues, the highest rates of consanguineous marriages are reported to be associated with low socioeconomic status, illiteracy, and rural residence. However, in some instances, a high prevalence of marital unions between close relatives has reported among land-owning families, and in traditional ruling groups and the highest socioeconomic strata (Bittles & Neel, 1994). Few studies have revealed a decrease in the prevalence of consanguineous marriages as there is an increase in level of literacy among the population (Rao, Inbaraj, Jesudian 1972). Contrary to these findings no significant relationship was found between consanguinity and education by some other investigators (Ramesh, Srikumari, Sukumar, 1989 & Govinda Reddy, 1988).

Need for the study:

In India, the bases of consanguineous marriages are explained based on various factors such as constrains of religion, status, caste, family differences and the fear of incompatibility with a mate outside the family, strong family tradition of consanguineous unions, maintenance of family structure and property, strengthening of family ties; financial advantages relating to dowry or bride wealth payments; ease of marital arrangements and a closer relationship between the wife and her in-laws; greater marriage stability and durability (Bittles et al., 1994; Hussain & Bittles, 2000). Security of knowing the mate in the family, culture and religion, and having more information about the mate before marriage are cited as reasons for the continued popularity of consanguineous marriages in India. Payment of dowry is reported to be less common in close kin marriages than in unrelated marriages (Reddy, 1988). Whatever are the reasons promoting the cause of consanguineous marriages, the ongoing debate that consanguineous marriages could have a negative impact on the offspring continues. An increased chance of health and developmental problems are reported in the offspring's due to shared inherited genetic information in children of related parents as compared to non related parents. Different types of genetic disorders such as congenital hearing loss, mental retardation, congenital heart defects, visual defects etc, are reported to be common among children born of consanguineous marriage. The genetic bases of this increased risk of disorders in offspring's of consanguineously linked parents are explained as due to changes or mutations in the genetic maps that

could be potentially harmful only if an individual has two copies of same mutated gene. Generally, two unrelated people will not have same mutated genes; hence children of unrelated parents are said to be at low risk than related parents whose genes are shared to a greater proportion.

General awareness on the effect of the consanguineous marriage on the offspring is however limited in the general population. Although a high proportion of marriages in India are consanguineous with some notable exceptions, there is dearth of literature on aspects of awareness among unmarried and married women regarding consanguineous marriages and their implications on the offspring. This paper attempts to probe into the awareness level among unmarried and married women from rural and urban strata and understand the relationship of such awareness in the backdrop of educational, geographical economical and cultural aspects in the population residing in and around Mysore district.

Aims of the study: The study aimed to analyze the percentage awareness among unmarried and married women about consanguineous marriages using a questionnaire survey method. The percentage awareness in unmarried and married women is compared across:

· Literacy level,
· Geographical factor (rural and urban residence)
· Economic Status
· Social Status

METHOD

Participants:

A total of 153 women, whose age ranged from 18 to 45yrs with the mean age of 31.5years served as participants for the study. The participants were selected randomly from undergraduate colleges, post graduate colleges, lay people visiting hospitals, mothers of new born infants in hospitals and general public. Based on the participant's marital status and the educational level they were divided into groups as shown in Table 1.

Table 1: Demographic details of the participants

Education level	Marital status of the participants		Total
	Married (n)	Unmarried (n)	
Secondary to Graduation level	41	47	88
Primary to secondary level	38	27	65
Total	79	74	N=153

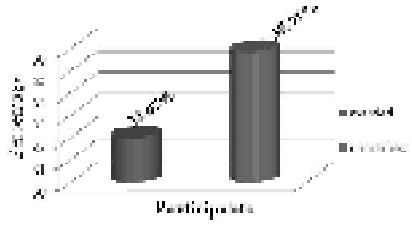
Material and procedure: Two close ended questionnaires were prepared to probe into the awareness level of married and unmarried women respectively regarding consanguineous relationship (enclosed Appendix A and Appendix B). The questionnaire focused on assessing the awareness level in different domains *viz.* educational, marriage relationship (for married women only), effects of consanguinity, source of knowledge about the consanguineous union and its probable effects on the future generation and the willingness towards consanguineous marriage. The questions in the questionnaire were so framed that the 'yes' responses indicated awareness and 'no' responses indicated lack of awareness with respect to the domain in question. Informed consent was obtained from all the participants' before administration of the questionnaire. The questionnaire was administered in individual set ups. The responses of the participants were analyzed by the investigators separately.

Analysis: A score of '1' was assigned to questions which elicited 'yes' response favoring awareness and '0' was assigned to questions which elicited 'no' response favoring 'non awareness' with respect to consanguineous relationship. The effect of Literacy level, Geographical factor (rural and urban residence), Economic and Social Status was probed into based on the responses of the participants. The raw data was converted to percentile scores and treated with suitable statistical analysis.

RESULTS AND DISCUSSION: The percentage awareness scores in groups of unmarried and married women was compared across the literacy level, geographical factor, economical status and the social status and are presented under 5 sections as follows:

Section 1: Overall percentage awareness among the married and the unmarried women

Results in Graph 1 show that the percentage awareness among the married women (32.05%) was comparatively lesser when compared to the unmarried women (35.91%). Although not significant, the differences raise questions as to whether the unmarried groups of women were more aware of the risks involved in consanguineous relationships compared to that of the married group. This is discussed in the backdrop of results presented in Sections 2 to 5.

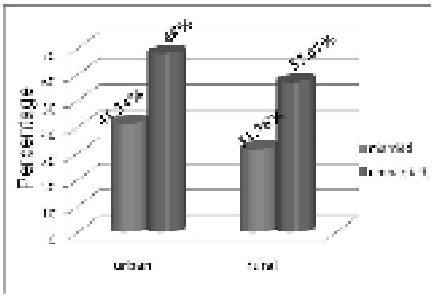


Graph 1: Comparison of percentage awareness among the married and unmarried women about consanguineous marriage.

Section 2: The percentage awareness among the married and unmarried women with respect to their geographical location

The participants were grouped as belonging to urban and rural areas based on the demographic details available in the questionnaire. The percentage awareness of married and unmarried women belonging to urban and rural areas is shown in Graph 2.

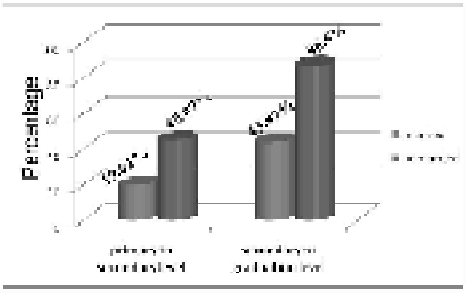
The results show that the percentage awareness among the married and unmarried women representing urban areas were relatively higher as compared to the women coming from rural areas. This trend is in line with the reported observation of Bittles & Neel (1994) in their survey report.



Graph 2: Comparison of percentage awareness among the married and unmarried women from urban and rural areas about consanguineous marriage

Section 3: The percentage awareness among the married and the unmarried women with respect to their educational background.

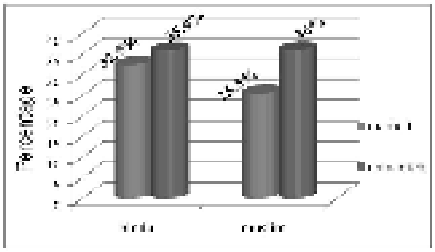
Graph 3 represents the percentage awareness scores as analyzed among the married and unmarried women based on the education level of the participants. It is seen that the percentage awareness about consanguineous marriage is more among women with higher level of literacy when compared to women with lower literacy level. This finding stand in support of a similar trend observed by Rao, Inbaraj, Jesudian (1972), on consanguinity in their study conducted on Indian population.



Graph 3: Comparison of percentage awareness among the married and unmarried women from higher and lower educational background about consanguineous marriage.

Section 4: The percentage awareness among the married and the unmarried women with respect to their social background.

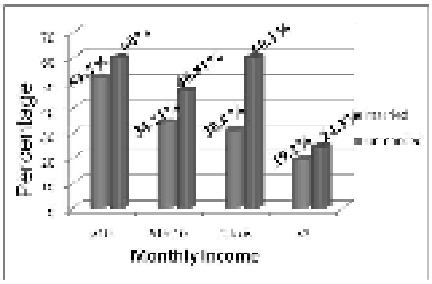
Graph 4, which represent the distributed percentage awareness on effect of consanguineous relationship among two groups of participants, viz., and Muslim community versus that of Hindu community. The results show an increased awareness among the married Hindu women as compared to the married Muslim women about the consanguineous marriage. This is also well in agreement to the observed reports of Bittles (2001), who reported that the consanguineous marriages in India are higher in Muslim community, when compared to other communities. There is however, less difference in the percentage awareness scores of unmarried Hindu and Muslim women about the consanguineous marriage. The observation reported under this section is drawn with caution as the number of participants in the Muslim community was 17 in number as compared to 136 in Hindu community which could have lead to a bias due to imbalance in the sampled population.



Graph 4: Comparison of percentage awareness among the married and unmarried women from different social background about consanguineous marriage.

Section 5: The percentage awareness among the married and the unmarried women with respect to their economic status

Graph 5 represents the percentage awareness scores in married and unmarried women belonging to 4 randomly assigned groups based on the economic status which was derived from the monthly family income of the participants. These groups were classified as '> Rs 10,000 / mth', 'Rs 6,000 to Rs 10,000/mth', 'Rs 2,000 to Rs 6,000/mth', '< Rs 2,000 / mth'. The results show that the awareness about consanguineous marriage among the married women who belong to higher income group is better than those belonging to the lower income group with the exception of group with an income slab of 'Rs 2,000 to Rs 6,000/mth'. These results are also in agreement with that of Bittles & Neel (1994).



Graph 5: *Comparison of percentage awareness among the married and unmarried women from various economical backgrounds.*

In summary, the trend observed in this study points to similarity in the observed results of Brittle and Neel (1994) and Bittles (2001) conducted on Indian population as a part of population survey for consanguineous issue across the globe. However, the point to be noted is that while these studies included women as a whole without classifying them into unmarried and married groups, the present study at

tempted to address this issue in married and unmarried women. The consistent trend observed from the Graphs 1 to 5 suggest a comparatively better percentage awareness scores in unmarried women regarding consanguineous issues as compared to the married women.

However, the qualitative analyses of the responses reveal that there was a greater awareness amongst both the groups regarding the probability of having a progeny with physical and mental disability rather than speech-language and hearing disorders. Most of the participants were aware of the risk involved in consanguineous marriage through real life experience and also through information received through various media such as television and radio.

The percentage awareness about the consanguineous marriage and its effects on the offspring's amongst the Indian women was higher for unmarried and lower for married can probably be postulated as due to the higher literacy level among the younger unmarried generation through wide exposure to different media inputs derived through television, news paper, internet, radio etc which improves the knowledge base of information regarding various medical issues which are unique to women, including that of effects of consanguineous union on the progeny.

Women who grew up in cities/towns were more aware about the effects of consanguineous marriage than women who were raised in the countryside, falling in line with the results reported in the study by Tfaily (2005), who reported that women from the urban areas were significantly less likely to marry relatives than who were brought up in a rural area. This result can be attributed to the increased influence of modernization across the globe promoting better awareness among the young regarding all issues including that of consanguineous relationship. A study by Nath, Patil and Nayak (2004) also reports that awareness with regards to the hazards of consanguineous marriages were very low among rural community (7.6 %) which is also in concordance with the current results.

It was also observed from the data that women with only primary schooling were more unlikely to be aware of consanguineous marriage than women with more advanced education. This reflects that literacy plays an important role in creating awareness about the after effects of consanguinity. And also illiterate women / with lower education were more likely than with any other higher level of education to marry their relatives.

The preference to consanguineous marriage has been attributed to traditions, maintenance of family structure and property, strengthening of family ties, financial advantages relating to dowry, closer relationship between the wife and the in-laws, greater social compatibility, greater marriage stability and durability. Probably these factors are still very sensitive in the population with secular outlook which is more prevalent in the population with low economic status as compared to that of higher economic status and thus maybe it reflects on the higher percentage of consanguineous marriages in these sections of the society.

The percentage awareness scores among unmarried women is higher than that of married women when compared across the factors of geographical location (rural v/s urban areas), educational level (primary to secondary level v/s secondary graduation level), social group (Hindu v/s Muslim) and economic status ('> Rs 10,000 / mth', 'Rs 6,000 to Rs 10,000/mth', 'Rs 2,000 to Rs 6,000/mth', '< Rs 2,000 / mth'). The implication of the findings are discussed in background of generic input received by the younger population *viz.,* the unmarried population through various mass media resources compared to that of married population. It may even imply that there is an emerging trend of increasing awareness for health related issues including that of adverse effect if any of consanguineous relationship. However, these conclusions are drawn in a limited sense since the participants involved may not have represented a stratified sample and there could have been a sampling bias.

REFERENCES:

Bittles, A. H., & Neel, J. V. (1994). *The costs of human inbreeding and their implications for variations at the DNA level.* Nature Genetics (vol. 8, pp. 117-21).

Bittles, A. H. (2001). *Consanguinity and its relevance to clinical genetics*. Clinical Genetics (vol. 60, pp. 89-98).

Bittles, A. H., & Hussain, R. (2000). *An analysis of consanguineous marriage in the Muslim population of India at regional and state levels.* Annals of Human Biology (vol. 27, pp. 163-71).

Govinda Reddy, P. (1988). *Consanguineous marriages and matrimonial distance: a study among three South Indian caste groups*. Biological Society (vol. 5, pp. 173 – 178).

Kapadia, K. M. (1958) *Marriage and family in India.* 2nd edition. Calcutta: Oxford University press. (pp. 117-37).

Nath, A., Patil, C., & Naik, V. A. (2004). *Prevalence of consanguineous marriage in rural community and its effects on pregnancy outcome.* Indian Journal of community medicine. (vol. 26, pp. 41-43).

Ramesh, A., Srikumari, C. R., & Sukumar, S. (1989). *Parallel cousin marriages in Madras City: new trends in Dravidian kinship*. Social Biology (vol. 36, pp. 248-254).

Rao, P., S., S., Inbaraj, S., G., & Jesudian, G. (1972). *Rural-urban differentials in consanguinity*. Journal of medical Genetics. (vol. 9, pp. 174-178).

Reddy, P. (1988). Annals of Human Biology, (Vol. 15, pp. 263-268).

Tfaily, R. (2005), *First cousin marriages and marital relationships in Egypt, Jordan, Turkey and Yemen*, Paper prepared for presentation at the 25th International Population Conference of International Union for the Scientific Study of Population, Tours, (pp. 18-24).

S.E.E.P.H.C.M:-2

EMPOWERMENT OF WOMEN FOR APPROPRIATE WATER CONSERVATION AND MANAGEMENT AT THE LOCAL LEVEL THROUGH THE ADOPTION OF S & T INTERVENTIONS

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Empowerment is the process of multiplying the power or creating autonomy in a social system, which will ultimately help people take charge of their efforts and promote the ability to act collectively to solve problems. Thus empowerment helps people to recognize their internal power and exercise it for the benefit of themselves and others.

Water is an essential natural resource for sustainable development of any locality. Sustainable development of water resources calls for awareness among the public and people's participation in the management (Samra, 1996). For integrated water resource management, a watershed is an ideal geographic unit. Both National and State Governments have implemented many projects for the conservation and management of water resources at the watershed level. Even though these programmes are envisaged on a participatory mode, many evaluation studies revealed that the overall women's participation was low, passive and as proxy by their husbands (Samra 2001). In watershed management, women have to be given a prime role, since at the domestic level they are users and managers of water. Hence, a project was undertaken to promote and ensure the involvement of women in harnessing science and technology for sustainable water resource development and to develop strategies for effective participation of women in the utilization of the technologies.

Methodology: *Kakkad* watershed of Kozhikode District of Kerala was selected for implementation of the project. It comprises of part of *Kakkad* village in *Karassery panchayath* and *Kodiyathur* village in *Kodiyathur panchayath*. The watershed area lies between 11^0 16' and 11^0 18' North latitude and 75^0 59' and 76 ^{0}3' East longitude. Total area of the watershed is 625 ha. The preliminary investigation revealed that there was acute water scarcity and that the inhabitants were not serious about water conservation. Since male migration has become almost essential in the area due to the changing socio-economic scenario, empowerment of women was expected to improve the water availability status in the watershed. It is clear that neither empowerment through awareness creation alone nor development through economic activity alone could satisfactorily address women empowerment. The strategy adopted in this project, therefore, emphasized the importance of a holistic approach including a blend of empowerment and development activities in order to have a broader impact on the life in the watershed. The target group for the project consisted of the women in the *Kakkad* watershed.

Procedure adopted for implementation of activities

First, the problems were identified and prioritised, and then the following procedure was adopted for implementation of the interventions.

- Motivating and mobilizing local support;
- Establishing linkages with outside institutions, departments, schemes etc.;
- Discussing possibilities, merits and demerits of new development programmes.
- Identifying the beneficiaries, volunteers, coordinators, leaders etc;
- Encouraging development measures to be taken up and replicating such activities on their own in a sustainable manner;
- Utilising the local level resources and sharing of benefits among the community;
- ***Matching the water demand of various sectors and evolving a strategy to meet the projected demands.***

Interventions

After a detailed survey and analysis of resources, problems and possibilities in the watershed, participatory problem prioritization and planning were done based on which the interventions were implemented.

1. Entry point activities in the project

Dumping of plastic wastes in the common places and paddy fields was a great problem experienced in the area. It was found that 85% of the residents disposed off plastic waste near their houses and 15% of them dumped it outside the colony even in paddy fields.

It was reported that the plastic waste deposition in the paddy fields and in open places interrupted the cultural operation and rain water infiltration in many areas. Support was given to the target women to get public land for digging a common dump pit in the watershed. Necessary guidance and a token remuneration for labour work was given for digging the pit and this was used exclusively for dumping the plastic wastes. It could be understood that on an average a family disposed about 400 gram of plastic per month and this worked out to about 38 kg for a group of 8 families. The pit was effectively made use of by all the families in the *Chelamkunnu* Colony as well as others from outside the colony. Analysis of the effect of this intervention revealed that environmental problems created by the plastic wastes could be stopped by the intervention. The footpaths, which were made dirty by the waste heaps, became clean and healthy. Paddy fields were renovated to a healthy condition. The watershed inhabitants were made fully conscious of the need for scientific waste disposal. This intervention helped the project personnel to develop considerable trust among the watershed inhabitants.

2. Scientific interventions in water resource development, water conservation and water management

1. Interventions for improving soil water retention through organic matter enrichment

It is well known that organic matter will improve the soil characteristics that favour its water retention capacity. Meeting one's own compost requirement in the least expensive way was the strategy adopted to satisfy one's organic matter need.

Vermi-composting

In the *Kakkad* watershed, as is in other places, the bio - wastes from houses and shops in townships were dumped carelessly in the nearby ground. Each family was encouraged to have a composting unit for recycling their kitchen waste. The intervention started with about half of the target women and was diffused to the entire target group by those who were involved in the activity and it became a great success. The reasons attributed for the success and sustainability of the activity were income generation, productive utilization of leisure time, safe and profitable disposal of bio-wastes, reduction in water and environmental pollution, etc.

Coir pith composting

Coir pith is a bye-product of the coir industry. Extraction of 1 kg of coir fibre generates about 2 kg of coir pith and in India an estimated 500,000 MT of coir pith is produced per annum. Coir pithy composting technology was demonstrated to a women group in the watershed. This activity cannot be carried out by small groups, since it needs comparatively more area and more inputs. Hence this technology could not be replicated, and instead, coconut husk burial technology was adopted wherever possible so that water conservation and retention could be improved.

Effective utilization of water and land for crop production

Due to the scarcity of water for meeting the requirement of a full crop of paddy, a good portion of the paddy fields in the watershed remained fallow during the summer season. Fallow land cultivation was encouraged in the watershed. The major purposes of this activity were: efficient and sustainable use of fallow land and water, income generation, developing the culture of collective/ community action, skill development in water conservation/ improved water use efficiency and promotion of organic farming technology for reducing water pollution. This activity was proposed by the women who had resorted to small-scale vegetable cultivation in the homesteads. The normal practice was to irrigate manually using pots and this was highly time and energy consuming. Introduction of bush pump in the area helped the target group to save both time and physical energy. A time analysis study showed that one-third of the time was enough to irrigate the entire area using bush pump. Even children could attend irrigation easily.

Before the project interventions, the entire vegetable requirement in the watershed was met from the market and hence the vegetable consumption was very less due to the non affordable cost and reluctance of women to go to market. After adoption of vegetable cultivation, the quantity and variety of vegetable consumption increased by about 60% in all the families. Analysis of results of interventions revealed that the extraneous benefits included mental pleasure and enjoyment, utilization of leisure time in a productive manner, increased chances of communication and interaction, better health of family members through increased vegetable consumption etc. Another encouraging result was that women could contribute to the household economy by cutting the expenses on vegetable purchase and through the sale of vegetables. Barriers to such activities the non availability of land on lease, difficulty in sustained leasing possibility, problems related to marketing and aberrations of weather.

2. Water conservation activities

The concept of rainwater harvesting lies in tapping the rainwater where it falls, as otherwise a major portion of rain water that falls on the earth's surface will run off the streams to rivers and finally to the sea. The soil and water conservation activities adopted in the watershed included mechanical measures, water harvesting, afforestation, fodder raising etc. Important principles to be kept in mind while planning mechanical measures are: increasing the time of concentration of run off and thereby allowing more of it to be absorbed and held by the soil, intercepting a long slope into several short ones so as to maintain less than a critical velocity for the run off water, protection against damage due to extensive run off etc. The mechanical measures adopted were mud bunds, terraces, rain pits and trenches.

Bunds and terraces were taken wherever possible. After giving the needed awareness, the target women took interest and initiative in forming bunds and small terraces wherever possible in their homesteads and farm lands. A token remuneration was given based on the measurements, subject to a ceiling. Stones and other materials available locally were used for the purpose.

Rain pits and trenches were taken in selected areas to collect rain water and for groundwater recharge. These pits trapped the soil and sediments. Pits and trenches of different sizes ranging from 0.42 m^3 to 3.8 m^3 were taken in different parts of the watershed. The analysis of results revealed that this has helped considerably in groundwater recharge. A questionnaire was administered among the target women to study the effect of rain pits and trenches. All the respondents opined that soil moisture in their field increased due to this intervention. 40% of them remarked that the yield of different crops also increased. 97% remarked that the water level in their well and the duration of water availability increased. All the beneficiaries expressed their willingness to continue this intervention in future. 73% of the beneficiaries shared their experience with regard to the intervention with others. All the respondents considered this intervention as an asset to their land and as a replicable intervention for water conservation.

Thus, from the survey, it could be seen that rain pits and trenches were very effective measures for rain water harvesting and conservation in the homesteads.

Centripetal terraces for tree crops can conserve a good quantity of rain water. The watershed inhabitants were insisted to take the basins for coconut and arecanut in such a manner that it formed terraces for impounding the monsoon rains. **On** an average, with just centripetal terraces, in one hectare of coconut garden 2810 m^3 and in one hectare of arecanut garden, 5733 m^3 of water could be taken into the soil which **can possibly** contribute to groundwater recharge. After experiencing the positive influence of the intervention, centripetal terraces were taken for almost all the coconut and arecanut trees in the watershed. This was because of the fact that the women participants in the watershed could propagate the success of the programme to all the watershed inhabitants.

3. Water resource development

Check dams - Six masonry check dams and five gabion check dams were constructed in the streams. The locations were selected based on the criteria fixed for the same. The major objectives were to conserve soil and water, to improve groundwater recharge, to reduce the flow velocity in the streams, and above all to solve the water scarcity problem in the watershed. It was found that the check dams had arrested silt flow on the upstream of the gullies and stabilized the gully beds during the monsoon season. Soil moisture status at depths of 15 cm, 30 cm and 45 cm was monitored at different sites to study the effect of different practices on soil moisture conservation. It could be observed that the interventions had a positive influence on the soil moisture status of the watershed. A general analysis of water level in the selected wells revealed that none of the wells dried up fully during both the years under observation. This might be due to the intensive water conservation treatments adopted.

Roof water harvesting - In areas of acute drinking water shortage and in very difficult terrain, it was decided to implement two roof water harvesting structures on a demonstration basis. Due to this, the time and energy spent to fetch water could be considerably reduced. Even though they knew the value of water, the concept of rainwater harvesting and storing it for further domestic use was novel and this was the motivating factor for active participation in the implementation, operation and maintenance of the scheme. Moreover, it had saved the time considerably and lessened the hardship in fetching water from far away places and hence a relief to the physical ailments.

Development of traditional drinking water source - The traditional drinking water sources in the area were surveyed. There were two springs and one depression where water accumulated and where water source was perennial. Water analysis revealed that the water quality was inferior, but at the same time, water scarcity was a felt problem in many households. With the needed technical support given, the beneficiaries took up the renovation work and the subsequent maintenance / upkeep of the same.

Development of abandoned quarry - There were six big abandoned quarries in the watershed, in which a huge quantity of rain water used to get collected. One such quarry was taken up for development. The quarry was having a water depth of upto 15 m and in spite of the fact that the water quality was much polluted, it was being used by about 17 families for washing clothes and cattle and for irrigating a paddy field of about 7 hectares. After a thorough physical survey, a suitable design for the development of the quarry was made. The retained water was pumped out, the sides were protected, separate area was made outside the protection wall for washing clothes and draining out the excess water as well as used water. This helped to prevent the entry of polluted water into the quarry. The water is being used for multiple purposes.

Efforts taken to ensure the sustainability of the programme

A programme is said to be sustainable if it continues to operate after the monetary and technical support period of the project is over. Conscious efforts were taken for integrating social resources management with natural resources management**.** Involvement of all residents in the activities right from planning stage, capacity building, inter agency coordination etc ensured the sustainability of interventions. A slow withdrawal strategy was adopted..

Conclusion

The project brought to light many replicable strategies. The activities have created a "we" feeling among the community and increased group cohesion. Women need proper education and motivation to overcome their shyness, recognize their capabilities, understand their own needs and desires and limitations and to develop a strong will to achieve their goals. It is advisable to include lady extension workers in the watershed where strong cultural inhibitions exist. Men and children in the family should be involved and thoroughly informed about the necessity of mainstreaming women in such development activities. Efficient communication with the women should be ensured by being with them, being friendly to them, working with them and understanding their life and explaining the things in multiple ways in their local dialect. Training, awareness and demonstrations on alternate livelihoods will have an everlasting impact on the minds of women, it will lead them to adopt new income generating activities, health care and other technologies to which they were hitherto averse. In nutshell, efforts to empower women in development activities will result in human resource development in the watershed and thus the integrated development and management of resources.

Acknowledgement

The authors are grateful to the Executive Director and Staff of the Centre for Water Resources Development and Management for the guidance, support and encouragement given for the execution of the project. The financial assistance from the Department of Science and Technology, Government of India is also gratefully acknowledged.

S.E.E.P.H.C.M:-3

GENDER DIFFERENCES IN THE HEALTH SEEKING BEHAVIOR FOR VOICE DISORDERS: A STUDY AMONG TEACHERS IN KERALA

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Introduction: Health seeking behavior in terms of illness behavior refers to those activities undertaken by individuals in response to symptom experience. Health seeking behavior is influenced by a large number of factors apart from knowledge and awareness. This behavior is a complex outcome of many factors operating at individual, family and community level including their bio-social profile (literacy and profession), their past experiences with the health services, influences at the community level, availability of alternative health care providers including indigenous practitioners and last but not the least their perceptions regarding efficiency and quality of the services.

Gender analysis in health provides an understanding of the different experiences of women and men in economic, social and psychological terms, such as differences in ability to access services, experiences of health care, attitudes to health and disease (e.g., estimation), social structures (e.g., women's role as carers in the home), and aspects of economic and social status (WHO, 2000a: 280). Studies in gender and health-seeking behaviour mainly centre on the differences in access to health care between men and women due to gender inequalities. To a higher or lesser extent, inequalities exist in all societies and social classes, but in developing countries and among the poor, they are assumed to have more negative impact on women's health. Gender analysis helps us to identify the kind of inequality that exists in the "gender organization" of a specific community. Many women suffering from poor health status are found to lack knowledge, information skills, purchasing power, income-generating capacity and access to essential health services (UNPFA). Nash Ojanuga & Gilbert (1992) systematized the obstacles which women face into four categories:

- Institutional barriers: unequal treatment by health providers
- Economic barriers: different access to resources
- Cultural barriers: social status of women which situates them in socially inferior positions, male doctors who attend women with sensitive health problems, etc.
- Education barriers: women having less access to education (e.g. seen in literacy)

Issue of voice disorders in professional voice users:

A large group of individuals are by the very nature of their occupations, at a greater risk of developing voice problems and laryngeal pathologies. Professional voice users are defined as those, who require the use of their voice to maintain income (Murry & Rosen, 2000). They include singers, actors, teachers, attorneys etc. Nature of the job, the physical environment in which the voice usage occurs, the extent of voice usage etc might affect the degree and nature of voice problems faced by them. Most of the time professional voice users may not be aware about the anatomy and physiology of the vocal system and form a high risk group to develop voice problems (Sapir, Keider &Schimdt, 1993). Different professional groups experience different voice problems that stem from different sources/ practices. The impact of voice disorders in professions where the voice is an occupational tool is two-fold. They not only have a negative effect on the quality of life of those who suffer from them (Yiu, 2002), but they also burden society with additional health care expenses (Verdolini & Ramig, 2001). Voice problems negatively affect job performance (Roy, Merrill Thibeault, Gray et al., 2004), and about 20% of the teachers have been reported to miss workdays because of voice problems (Roy et al, 2004). The awareness of voice disorders as a work-related disease has increased, and voice disorders have been accepted as occupational disorders in some European countries, even if not as a rule (Vilkman, 2004). Still, health care and occupational safety for professional voice users are poor, and the duty to prevent voice disorders falls on the employee (Vilkman, 2000). This indicates that voice problems are mainly seen as personal problems that have been caused by one's own voice limitations or by abuse of the voice. In order to develop occupational voice care for those who work in vocally demanding professions, it is essential to demonstrate the relationship between voice use and voice disorders (Vilkman, 2004).

Voice is the most effective tool for a teacher's trade as they use their voice regularly due to the specific occupational demand and hence are vulnerable to develop voice problems. There aren't many professions, except for teaching, that demand a person to go on a regular basis and within a split second, from talking at a normal level to shouting across the classroom to overcome poor acoustic conditions (Vilkman, 2000). Apart from the use of voice for normal day to day communication, it is also used for other professional purposes .Thus teaching as a profession places high on voice endurance because of the need to speak loudly for long periods, often under unfavorable circumstances caused by loud background noise and poor acoustic conditions (Sapienza, Crandell & Curtis, 1999). This causes vocal loading. The background factors for voice disorders are manifold, and individual factors related to health and stress may also have an adverse effect on the voice (Stemple, 1995) and affect the physical and psychological health.

The most vulnerable teachers are either the newly qualified who have had little training in voice awareness, or those who have been doing the job for 15-20 years and who suddenly find their voice wearing out (Siebert, 1999). Allen (1995) and Gotass and Starr (1993) reported that 80% of teachers in their study claimed that they had experienced vocal fatigue. More than 20% of teachers had reported that voice problems prevented them from attending work ranging from one day to one week during the academic year. Added to the poor acoustics of classrooms, the use of chalk and blackboard would result in an environment, which assaults the vocal system of every teacher day in and day out (Harisinghani, 2000)

Teachers as a treatment-seeking population for voice disorders

As to voice disorders, teachers have been reported to be statistically over represented in treatment-seeking populations (Titze, Lemke & Montequin, 1997) based on the western studies. However, studies show that only a small percentage of teachers who report voice problems seek professional help (Roy, Merrill, Thibeault, Parsa, et al., 2004). The reasons for this have not been explored but practical and economic causes have been suggested (Smith, Lemke et al., 1998). Teachers might also be ignorant about where to get help, or perhaps help is not easily available. Teachers might think that their voice problems are a normal inconvenience in their occupation (Morton & Watson, 1998), which may account for why they do not seek help at an early stage. Another reason for ignoring to seek early help may be that persons adapt to such adverse vocal symptoms as hoarseness (Sonninen, 1970).

Most of the studies in this context have been one in the western contexts and the studies done in the Indian context is majorly limited to prevalence of voice disorders and acoustic measures of their voice characteristeics. Moreover, an interdisciplinary research in these areas will help to develop better public health empowerment models.

Considering the, Health status in India, it is remarkable for its myriad contradictions and the health situation in some states like Kerala is almost comparable to that of developed countries. Kerala has made significant achievements in health status and has successfully tackled the first generation problems like infant mortality rate, maternal mortality and death rate [Economic Review, 2007]. Health-seeking behavior is also very high in Kerala. Even though the mortality rate is low, morbidity is high, especially in the case of diseases of affluence [Economic Review, 2003]. Research on gender and economic determinants of health and illness is relatively scarce, especially in the case of occupational voice disorders. Considering this paucity of research and the high morbidity in Kerala, a gender-based study of voice disorders among teachers in Kerala is being made.

The specific objectives were:-

1. To study the gender vulnerability for voice disorders among teachers
2. To study the gender differences in the health-seeking behavior, in specific the treatment seeking behavior for voice disorders
3. To investigate the extent of awareness about voice disorders among the target group

Material and Methods

The present study was carried out among a group of lecturers and teachers in the age range of 30 – 60 years, with a mean age of 46.1 years. A total of 40 subjects, 20 males and 20 females, chosen randomly were considered. All the subjects had a minimum of 3.5 hours of teaching per day and had at least 16 years of work experience. A self administered questionnaire survey regarding general information, hours of teaching per day, years of experience, stress factors, vocal symptoms most reported in voice disorders, steps taken to conserve voice, kind of treatment taken, awareness about voice disorders and the source of awareness was completed by the subjects. There were a total of 18 questions pertaining to vocal symptoms most often reported in voice disorders, 1 question regarding the self perceived severity of voice disorder and 12 questions regarding health seeking behavior and awareness about the disorder in addition to the general demographic data. The questions related to vocal symptoms were adapted from Voice handicap index (Jacobson et al, 1998) which is an instrument designed to examine the emotional, functional and physical responses to dysphonia and also from a questionnaire concerning vocal symptoms developed by Sussana Simberg in 2004. The patients were instructed that, these statements are that which many people have used to describe their voices. The patients marked the response that indicates how frequently they have the same experience. 0=Never 1= Sometimes and 2=Always.

TABLE 1: Severity rating for voice problems:-

Total score	
0-9	This is a low score and indicates that there most likely is a minimal amount of handicap associated with the voice disorder.
10-18	Denotes a moderate amount of handicap due to the voice problem.
19-36	This score represents a significant and serious amount of handicap due to a voice problem

For the rest of the questions Yes (1) and No (0) was the expected response.

Results:

The first aim of the study was to determine the number of teachers who were at risk for voice disorders. This analysis was entirely based on the responses collected for the statements pertaining to the frequency of occurrence of vocal symptoms most often reported in voice disorders. The total score for each subject was found out and were classified as those at minimal risk, at moderate risk and those who are at high risk for voice disorder. Comparison of both gender were done to see if there is significant difference between male

and female teachers for being at risk for voice disorders using the Independent t test. Male mean was 10.45 with standard deviation 7.43 while female mean was 13.55 with a standard deviation of 5.79. t with 38 degrees of freedom is 1.470, $p>0.05$, hence there was no significant difference between males and females. The analyses were done using the SPSS 10 version software.

TABLE 2 shows the number of males and females classified under each category showing the risk for voice disorder.

RISK	MALES		FEMALES	
MINIMUM	10	(50%)	5	(25%)
MODERATE	7	(35%)	11	(55%)
MAXIMUM	3	(15%)	4	(20%)

Regarding the question on self perceived degree of vocal handicap, severe vocal handicap was reported by 7 (35%) males and 9 (45%) females. Their responses regarding treatment behavior and reasons for not seeking proper health care were analyzed and are reported in TABLE 3 and 4 respectively.

TABLE 3: Number and percentage of male and female respondents regarding the type of treatment taken

TYPE OF TREATMENT TAKEN	MALES	FEMALES
Medical doctor	5 (71.4%)	2 (22.2%)
Speech language pathologist	0 (0%)	0 (0%)
Self treatment	1(14.2%)	2 (22.2%)
No treatment	1(14.2%)	5 (55.5%)

TABLE 4: Percentage responses for not seeking appropriate treatment as reported by the subjects

REASONS	MALES	FEMALES
No time	1 (100%)	3 (60%)
Not taken seriously	0 (0%)	1 (20%)
Will get cured naturally	0 (0%)	1(20%)

On analysis, it was found that an equal number of males and females were taking appropriate steps towards conserving their voice, 14 males and 14 females i.e.:, 70% of the total sample taken were taking steps to conserve their voice with or without explicitly knowing about voice conservation.

Table 5 below shows the number of males and females along with the percentage scores about the strategies used for conserving voice

STRATEGY USED	MALES	FEMALES
Drinking water	7 (50%)	9 (64.2%)
Avoid talking loudly	4 (28.57%)	3 (21.4%)
Regular food habits	3 (21.4%)	1 (7.14%)
Avoid spicy food	0 (0%)	1 (7.14%)

Responses to the psychological stress level were also considered. Out of the 20 males, 3 males reported increased stress level, 2 with working environment and 1 reported that he is stressed more than his spouse. On the other hand, among the 20 females, 9 reported higher stress levels, 7 reported that they are more stressed than their spouses and 2 reported stress from work environment.

The third objective of the study was to assess the awareness level regarding voice disorders among the professional voice users of teachers.

Table 6 below illustrates the number and percentage of males and females who were aware about voice disorders and also about their source of awareness

AWARENESS	MALES	FEMALES
SOURCE OF AWARENESS	14 (70%)	11 (55%)
Media	9 (64.28%)	6 (54.54%)
Public education materials	3 (21.42%)	4 (36.36%)
Internet	2 (14.2%)	1 (9.09%)
Neighbour	0 (0%)	0 (0%)

Discussion: It was found that there is no significant difference between males and females with respect to risk for voice disorders. But a deeper inspection with respect to the mean and severity within group shows that females were more at risk for voice disorders. This may be because similar classroom acoustics might be posing a greater vocal demand on female teachers than on male teachers because of the anatomical and physiological differences of the vocal system. In addition to this the fact that the menopausal changes in females starting in the 4th decade of life may be leading to laryngeal changes which would then be aggravated by vocal abuse during this period.. It needs to be noted that the mean age of the females participated in the study was 45yrs. These could be some of the reasons that can explain the minor gender differences between male and female teachers with respect to their risk for voice disorders. It is also reported that the stress levels are higher in female teachers compared to male teachers. Psychological stress is also a contributing factor for voice disorders.

On the basis of self perceived degree of vocal handicap, severe vocal handicap was reported by 7 (35%) males and 9 (45%) females. Differences were noted with respect to the treatment seeking behavior for voice disorders in males and females. Medical treatment was availed mostly by males than females. Among those who have not availed any treatment for their voice problem the reasons mentioned for not availing proper treatment were no time, not taken seriously and thinking of getting the problem cured naturally. A clear gender difference was observed in treatment seeking behavior. Although females reported diseases more than males, treatment seeking was higher for males compared to females. Gender differences in treatment seeking behaviors mostly attrib

uted to socioeconomic status and related inequalities exist in the societies. In view of this, the current finding needs to be highlighted because the women in this study were involved in both productive and reproductive labor and are expected to be enjoying a better social status, self confident and economically independent when compared to unemployed poor women. In spite of these societal advantages the women teachers in the present study are lagging behind men with respect to health care. Several reasons mentioned for not availing proper treatment would indeed be speculated as due to the burden of household or other work, lack of familial support, fewer resources/ control over their own earnings etc. Further investigations in this direction are necessitated.

Regarding the third objective of awareness, males seemed to be more aware about the voice disorders than females. This might be because of the increased social participation and social involvement of males compared to females. This increased awareness would be a strong factor that has enabled more males to seek proper treatment care for their voice problems. The main source of awareness for voice disorders was media followed by public education materials and internet. In our society, males have more access to these resources than females. Because in the Indian scenario, females have more burdens of managing household chores and childcare along with their professional work and thus they will leave them with less time for updating themselves on health related issues.

The study also attempts to discuss that equal number of females and males were taking steps to conserve their voice. The strategies used are drinking water in between the classes, avoid talking loudly and following regular food habits. Avoiding spicy food is also reported as a strategy used to conserve voice. Gender differences in terms of the percentage of response were noticeable with respect to the strategies used in conserving voice. It can be speculated from this data that awareness about the disorder may not be a contributing factor towards taking appropriate steps for prevention of these types of problems. Subjects knowingly / unknowingly might have taken steps to overcome their difficulties while taking classes.

Conclusions and implications:

The current study investigated gender differences in vulnerability for voice disorders among teachers, their awareness and attitude towards occupational health in terms of treatment seeking behavior, but considerably more research is needed to confirm the early findings in this regard.

Increasing awareness about the signs and symptoms associated with voice disorders have to be taken up at least among professional voice users to prevent voice disorders and also to achieve better job productivity. The present study is an initial attempt in this direction and this can be further elaborated into various directions keeping in view the factors such as income level, health care professional attitude, gender differences within a particular socioeconomic class etc. The data driven cues from such studies would help to develop guidelines for professional voice users to conserve their voice and to reduce vocal abuse. Thus multidisciplinary inputs from varied professions such as health economics, psychology, public health, speech language pathology etc would promise better implementation of health belief models. The current study thus tries to incorporate the principles from two distinctly figured professions and tries to tackle a common problem for empowering the health care sector especially in case of those diseases which goes unnoticed but which may seriously affect the economic productivity. The study also lights up the fact that interventions intended to influence behavioral change may have to be targeted differently for men and women. Gender sensitive strategies and programmes need to be developed in most of the disorders regardless of education, literacy and socioeconomic backgrounds. Also studies in this direction are important because they provide relevant information on what patients do when faced with a health problem. An important component of any health intervention programme must deal with providing information to users, educating the users and channeling the information in a manner which is acceptable to the users. Information, education and communication (IEC) campaigns combine strategies, approaches and methods that enable individuals, families, groups, organizations and communities to play active roles in achieving, protecting and sustaining their own health. The influence of underlying social, cultural, economic and environmental conditions on health should also be taken into consideration in the IEC processes.

REFERENCES

Allen, L. (1995). *The Effect of Sound-Field Amplification on Teacher Vocal Abuse Problems*. Paper presented at the Educational Audiology Association Conference, Lake Lure, NC.

Economic review - various issues. State planning board. Government of Kerala

Harisinghani, Ajit. (2000). 'Voice Problems: An Occupational Hazard for Teachers'. http://www.boloji.com/health/voiceproblems.htm. (Accessed: 4 January 2002).

Gotass, C. & Starr, C. D. (1993) Vocal fatigue among teachers. *Folia Phoniatrica Logopaedica,* 45 , 120–129.

Nash Ojanuga, D. & Gilbert, C. (1992) Women's access to health care in developing countries. Social Science & Medicine, 35(4), 613-617.

Morton, V., & Watson, D.R. (1998). The teaching voice: problems and perceptions. *Logopedics, Phoniatrics, Vocology 23,* 133–139.

Rosen, C. A., Murry, T., Zinn, A. (2000). Voice Handicap Index change following treatment of voice disorders. *Journal of Voice,* 14, *619-623*.

Roy, N., Merrill, R.M., Thibeault, S., Gray, S.D., & Smith, E.M. (2004). Voice disorders in teachers and the general population: effects on work performance, attendance, and future career choices. *Journal of Speech, Language, and Hearing Research, 47,* 542-551.

Roy, N., Merrill, R.M., Thibeault, S., Parsa, R.A., Gray, S.D., & Smith, E.M. (2004). Prevalence of voice disorders in teachers and the general population. *Journal of Speech, Language, and Hearing Research, 47,* 281-293.
Sapienza, C.M., Crandell, C.C., & Curtis, C. (1999). Effects of sound-field amplification on reducing teacher's sound pressure level in the classroom. *Journal of Voice*, *13,* 375–381.
Sapir, S., Keidar, A., & Mathers-Smith, B. (1993). Vocal attrition in teachers: Survey findings. *European Journal of Disorders of Communication, 28,* 177–185.
Siebert, M. (1999, February 7). Educators often struck by voice ailments. *The Des Moines Register*, 4
Sonninen, A. (1970). Phoniatric viewpoints on hoarseness. *Acta Otolaryngologica,* 263, 68–81.
Smith, E., Kirchner, H.L., Taylor, M., Hoffman, H., & Lemke J.H. (1998). Voice problems among teachers: Differences by gender and teaching characteristics. *Journal of Voice, 12,* 328–334
Stemple, J. (1995). Clinical voice pathology. Theory and management. San Diego, California: Singular Publishing Group
Sussanna Simberg (2004). Prevalence of vocal symptoms and voice disorders among teacher students and teachers and a model of early intervention. *http:*ethesis.helsinki.fi/julkaisut/*kay/fonet/vk/**simberg**/prevalen.pdf* (Accessed: 28 October 2009).
Titze, I.R., Lemke, J., & Montequin, D. (1997). Populations in the U.S. workforce who rely on voice as a primary tool of trade: A preliminary report. *Journal of Voice 11,* 254– 259.
United Nations Population Fund Association (2000). State of world population report. New York: UNFPA Press.
Verdolini, K., & Ramig, L.O. (2001). Review: Occupational risks for voice problems. *Logopedics, Phoniatrics, Vocology 26,* 37–46.
Vilkman, E. (2000). Voice problems at work: A challenge for occupational safety and health arrangement. *Folia Phoniatrica et Logopaedica, 52,* 120–125.
Vilkman, E. (2004). Occupational safety and health aspects of voice and speech professions. *Folia Phoniatrica et Logopaedica, 56,* 220-253.
World Health Organization (2000a). Gender and Tuberculosis: Toward a strategy for research and action. (WHO/CDS/TB/2000.280). Geneva, Switzerland: WHO Press.
Yiu, E.M. (2002). Impact and prevention of voice problems in the teaching profession:Embracing the consumers' view. *Journal of Voice, 16,* 215–228.

S.E.E.P.H.C.M:-4

MOTIVATIONAL FACTORS FOR GRAM PANCHAYAT MEMBERS TO JOIN POLITICS – A STUDY IN RANEBENNUR TALUKA

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Introduction: Women make a major contribution to the economy. Despite their predominant role in the primary sectors of economic development, Women today, continue to be marginalized with limited access to public and private services. To counter these trends the experiences and perspectives of women need to be heard and their capacity for economic and social contributions to the community should be recognized and strengthened. Women empowerment refers to the process by which women acquire due recognition on par with men to participate in the development process of the society through the political institutions as a partner with the human dignity. Political empowerment for women has been shown to be a key drive for economic and social empowerment. If we see the pages of history India has seen exemplary women political leaders like Rani Ahalya bai, Jhansi Rani Lakshmi bai, Rani Kittur Chennamma, Noorjahan, Indira Gandhi and Sonia Gandhi.

The Indian constitution is one of the most progressive in the world and guarantees equal rights for men and women. The constitution preamble and various articles are designed to provide equal protection before the law. However over 50 years have passed and gender equality is still far from being a reality. The equalities remain persistent in such basic issues as the right to education, the right to basic amenities and access to political power. Legislatures that lead to the reservation on women in panchayat have been an important milestone. As a result, nearly 1 million women have entered the sphere of public decision making. Representation in higher levels of governance is still minimal. To ensure the political representation and empowerment that have been promised requires organized and concerted action. Although India has been inclined towards increased empowerment for women still there is a long way to go. Today women only account for a dismal 33% of the current administration & 8 % of India's political representation. The formation of the National Commission for Women in the early 1990's has been an important step forward. However, its main role is to " wipe the tears of women".

PANCHAYAT RAJ IN KARNATAKA: In 1956, the Karnataka State came into being. In 1959, the Karnataka Village Panchayats and Local Boards Act were passed. The Act, though it gave a certain degree of uniformity to Panchayat Raj Institutions in the State, failed to secure any amount of democratic decentralization, as the Act did not confer real powers and resources to the Panchayat Raj Institutions.

With a view to making the Panchayat bodies more responsive to the needs and problems of rural society, a committee was constituted with Kondajji Basappa as Chairman to recommend a suitable structure for the state. Following the

broad guidelines of the Balwantrai Mehta Committee, the Kondajji Basappa Committee recommended a three- tier Panchayat system for Karnataka. Accordingly, a bill was introduced in the assembly in 1964. However, neither the ruling party in the state nor the government was interested in such radical steps nor as a result nothing happened in this direction. So much so that elections to the panchayat bodies could not be held for a decade-1975-85. The state had to wait till 1983 when the Janata Party came to power. The Karnataka Government accepted and implemented the Panchayat Raj system in 1985 based on the model proposed by the Ashok Mehta Committee viz., two-tier system

A historic moment arrived for women of India on 24th April 1993, when the 73rd Amendment Act came into force. This was considered as a land mark in our democratic history and was expected to provide the Panchayat opportunities for better management of local resources for their balanced and rational utilization plan and implement the need based programmes and manage or generate additional sources according to their needs and priorities. The act is extremely important for the political empowerment of women. The idea behind their move was to enable more women at grass root level to enter in the political stream and create i.e., "critical mass" of women leaders whose voices are heard at various levels.

The Participation of women in the PRI's is considered essential not only for ensuring political participation in the democratic process but also for realizing the developmental goals. Participation of women in PRI's involves women as voters, women as members of political parties, women as candidates, women as elected members of PRI's taking part in decision making, planning, implementation and evaluation of programmes, women members of Mahila Mandali and their association with various organizations.

A women's entry into politics does not mean that she has real power or is empowered. Rigorous training is required to make them understand the concept of power they wield and learn to assert it effectively. Unless women get an equal share in political power it is difficult to adhere to equity, equality and empowerment. To conclude, it can be said there is no doubt that the election to the PRP's has bought rural women to the fore and they have shown remarkable maturity to closely align themselves in the mainstream of development. In this background a study was designed with the following objectives in Rannebennur taluka of Haveri district in Karnataka state.

Objectives of the study: 1. To identify the motivational factors for women members for contesting elections.
2. To study the participation of women in extension activities

Methodology: The study was conducted in Ranibennur taluka of Haveri District.It is situated in the Southern part of the district on National Highway number at a distance of about 300 Km away from Bangalore & also connecting Pune.

The literary percentage according to 2001 census is 69.89% Male literary is 79.89% & female literary is 59.26%. The taluka has 10 primary health centres, 190 Yuvak Mandal, 100 Yuvathi Mandal, 626 Self Help Groups total male population 157019 & female population is 147971.Rural population is 208691 and Urban population is 96349.A total of 10 Gram Panchayats were selected for the study. The Gram Panchayats selected for the study were Makanur, Kamadod, Mudenur, Rahutanakatti, Aremallapur, Benakanaconda, Kodiyal, Chalageri, Kajjari, Karuru

Five members from each selected Gram Panchayat were randomly selected as respondents. As the study is on women panchayat members' only women were selected for the study. The sample size was of 50 members. The data was collected through personal interview method and analysed with appropriate statistical methods like frequency and percentage.

Motivation: It refers to striving to do good work with standard of excellence which may be task related self related or related to other aspect. In the present study the motivational factors which have lead to women to contest elections were recorded in the form of yes/no responses

Extension Participation: It referred to the awareness of respondents about various extension activities and their extent of participation i.e., regular occasional and never.

Results and discussion

Table1 Motivational factors for women members for contesting election

n=50

Sl. No.	Statements	Yes	%	No	%
1	Encouragement from family members	50	100	0	00
2	The quest for power and liberalisation	20	40	30	60
3	Peer group encouragement	13	26	37	74
4	Reservation	26	52	24	48
5	An urge to get empowered and emancipated.	50	100	0	00
6	To get equal status in the society	40	80	10	20
7	Curiosity to enter politics	17	34	33	66
8	To get financial gains	0	00	50	100
9	Political background of the family	08	16	42	84
10	To get recognition and fame as a member of the society	03	06	47	94
11	Participation in activities of various organizations like Mahila Mandal NGO etc	05	10	45	90
12	To gain knowledge about the surrounding environment	50	100	0	00
13	Involvement in decision making	35	70	15	30

Motivational factors for Women Gram Panchayat member for contesting elections.

The results from the table 1 motivational factors for women members for contesting elections revealed that cent per cent were encouraged from their family members to contest elections and cent per cent had an urge to get empowered and emancipated and gain knowledge about the surroundings where as 80 per cent were interested to get equal status in the society, 70% were involvement in decision making, 34 per cent had the curiosity to enter politics, 26 per cent were encouraged by the peer group to contest in elections. 16% had political background hence they opted to join politics, 10 % were members of various NGO's this encouraged them to join politics, six percent opined that they wanted fame and recognition as members of the society and None of the respondents joined politics to get financial gains.

The reason for such a result might be that the family members were the driving force for the women to join politics changing values are paving the way for many women to join politics usually a woman's decision to join politics depends upon the decision of the family members. In earlier days women were confined to homes looking after the household chores and children, they seldom participated in activities outside the home. Increasing educational facilities and other infrastructural facilities has lessened the burden of women in carrying out the activities at home this has resulted in family members to coax her to join politics as the thoughts of the male members of the society are changing and they want their women folk to come out of their homes to carry out responsibilities of the societies. *"Women is the builder and moulder of nation's destiny. Though delicate and soft as lily, she has a heart, far stronger and bolder than of man… she is supreme inspiration of man's onward march"* These are the words said by Rabindranath Tagore about women. Women have been always contributing to the economy indirectly. In the male dominated society a women's role is often neglected and her labours are never rewarded. Women always feel that she can carry out all the jobs that a man can do and after the reservation policy for women she has always felt that this will provide a platform to deal with issues like women welfare, gender justice and priority for the female child and she feels that joining politics will make her empowered and emancipated

Since Independence, the Government of India (GOI) policies for women's development have evolved in emphasis, from an initial welfare oriented approach to the current focus on development and empowerment. Significant changes occur in the mid-1980s with the Seventh Five Year Plan, which operationalizes the concern for women's equality and empowerment and focused on inculcating confidence among women, generating awareness of their rights and privileges, training them for economic activity and employment and bringing them into the mainstream of national development. Women's need for equal status can be viewed from the point of view of issues circumventing her. She is always surrounded by problems of poverty, male alcoholism, dowry, desire for a male child, decision on reproduction rights and domination of male members in all decision making matters of the family. Under such circumstances women felt that being members of gram panchayat would allow them to tackle the above issues. Thus giving them equal status in a society where their male counter parts would respect their decisions.

Thirty four per cent had the curiosity to enter politics, 26 per cent were encouraged by the peer group to contest in elections. 16% had political background hence they opted to join politics, 10 % were members of various NGO's this encouraged them to join politics, six percent opined that they wanted fame and recognition as members of the society and None of the respondents joined politics to get financial gains. The above result clearly states that the out side influence was the most contributing factor for women to contest election. None of the women expressed they had any financial gains because they opined that the fund which was allotted was spent exclusively for development purpose. The opinion may be far from reality or the male members might have been looking after the financial matters.

Extension participation of the Respondents

Table 2 Extension Participation of the Respondents

n=50

Sl. No.	Extension Activity	Frequency	%
1	Gender Sensitization and capacity building	48	96
2	AIDS awareness campaigns	40	80
3	Jala Nirmala Yojana	36	72
4	Organic Farming	35	70
5	Training on NREGP	34	68
6	Training at BDO Office on working of G.P.	50	100
7	Literacy campaigns	20	40
8	Agricultural Technologies	25	50
9	Training through Video Conferencing	04	08

It is noticed from Table 2 that cent percent of the participants were trained in BDO office at Ranebennur on working of Gram panchayat & 96 percent were trained in gender sensitization & capacity building followed by literacy campaign (90%). The others trainings undergone by the respondents were on AIDS aware programme (80%), Jala Nirmala Yojana(72%), Organic faring (70%), Training on NREGP (68%), Training on Agricultural Technologies (50%), literacy campaigns (40%) and Trainings through video conferencing (8%).

The reason for such a result might be that few of the training are compulsory for the members and these training give wide exposures to the members on the various government schemes and empower them by creating awareness about the various benefits provided to villages and gram panchayats

most of the trainings are on generating employment and gender issues

Conclusion: The present study focuses on the empowerment of women through political participation. The Participation of women in the Panchayat Raj Institutions is considered essential not only for ensuring political participation in the democratic process but also for realizing the developmental goals. As the study was on women Gram Panchayat Members, it gives the inner view why women really contest elections though there may be many pseudo representations many women have revealed the real motive behind joining politics. Cent per cent were encouraged from their family members to contest elections. As women are part of a family the decisions are usually taken jointly, this gives a chance for women to express her desire to involve in activities other than home. Irrespective of age and education all had an urge to get empowered and emancipated and gain knowledge about the surroundings this clearly shows that it is a positive gesture for women to come in forefront in different issues for which otherwise she had to depend on male members of the family in a male dominated society. Another aspect of the study was their participation in extension activities, majority of the members attended only those trainings which were compulsory, and this may be due to family pressures or some other reason. However they expressed that the trainings have contributed to their knowledge.

References

ANONYMOUS,2009, Women's day: UNDEF project to improve participation in politics., *Deccan Herald*, March 8,2009: 4

BHARGAVA, B. S. AND VAIDYA, K. C., 1992, Position of women in political institutions. *Journal of Rural Development*, 11(5) : 601-628.

GAJRE, B.M., 1997, A study of role perception and performance of Gram Panchayat members from Haveri taluka of Pune Diistrict. *M.Sc.(Agri) Thesis,* Mahatma Phule Krishi Vidyapeeth, Rahuri.

HIREMATH, D., 1992, Women's in grass-root politics. *Journal of Social Welfare,* 44 (2) : 7-12.

S.E.E.P.H.C.M:-5

WOMEN SHG'S- A REFORM IN ECONOMIC UPLIFTMENT AND WOMEN'S EMANCIPATION

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Introduction: Rural areas in Karnataka has witnessed a rapid growth of self-help groups (SHG's) in the last one decade or so. SHG's are working with a simple motto,

"Coming together is Progress
Working together is Success".

A self group is a small and informal association of like minded members with similar Socio-economic back ground , who have come together to realise some common goals based on the principles of self-help and collective responsibility.

In Karnataka, SHG growth has ensured a form of movement representing a massive grass root level mobilisation of poor rural women for their socio-economic advancement. SHG's are being promoted as part of micro finance intervention aimed at helping the poor to obtain easily financial services like savings, credit and insurance. Apart from this, they are also playing a major role in developing habit of saving, leadership and entrepreneurship qualities, personality development, bringing out the hidden talents in rural women there by building overall self confidence and self respect in them.

Though there is widespread gender bias against women in various fields, interventions like microfinance have the potential to enhance women's capabilities make a significant difference to overall development of women. There are evidences that Self Help Groups (SHG'S), more visible as microfinance clients have enhanced women's status in the household as income contributors and decision makers. Many activities have brought women members of SHG's in the mainstream development. Women now have the capacity to become successful entrepreneurs and are able to supplement to their family income, which has resulted in overall upliftment of the family.

Government of Karnataka has initiated many schemes which are implemented by various developmental departments for the upliftment of rural women through SHG'S Studies on SHG'S show a decline in dependence on money lenders. SHG's have also enhanced the awareness, skills and other abilities of the women resulting in building of individual self-esteem and overall economic upliftment.

Department of Agriculture under WYTEP project has formed many SHG'S in all taluks of Karnataka. About 30 -40 farm women SHG'S are developed in Sirsi taluk of Uttara kannada district . An impact study of four groups formed under WYTEP project to study the role of SHG'S in economic and social empowerment of women was conducted in the year 2008 .

Swarna SHG of Golikoppa Village : Under the guidance of State Department of Agriculture, Swarna SHG group was started with meagre financial assistance of Rs. 4000/- from department of Agriculture in 2004. For two years the group operated by mere saving and taking internal loans.

The group later started thinking of starting an enterprise to lead a self reliant life. With an initial capital of Rs. 10,000/- they brought two sewing machines and started stitching Razais. The group prepares Razais of various sizes which can

be used as bed spreads, chair mats, carpets, rugs, etc.,The cost of razais range from Rs.250/- to Rs.1200 .Earlier the group used foam as wadding material for Razais. Today they are preparing cotton razais of good quality which have become popular not only in the Uttara Kannada district but also in neighbouring districts. Women who were shy earlier, now are boosted with high confidence which has made them go for purchase of raw materials from Hubli and Belgaum market Though the group members work in their leisure hour, they earn and average of Rs. 5000-6000 per month. In last three years the group have done a turnover of Rs. 1,00,000/- with a net profit of Rs. 50,000/-.

The group also participates in all social, religious activities which has developed a sense of unity among the village people. The group now is aiming at buying technically advanced sewing machines to widen their business.

1.**Sri Lalitha SHG of Gadigehole village:** Self reliance and women are two faces of a coin. The Sri Lalitha SHG of Gadigehole village is a sheer example of this. Gadigehole village of sirsi taluk is a typical malnad village in dense forest area with scattered households. Paddy, Areca nut, Banana, Turmeric, Pepper etc, comprises the major cropping pattern in the village. The group consists of 10 members who have inherent handicraft skills in them. The group started in 2005 with an initial capital of Rs. 3,000/-.

The group uses locally available natural resources to grow turmeric in their back yards and later they process and prepare fine quality turmeric power (value addition of turmeric). Initially the group marketed their product in local exhibitions and Agricultural melas. Due to maintenance of purity and high quality in processing, today the product has great demand even from tourists of neighbouring states.

The group comprises only ten members , who are highly self reliant and enthusiastic people involved in under taking various agro enterprises. Apart from processing turmeric powder, they have purchased candle mould and Rava machine under subsidised rate from department of agriculture. Today they are a model example of women empowerment marketing turmeric powder, candles, Rava, etc.

The local Agricultural Co-operative bank and NGO's have backed them in marketing of these products. Their marketing linkage today is extend upto Madhyapradesh and Maharastra. The group earns an average Rs. 6,000/- to Rs. 8000/- net income per month. Each SHG member earns on an average of Rs.500/- per month which supplements their family income.

Apart from economic activities, the group has contributed to overall personal and social development of the members. Today the SHG member have formed a "All Women Yakshagana" troop and give performance all over Karnataka.

3. Adarsh SHG of Achanalli village: Achanalli is a very backward village comprising of Jogi community. The SHG members of Adarsha group are economically as well as educationally backward people. The farm women today have gained economic as well as education empowerment by participating in various training programmes conducted by Department of Agriculture and formed SHG in the year 2006. Today with the guidance and support of the State Department of Agriculture and KMF they have started an "All Women's Dairy".

The dairy does 100-150 litres milk transaction per day. They also prepare and sell balanced cattle feeds and thus earn about Rs. 80,000/- per annum. Some times the yearly transaction is up to rupees three lakh.

The group has joined "Save Environment Campaign" by slowly switching towards organic farming. All the members compulsorily have constructed vermicompost pits and are actively involved in vermicompost production. The raw material required for vermicompost preparation is available in surplus from the surrounding forest which is a great advantage for them. This has helped each family of SHG members in producing 8-10 tonnes of vermicompost in a year. The members use 60% of vermicompost to their own agricultural lands which has improved their agriculture yield as well as reduced the cost of cultivation their by increasing their economy. Remaining 40% of vermicompost is sold by the members which fetches an additional income.

Thus Adarsh SHG is an example of wonders created by an informal organising sector at rural level.

4. Laxmi Narayana SHG Badalkoppa-Hulasehonda : Laxmi Narayana SHG of Badalkoppa-Hulasehonda is situated in remote village in deep forests of Sirsi taluk. The group started its activity in 2007 and consists of 10 members.

The SHG members gather during their leisure time, to string a few rupees (with the motto drops of water makes an ocean) and have become role model for other home makers. They prepare eco-friendly produces like natural colours, kumkum powder. Apart from preparation and sales of natural colours, the group is involved in conducting awareness programmes on importance of usage of natural colours and stopping environmental pollution for school children, publics and even government employees.

They also produce dried banana figs of high nutritive value, which has marketing linkage up to Poona. The group in just 2 years has become a model group for others and earn about 4000-5000/- per month.

The group members also have purchased Banana coir making machines recently .They are undergoing a long term technical training programme in banana coir making , preparing banana coir products like mats , bags,baskets,etc. under the guidance of Department of Agriculture and Krishi Vigyan Kendra,Sirsi. The group has a huge plan of establishing a small scale industry of banana coir preparation as well as making banana coir products.

Conclusion : The impact studies indicate, Self Help Group concept which has gained momentum since 1990's has created impact in improving the economy of rural poor providing lively hood security. The present study has thrown light on such SHG groups which has led to overall development of women in all spheres of life empowering them socially, eco-

nomically and personal making. The present study shows members are able to access banking, insurance etc., their by providing opportunity which has reduced economic dependency on agriculture alone. With agriculture being major occupation of livelihood women have taken up subsidiary occupations like dairy, razai making,candle making, value addition,etc which has substantially improved their economic condition . The SHG's played a transformational role for women socially and economically, developing the skills and ability to decide thus, enhancing the women's status in the household as income contributors and decision makers. More over the women's entrepreneurship skills were refined through involvement in SHG group activities, thus bringing them in forefront of development ultimately resulting in emancipation of women.

References

Nanavaty Reema., 2008, Towards Livelihood Security, Yojana, Vol 52:21-23

S.E.E.P.H.C.M:-6

MISSAPPROPRIATION BY GOVERNAMENT EMPLOYEES IN ARTHASHASTRA

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Kautilya is also known as Visnugupta or Chanakya. Kautilya's Arthasastra is an work on political science and economics. Which is an edited work on these topics as these are present on our vedic litrature where their importance is necessary. These are also seen in Dharmasutras. Principal compilers of Dharmasutras are Gautama, Harita, Vasistha, Baudhayana, Apastamba, Hiranyakesin, Sankhalikhita, Vaikhanas, Usans, Kasyapa and Brhaspathi. Many of these have been quoted by Kautilya in his Arthasastra. Yajnavalklyasmrti, a successor to Manusmrti, forms the starting point in modern digests on Dharmasastra. It is divided into three main parts namely, Achara (contractual law), Vyavahara (Civil law) and Prayaschitta (punishement: criminal law). The most popular and authoritative commentary on this is Mitaksara (an original treatise in itself) by Vijnanesvara. Arthasastra's has the fact that translations made by earlier scholars have been 'rationalized' and 'improved upon by using legal terminology and made relevant to modern times. Rationalization has been achieved through its commentary and arrangement. It is not widely known that more than half of Kauatily'sArthasastra deals on arrangement. It is one such chapter dealing with the misappropriation by government employees which has a closer resemblance to present day misappropriations by government employees.

All establishments depend on finances. Therefore the importance is given for the amount deposited to treasury. Prosperity of the country, rewards for good work, capture of thieves, preventing the employees from cheating government by grabbing revenue, good harvest, abundance of goods, freedom from calamities, absence of exemption from tax's and income in the form of gold are the cause in increase in finances Obstruction giving loans, dealing in merchandise, meddling with accounts, lose of revenues cause self enjoyment exchange of objects and defalcation are the *loss of treasury*

Lack of efforts to collect revenue [siddhi] non-realization of revenues, not crediting the revenue to treasury is obstruction [prathibandha]. Ten times the amount involved is the fine to levied against employee.

कोशद्रव्याणां वर्द्धिप्रयोगाः The investment of the treasury money for lending for interest is called as prayoga.

पण्यव्यवहारो व्यवहारः 1

Dealing in merchandise is vyavahara.

तत्र फलद्विगुणो दण्डः 1

Two times the amount of profit should be levied for those who have commit this crime.

कोशद्रव्याणां वर्द्धिप्रयोगाः सिद्धं कालमप्राप्तं प्राप्तं करोत्यप्राप्तं प्राप्तं वेत्यवस्तारः 1

The meddling with accounts [avastara] consists in showing the proper time for revenue collection as improper time and improper time as proper time for the sake of favoring those who give bribe should be levied with five times the amount.

क्लप्तमायं परिहापयति व्ययं वा विवर्धयतीति परिहापणम् 1

The loss of revenue [parihapanam] is that caused by reducing the fixed revenue or by increasing the amount of expenditure. In this case the fine is four times the loss.

स्वयमन्यैर्वा राजद्रव्याणामुपभोजनमुपभौगः 1

The enjoyment of state revenue by oneself or causing others to do so is upabhoga. In this case for enjoying the gems and other valuables death sentence is the punishment. If the valuable objects are involved the punishment is imprisonment depending on the amount. For the enjoyment of articles of lesser value the punishment is a fine equal to the value of those articles along with the recovery of them.[tacca tavacca dandah]

राजद्रव्याणामन्यद्रव्येणादानं परिवर्तनम् 1

The bartering of government articles for similar articles of others constitutes exchange [parivartana]. This crime is explained as upabhoga.

सिद्धमायं न प्रवेशयति निबद्ध व्ययं न प्रयच्छति प्राप्तां नीवीं विप्रतिजानीत इत्यपहारः 1

The siddhi is revenue collected from people.Defalcation [apahara] consists in not crediting the realized revenue to

treasury or not spending, what is been ordered or not recording the net balance as received. The fine in this case is twelve times the amount involved.

The ways of misappropriation of funds are forty in number. They are

तेषां हरणोपायाश्चत्वारिंशत् 1 पूर्व सिद्धं पश्चादवतारितं पंश्चात्सिद्धं पूर्वमवतारितं साघ्यं न सिद्धं असाघ्यं सिद्धं सिद्धमसिद्धं क५तम् । असिद्धं सिद्धं क५तम् अल्पसिद्धं बहु कृतम् बहुसिद्धकृतम् अन्यत्सिद्धमन्यकृतम् अन्यत: सिद्धं अन्यत: कृतम् देयं न दत्तं अदेयं दत्तं कालै न दत्तं अकालै दत्तं अल्पं दत्तं बहु क५तम् बहुदत्तमल्पं कृतम् अन्यदत्तमन्यत्कृतम अन्यतो दत्तमन्यत: कृतम प्रवि८टमप्रवि८ट कृतम अप्रवि८ट प्रवि८टक८तम कुप्यमदत्तमूल्यं प्रवि८टं दत्तमूल्यं नप्रवि८टं संक्षेप: कृत: विक्षेप: संक्षेपो वा महार्घण परिवर्तितम् अल्पार्घ महार्घण वा सामारोहपतोऽर्घ: प्रत्यवरोपितो वा संवत्सरो मासविषम: कृत: मासी दिवसविषमो वा समागमचिषम: मुखयिषम: धार्मिकविषम: निर्वर्तनविषम: पिण्डविषम: वर्णाविषम: अर्घविषम: मानविषम: मापनविषम: वाजनविषम: इति हरणोपाया:।

1.What is collected earlier is entered later on.
2What is collected later is entered earlier.
3.What should have been collected is shown as not collected
4.What cannot be collected is shown as collected.
5.What is collected is shown as not collected.
6.What is not collected is shown as collected.
7.The collection that is smaller quantity is shown as larger quantity.
8.The collection that is larger is shown as smaller.
9.Something is collected and something else is entered.
10.What is collected from one source is shown as collected from another.
11.What is due is shown as paid.
12.What is not due is shown as paid.
13.The payment is not made in time, but payment made untimely.
14.What is given is small entered as huge amount.
15.What is given huge amount entered as small amount?
16.What is given one sort is entered as another sort.
17.The person givens name is replaced by another.
18.What is given from one head but entered under another head.
19.What is credited is shown as not credited.
20.What is not credited is shown as credited.
21.Raw materials unpaid for are entered.
22.Those paid for are not entered.
23.An aggregate is shown as parts.
24.Parts are shown as aggregate.
25.Higher valuable are exchanged with lesser valued.
26.Lesser-valued are exchanged with higher valuable.
27.The price of an object is inflated.
28.The price of an object is lowered.
29. The year is shown as less or more by months
30.The month is shown as less or more by days.
31.Inconsistency in transactions.
32.The source of income is misrepresented.
33.Inconsistency in giving charities.
34.Incongruity in representing the work turned out.
35.Misrepresentation in commodities [regarding price]
36.Misrepresentation in the quality Varna] of commodities.
37.Misrepresentation in the prices.
38.Misrepresentation in weights and measures.
39.Misrepresentation in counting articles
40.Making use of false cubic measures.

These are the several ways of misappropriation.

तत्रोपयुक्तनिधायक निबन्धक प्रतिग्राहक दायक दापक मन्त्रि वैयाव५त्यकरान् एकैकशोऽनुयुञ्जीत 1

In the above case the person concerned [upayukta] such as the treasury officer, the recorder, the receiver, the payer, the person causing payment and the ministerial staff of the officer [mantrivaiyavrttyakarah] should each one of them be separately questioned. If they lie they should be punished with fine equal to that levied on the chief officer. It should be proclaimed in the country as" who ever has suffered in the hands of the officer may make grievances known to the king." Those who report such things should be duly compensated.

अनेकेषु चाभियोगे८वपव्ययमान: सक५देव परोक्त: सर्व भजेत 1 वैषम्ये सर्वत्रानुयोगं दद्यात् 1

When an officer is involved in number of offences and is defeated [parokta] in one of them, he should be answerable to all of them. He can be tried for each of them. When misappropriation is of larger amount, and officer is found guilty for it he is answerable to the entire amount.

क५तप्रतिघातावस्थ: सूचको नि८पन्नार्थ: ष८टमंश लभेत द्वादशमंशं भ५तक: 1 प्रभूताभियोगादल्पनि८पतौ नि८पन्नस्यांशं लभेत 1

When an informant succeeds in proving the misappropriation of amount, if the person is a government servant [bhrtaka] he is entitled for 1/12 the amount. When an informant succeeds in proving a part of the amount proved. If the charges is not proved the informant is liable for monetary [hairanya] or corporal punishment. He should never be shown mercy. When the charges are proved, the informant may input his tale bearing [vada] to someone else or clear himself from blame.

नि८पतो निक्षिपद्वादमात्मानं वापवाहयेत् 1
अभियुक्तोपजापात्तु सुचको वधमान्पुयात्।१

If the informant withdraws his assertions due to insinuations [upajapa] of the accused, he should be condemned to death. Thus kautilya has explained the system present in those days and to be followed later in his arthashastra text. Except for the ways of misappropriation the punishments meat out for the people has changed. Thus we can find the arthashastra text to be relevant for present era.

THEME 9

SOCIO-CULTURAL SCIENCES INCLUDING ARTS & MUSIC (BHARATIYAM)

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S.C. A. M:-1

IMPACT OF ACADEMIC LEARNING ENVIRONMENT ON ACADEMIC ACHIEVEMENT OF STUDENTS FROM AIDED AND UNAIDED CO-EDUCATIONAL HIGH SCHOOLS

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Introduction: The first post independence comprehensive study on the status of education in India completed in 1966 gave a major thrust to the idea of alround development of the child's personality and intellect. It elaborated on the need for physical, intellectual and spiritual development of the child in equal measure. Academic achievement seems to be the ultimate goal in every one's mind. In attempts to pursue this goal, all concerned seem to deny the existence of the role of the affective in student's performance. They appear to assume that intellectual performance is divorced from any feeling or perceptions the student might have.

In the present era, schools have a greater responsibility than even before to help the students to develop appropriate behaviour patterns. The school is charged with realization, human relationships, economic efficiency and civic responsibility. The experience at school and school curriculum contribute to child's feeling of personal wealth, social competence, in winning acceptance from associates, satisfaction for the students to play and to accomplish purposeful tasks and develop interests and activities which would promote social values.

It is not the environment of school alone, types of management of schools but home also occupies the first and the most significant place for the development of children. It does not only provide the hereditary transmission of basic potentials for the development, but also provides environmental condition, personal relationships and cultural pattern, favourable or unfavourable, positive and negative, as reflected from its structure, socio-economic and cultural status and the pattern of mutual relationship and emotional state among its members. Dave (1965) defines educational environment of school "as the conditions, processes and psychological stimuli which affect the educational achievement of the child. Thus the present study is designed to study the academic learning environment at school and home, co-educational high school students from aided and unaided schools and to study the influence of academic learning environment on academic achievement of coeducational high school students.

Methodology

The population of the study consisted of high school children from 8th, 9th and 10th class students with an age range of 12-16 years studying in aided and unaided co-educational high school of Dharwad city. A preliminary survey was carried out in year 2005 to collect information regarding the total number of private and government schools in Dharwad city. There were 27 aided and 12 unaided high schools in Dharwad. Out of these 8 coeducational schools were selected (4 aided and 4 unaided). From each of the selected high school and from each of the class only one section of the students were selected randomly. From the selected section a minimum of 5 each boys and girls were selected. Thus the total sample for the study consisted 240 children.

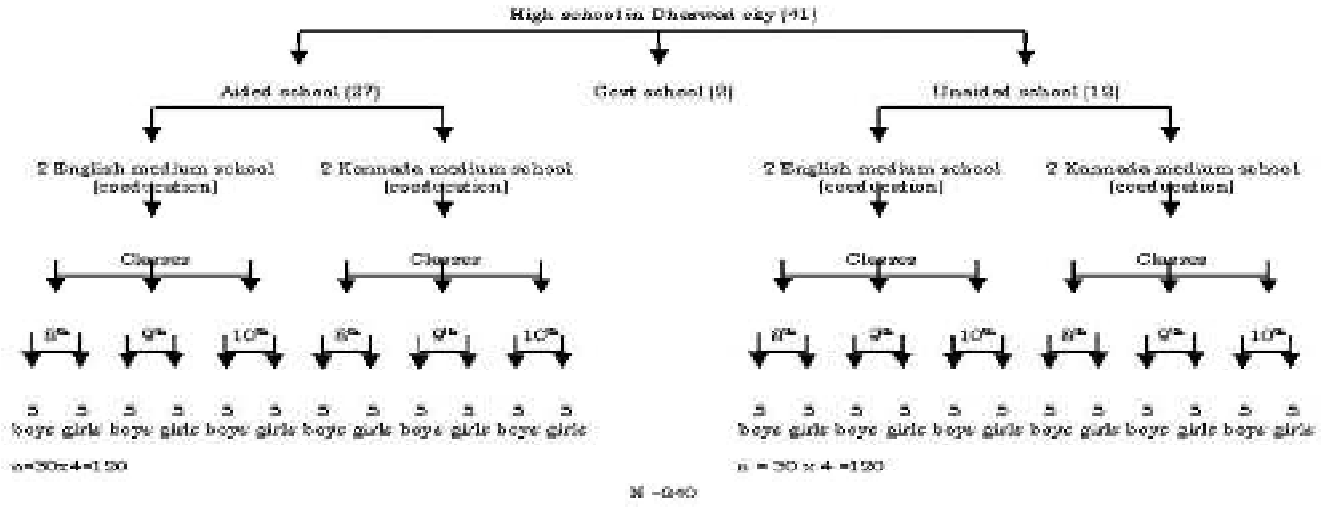


Fig. 1. Selection of the sample

Tools used for the study

1. Academic learning environment

a. School learning environment schedule

b. Home learning environment schedule

2. Academic achievement

3. Socio-economic status schedule a combination of items developed by Aaron et al. (1969),
Venkataramaiah (1983) and Hauser (1994).

a. School learning environment schedule

A full pledged schedule was developed to study the school learning environment. The schedule consists of 130 items with 10 components, viz., goal orientation, study habits, students involvement, physical facilities in school, teaching materials, teacher-student interaction, equality, and method of teaching and qualification of teacher. Each of the statement with a response as 'yes' or 'no' with score of 2 and 1 respectively. Spilt half method was used to test the reliability of the schedule. The reliability of the tool was = 0.65.

b. Home learning environment schedule

Home learning environment schedule was developed to know the home learning environment of students and its influence on academic achievement of high school students. The developed version has 37 items categorized into five components viz., parental encouragement and care, facilities provided at home, parental guidance & support, parenting and co-curricular activities. All statements are positive and score of 2 and 1 for 'yes'or 'no' responses are given respectively. Spilt half method was used to test the reliability of the schedule. The reliability of the tool was= 0.63.

Data collection was made by using pre-tested questionnaires. Prior permission of the principal or Headmaster's was taken from the aided schools, (which set up and run by private/voluntary agencies, trusts, associations, individuals, religious groups and so on and which receive a grant from the government are included in this category.) and unaided schools,(which set up, run and financed wholly by private / voluntary agencies, trusts, associations, individuals, religious groups and so on and which receive no grant from the government but are recognized.) coeducational high schools to conduct the study. After establishing a rapport with subjects, school learning environment schedule and home learning environment schedule was self administered on students. All the selected students from classes 8^{th} to 10^{th} were clubbed in one classroom and tool was administered on students. The students were instructed to give the responses.

Students't' test was carried out to know the differences in the school learning environment and home learning environment among aided and unaided high school students. Karl Pearson's product moment correlation coefficient analysis was used to measure the relationship between school learning environment, home learning environment, academic achievement and socio-economic status of the family of high school students. X^2 test was applied to know the association between school learning environment, home learning environment and academic achievement of high school students by type of school,

Results and Discussion

In this study, high school students of both aided and unaided schools were similar on almost all socio-economic status variables, such as mother's education, occupation and size of the family (Table 1).

Table 2 indicates that, higher proportion of unaided school students had high level of school learning environment than aided school students. The chi-square analysis revealed statistically significant association indicating that school learning environment was associated with type of school. It is also evident from the table that, a majority (45.0%) of students of unaided schools had high level of home learning environment than aided school students. The chi-square analysis showed statistically significant association indicating that home learning environment was associated with type of school.

Further results of the study revealed that, students of unaided schools had significantly (Table 3) better facilities in school and had better method of teaching than students from aided schools. It could be observed from the same table that, a higher proportion of the students of aided schools had low level of academic achievement than unaided school student. Further, chi-square revealed non-significant association between academic achievement of students and type of school. The reason might be that, the school learning environment by and large, differs between types of schools. It is therefore suggested that while recruiting teachers, schools should pay attention to teachers aptitude and personality characteristics, such as friendliness, sympathy, etc. This can provide congenial environment in the classroom and pleasant place for learning.

Students of unaided schools had significantly better facilities in home, received significantly more parental guidance, support than students from aided schools (Table 4). The students of unaided schools had good home environment compared to aided schools. This may be due to the fact that families with better socio-economic background could afford expensive educational system than that existed in unaided schools. Similarly Devi (1997) reported that, private school students had better environment than students from quasi government schools.

With regard to academic achievement, students of aided and unaided high schools did not differ significantly on academic achievement. But Wangoo and Khan (1991) reported, significant difference on academic achievement between the students from government and private schools. This study was in Srinagar on a sample of 180 female students from ten government and ten private schools within the age group of 13+.

It could be noticed from Table 5 that, there was a positive non-significant relationship between home learning environment and school learning environment and academic achievement among high school students. Khare (1996) reported sig

nificant correlation between home environment and academic achievement in boys and girls. Gutaman and Midgley (2000) reported that, significant interactions were found between family and school factors. They reported that the combination of both family and school factors was most effective in supporting the academic achievement of poor African American students during the transition to middle level schools.

It is observed from the Table 7 that socio-economic status was positively and significantly correlated with school learning environment and home learning environment and academic achievement of high school students among entire group of students and among aided school students. This may be due to the fact that, high socio-economic status tends to have good facility in home parents can afford better educational facilities in home. Familial factors such as parents support, parents education and occupation, their involvement and interaction with children contribute good learning environment. Similarly Devi and Mayuri (2003) reported that socio-economic status significantly contributed to academic achievement.

The above study indicates that, students of unaided schools (boys and girls combined) had significantly better school learning environment than students from aided schools. There was better involvement of students in school activities. The physical facilities in school and method of teaching was better, they had significantly better facilities in home and received more parental guidance and support. Students of both aided and unaided schools were similar in academic achievement. Socio-economic status of the family positively and significantly influenced the home learning environment and school learning environment of high school students among entire group of students and among students of both aided and unaided schools.

References

DAVE, R.H., 1963, The identification and measurement of environmental process variable that are related to educational achievement. *Ph.D. thesis, University of Chicago*.

DEVI, K.T., 1997, *Home and School Environment Their Influence on Perceptual Styles*.
Discovery Publishing House, New Delhi. 1-65

DEVI, S. AND MAYURI, K., 2003, The effects of family and school on the academic achievement of residential school children. *Journal of Community Guidance and Research*, **20** : 139-148.

GUTMAN, L.M. AND MIDGLEY, C., 2000, The role of protective factors in supporting the academic achievement of poor African American students during the middle school transition. *Journal of Youth and Adolescence*, **29** : 223-249.

KHARE, S. AND GAREWEL, A., 1996, Relationship among speed of information processing ability, creativity and academic achievement. *Psycholingua*, **27** : 53-56.

WANGOO, M.L. AND KHAN, M.A., 1991, Socio-economic status and academic achievement. A comparative study of government and private school students. *Indian Psychological Review*, **36** : 1-10

Table 1. Comparison of socio-economic characteristics between aided and unaided co- educational high school students

Sl. No.	Socio-economic characteristics	Unaided (n=120)		Aided (n=120)		't' value
		Mean	SD	Mean	SD	
1.	Age of the child	14.43	0.91	14.17	0.86	2.33*
2.	Father's education	14.00	3.74	14.76	3.73	-1.57
3.	Mother's education	15.08	4.68	16.23	4.23	1.99*
4.	Father's occupation	10.17	4.94	10.69	5.27	0.79
5.	Mother's occupation	1.80	1.52	1.83	1.61	0.16
6.	Size of the family	1.28	0.70	1.42	0.89	-1.28
7.	Economic status of the family	76.26	27.65	89.53	23.56	4.00*

* Significant at 0.05 percent level

Table 2. Frequency distribution of high school students by levels of school learning Environment, home learning environment and academic achievement by type of school

Variables	Type of school		Total	χ^2
	Aided	Unaided		
Home learning environment				6.60*
Low	49	31	80	
	(40.8)	(25.8)	(33.3)	
Medium	32	35	67	
	(26.7)	(29.2)	(27.9)	
High	39	54	93	
	(32.5)	(45.0)	(38.8)	
Total	120	120	240	
	(100.0)	(100.0)	(100.0)	

School learning environment				64.89**
Low	67	10	77	
	(55.8)	(8.3)	(32.1)	
Medium	26	38	64.	
	(21.7)	(31.7)	(26.7)	
High	27	72	99	
	(22.5)	(60.0)	(41.3)	
Total	120	120	240	
	(100.0)	(100.0)	(100.0)	
Academic achievement				0.64ns
Low	48	42	90	
	(40.0)	(35.0)	(37.5)	
Medium	35	38	73	
	(29.2)	(31.7)	(30.4)	
High	37	40	77	
	(30.8)	(33.3)	(32.1)	
Total	120	120	240	
	(100.0)	(100.0)	(100.0)	

** Significant at 0.01 per cent level
NS – Non significant,
Figures in the parentheses indicate %.

Table 3. Comparison of mean scores of components of school learning environment between students of aided and unaided coeducational high schools

Sl. No	Components	Aided (n=120)		Unaided (n=120)		't' value
		Mean	SD	Mean	SD	
1.	Goal orientation	17.95	1.67	18.32	1.56	-1.76
2.	Study habits	28.60	2.28	29.09	2.67	-1.53
3.	Co-operation	31.53	2.37	31.38	2.05	0.62
4.	Involvement of students	24.80	2.03	25.40	2.12	2.24*
5.	Physical facilities in school	24.70	4.20	26.84	2.31	4.89**
6.	Teacher-student interaction	47.08	4.62	47.93	2.70	-1.74
7.	Equality	20.12	2.08	20.57	1.84	1.77
8.	Method of teaching	14.68	1.33	15.06	1.30	2.21*
9.	Qualification of the teacher	8.06	0.79	7.91	0.76	1.50
10.	Teaching materials	19.94	1.64	19.75	1.76	0.87
	Total school learning environment	227.16	16.36	242.36	10.24	8.63**

*- Significant at 0.05 level
**- Significant at 0.01 level

Table 4. Comparison of mean scores of components of home learning environment between students of aided and unaided co-educational high schools

Sl. No	Components	Aided		Unaided		't' value
		Mean	SD	Mean	SD	
1.	Parental encouragement and care	14.39	1.50	14.60	1.21	-1.18
2.	Facilities in home	10.26	1.42	10.64	1.17	2.28*
3.	Parental guidance and support	13.24	1.61	13.70	1.28	2.44*
4.	Parenting	21.73	1.90	21.98	1.56	-1.08
5.	Co-curricular activities	7.56	0.72	7.67	0.63	-1.62
	Total home learning environment	67.16	4.24	68.61	3.19	2.99**

* Significant at 0.05 per cent level
** Significant at 0.01 per cent level

Table 5. Correlation co-efficient between school learning environment, home learning environment and academic achievement of students

	Group	N	'r' between HLE x SLE	'r' between SLE x AA	'r' between HLE x AA
Type of school	Aided	120	0.04	0.03	0.17
	Unaided	120	0.09	0.12	-0.01
	Total	240	0.09	0.05	0.08

* Significant at 0.05 per cent level
** Significant at 0.01 per cent level
SLE – School learning environment
HLE – Home learning environment
AA - Academic achievement

Table 6. Correlation co-efficient between socio-economic status of the family, school learning environment, home learning environment and academic achievement of the students

	Group	N	'r' between HLE x SLE	'r' between SLE x AA	'r' between HLE x AA
Type of school	Aided	120	0.11	0.32*	0.21*
	Unaided	120	0.01	-0.06	0.08
	Total	240	0.21**	0.18**	0.14*

* Significant at 0.05 per cent level
** Significant at 0.01 per cent level
SLE – School learning environment
HLE – Home learning environment
AA - Academic achievement
SES – Socio –economic status

S.C. A. M:-2

A STUDY OF ACADEMIC LEARNING ENVIRONMENT OF HIGH SCHOOL STUDENTS IN RELATION TO SOCIOECONOMIC STATUS

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Introduction: One of the major aims of the education is the development of wholesome personality. Family is the socio-biological unit that exerts the greatest influence on the development and perpetuation of the individual's behaviour. Next to home, school is the most important experience in the process of development of children. Both the environments, share influential place in child's life and also contribute to the development of children. School is the second home to children. Teachers and parents have greater responsibility to foster mental health status of the students. At times in adverse conditions the school may also substitute the home situations and meets the emotional needs of those neglected in the home. Pupils perception, or attitude towards the school climate or environment has got considerable influence over their mental health. School atmosphere, includes favourable attitude towards school teacher, co-students, curriculum, methods of teaching, facilities available in the classroom and teacher-student interaction.

Children living in poor environment may fail to develop their potentials and skills to the optimum extent, may have a negative affect on their performance in school and achievements in social life, while children growing up in conducive environment may show superior cognitive abilities and academic competence. It is therefore necessary to study the academic learning environment of children in these two different contexts of home and school and trace the causal factor for enhancing the academic accomplishment of children.

Home environment has been conceptualized as the quality of human interactions, from the point of view of the child. It includes those aspects which foster growth and development, such as family trust and confidence, sharing of ideas, parents support, parental approval, parenting, parental encouragement, care, affection and approval and support of siblings.

Children living in rural or urban areas are exposed to different environment. Generally children from low socio-economic status attend government schools while, children of well-to-do families attend private schools or public schools. These two types of schools have another major difference – difference in medium of instruction.

In addition, home learning environment, school learning en

vironment and academic achievement may be influenced by various socio-economic factors like age, gender, family size, parent's education and occupation and also by economic status of the family.

Thus the present study was an attempt to investigate the effect of familial factors like family education, size of the family and socio-economic status of the family on academic learning environment of school students.

Methodology : The population of the study consisted of high school children from 8th, 9th and 10th class students with an age range of 12-16 years studying in aided and unaided co-educational high school of Dharwad city. A preliminary survey was carried out in year 2005 to collect information regarding the total number of private and government schools in Dharwad city. There were 27 aided and 12 unaided high schools in Dharwad. Out of these 8 co-educational schools were selected (4 aided and 4 unaided). From each of the selected high school and from each of the class (8th, 9th, and 10th) only one section of the students were selected randomly. From the selected section a minimum of 5 each boys and girls from all three classes were randomly selected. Thus the total sample for the study consisted 240 children.

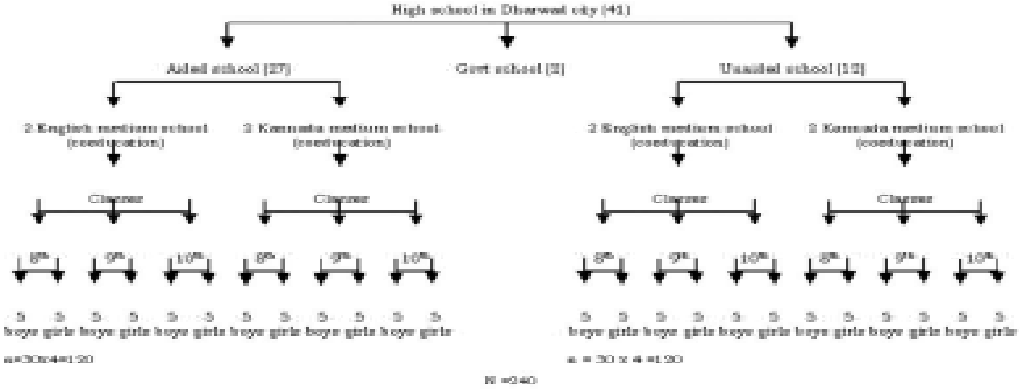


Fig. 1 Selection of the sample

Tools used for the study

1. Academic learning environment

1. Academic learning environment
a. School learning environment schedule
b. Home learning environment schedule
2. Academic achievement1.
3. Socio-economic status schedule a combination of items developed by Aaron *et al*. (1969), Venkataramaiah (1983) and Hauser (1994).

a. School learning environment schedule

A full pledged schedule was developed to study the school learning environment. The schedule consists of 130 items with 10 components, viz., goal orientation, study habits of students, school environment of the students, involvement of students in school activities, physical facilities in the school, teaching materials used by school, teacher-student interaction, equality, and method of teaching by schools and qualification of teacher. Each of the statement with a response as 'yes' or 'no' with score of 2 and 1 respectively. Spilt half method was used to test the reliability of the schedule. The reliability of the tool was = 0.65.

b. Home learning environment schedule

Home learning environment schedule was developed to know the home learning environment of students and its influence on academic achievement of high school students. The developed version has 37 items categorized into five components viz., parental encouragement and care, facilities provided at home, parental guidance and support, parenting and co-curricular activities. All statements are positive and score of 2 and 1 for 'yes' or 'no' responses are given respectively. Spilt half method was used to test the reliability of the schedule. The reliability of the tool was= 0.63.

Data collection was made by using pre-tested questionnaires. Prior permission of the principal or Headmaster's was taken from the aided coeducational high schools to conduct the study. Among each section 5 boys and 5 girls were selected randomly. After establishing a rapport with subjects, school learning environment schedule and home learning environment schedule was self administered on students. All the selected students from classes 8th to 10th were clubbed in one classroom and tool was administered on students. The students were instructed to give the responses. To obtain student's academic achievement, students previous year's final mark's (percentage) as well as the current year's last two semester's grades were considered.

Karl Pearson's product moment correlation coefficient analysis was used to measure the relationship between school learning environment, home learning environment, academic achievement and socio-economic status of the family of high school students. ANOVA (Analysis of variance) technique was used to test the effect of mother's occupation, size of the family and socio-economic status of the family on school

learning environment, home learning environment and also academic achievement of high school students

Results and Discussion

The results indicated that (Table.1), parent's education and father's occupation had positive relation with school learning environment. Parent's education had positive and significant influence on home learning environment and academic achievement of high school students. Supporting to this result, Poonam and Balda (2001) reported that parents educational status had positive correlation with the intelligence of children. Similarly, Cherian and Cherian (1995) reported that children of more educated parent were exposed to a more stimulating and richer environment than those of less educated. Grolnick (1997) found that better the education of mother better was the home environment because mother was better equipped with the skills in coaching and better was the capacity in involving in cognitive, social and intellectual activities of children.

Further, father's occupation was positively and significantly related to academic achievement of students. Similarly Gill and Sidhu (1988) reported that occupation of parents influenced the school performance of their children.

Table 2. shows that, the students whose mothers were working had significantly higher mean scores than labourers on school learning environment i.e., mothers who were working in professional jobs, provided significantly better school learning environment. While no such trend was observed in case of home learning environment and academic achievement.

The results also revealed that, there was non-significant difference in home learning environment, school learning environment and academic achievement between students of different family sizes though the low family size had higher mean scores. Size of the family were negatively related to home learning environment and academic achievement high school students. Supporting to this result, Cherian (1990) revealed that, negative relationship between family size of children and their academic achievement and Poonam and Balda (2001) reported that family size was negatively correlated with academic achievement and IQ of the children respectively. Increase in family size lead to decrease in academic achievement, which may be due to greater number of siblings sharing their physical environment, parental attention and reduction in opportunities for learning material at home.

The socio-economic status of the family was positively and significantly related to academic achievement of students. Supporting to this result, Vijaylaxmi and Natesan (1992) reported that socio-economic status influenced academic achievement. Mathur and Hundal (1972) revealed that, positive correlation between academic achievement and economic status of parents.

Results of the study revealed that, familial factors viz., parental education, occupation and socio-economic status of family also influenced the school learning environment, home learning environment and academic achievement of students. This implies that there is an utmost need to counsel and guide under privileged students and their parents and teachers to facilitate better learning process. Teachers and parents should be made aware of the existence of different cognitive styles in children and help the children to achieve better cognitive competence.

References

POONAM AND BALDA, S., 2001, Effect of familial factors on children's intelligence. *Indian Psychological Review*, 56 (1) : 8-11.

CHERIAN, V.J. AND CHERIAN, L.V., 1995, Relationship between parental occupation and academic achievement of Xhosa children from polygynous and monogamous families. *Journal of Family Welfare*, 41 : 49-52.

GROLNICK, W.S. AND SLOWIACZEK, M.L., 1997, Parent's involvement in children's schooling : A multidimensional conceptualization and motivational model. *Child Development*, 65 : 237-252.

GILL, J.K. AND SIDHU, H.S., 1988, Intelligence and academic achievement in the children
belonging to different socio-economic groups in rural Punjab. *Indian Psychological Review*, 33 (4) : 50-54.

CHERIAN, V.J., 1990, Family size and academic achievement of children. *Journal of Family Welfare*, 36 (4) : 56-59.

VIJAYALAXMI, O. AND NATESAN, H., 1992, Factors influencing academic achievement. *Research Highlights*, 2 : 62.

MATHUR, S.S. AND HUNDAL, B.S., 1972, School achievement and intelligence in relation to some socio-economic background factors. *Journal of Educational Psychology*, 30 (1) : 42-48.

Table 1. Influence of parent's education on school learning environment, home learning environment and academic achievement of students

Sl. No.	Socio-economic characteristics	School learning environment 'r'	Home learning environment 'r'	Academic achievement 'r'
1.	Father's education	0.10	0.12	0.19**
2.	Father's occupation	0.11	0.19**	0.20**
3.	Mother's education	0.12	0.20**	0.14*

* Significant at 0.05 per cent level
** Significant at 0.01 per cent level

Table 2. Comparison of mean scores of school learning environment of high school students by mother's occupation

Category	N	Mean	SD
1. House wife	186	234.02	15.69
2. Labourer	10	228.20	17.53
3. Working women	44	239.36	14.01
4. Total	240	234.76	15.60

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig	CD
Between groups	2	1464.28	232.14	3.06**	0.049	2.79
Within groups	237	56735.69	239.391			

** Significant at 0.01 per cent level

Home learning environment

Category	N	Mean	SD
1. House wife	186	67.82	3.87
2. Labourer	10	66.30	5.21
3. Working women	44	68.52	3.14
4. Total	240	67.88	3.82

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	43.87	21.93	1.51	0.22^{NS}
Within groups	237	3436.86	14.50		

NS – Non significant

Academic achievement

Category	N	Mean	SD
1. House wife	186	71.00	11.44
2. Labourer	10	63.80	13.13
3. Working women	44	73.63	12.23
4. Total	240	71.18	11.76

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	815.78	407.89	2.99	0.05^{NS}
Within groups	237	32242.77	136.04		

NS – Non significant

Table 3. Comparison of mean scores of school learning environment of high school students by size of the family

Category	N	Mean	SD
1-5	200	234.78	15.65
6-8	38	234.00	15.52
>8	2	247.00	14.14
Total	240	234.76	15.60

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	321.66	160.83	0.659	0.519
Within groups	237	57878.32	244.21		

Home learning environment

Category	N	Mean	SD
1-5	200	67.96	3.81
6-8	38	67.45	3.94
>8	2	68.50	2.12
Total	240	67.88	3.82

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	9.159	4.57	0.31	0.73^{NS}
Within groups	237	3471.57	14.64		

NS – Non significant.

Academic achievement

Category	N	Mean	SD
1-5	200	71.49	11.90
6-8	38	69.31	10.99
>8	2	76.00	12.72
Total	240	71.18	11.76

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	198.35	99.17	0.71	0.49^{NS}
Within groups	237	32860.20	138.65		

NS – Non significant.

Table 4.7a. Comparison of mean scores of school learning environment of high school students by SES

Category	N	Mean	SD
Low	88	230.33	15.33
Medium	71	237.51	15.90
High	81	237.16	14.71
Total	240	234.76	15.60

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig	CD
Between groups	2	2729.88	1364.94	5.83**	0.003	2.77
Within groups	237	55470.10	234.05			

** Significant at 0.01 per cent level

Home learning environment

Category	N	Mean	SD
Low	88	66.72	4.03
Medium	71	68.32	3.64
High	81	68.77	3.43
Total	240	67.88	3.82

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig	CD
Between groups	2	196.74	98.37	7.09**	0.001	0.68
Within groups	237	3283.99	13.85			

** Significant at 0.01 per cent level

Academic achievement

Category	N	Mean	SD
Low	88	69.42	10.81
Medium	71	71.98	12.05
High	81	72.40	12.38
Total	240	71.18	11.76

ANOVA

Source	d.f.	Sum of square	Mean square	F	Sig
Between groups	2	440.57	220.28	1.60	0.20^{NS}
Within groups	237	23617.98	137.62		

NS – Non significant

S.C. A. M:-3

ಮಹಿಳೆ : ಸಾಧನೆಯ ಸವಾಲುಗಳು ಮತ್ತು ಸಮಸ್ಯೆಗಳು

ಡಾ। ಲಕ್ಷ್ಮೀದೇವಿ ಎಲ್.
ಆಯ್ಕೆ ಶ್ರೇಣಿ ಉಪನ್ಯಾಸಕರು, ಫೀಲ್ಡ್ ಮಾರ್ಷಲ್ ಕೆ.ಎಂ.ಕಾರ್ಯಪ್ಪ ಕಾಲೇಜು, ಮಡಿಕೇರಿ, ಕೊಡಗು ೫೭೧ ೨೦೧

ಹೆಣ್ಣನ್ನು ಪ್ರಕೃತಿ–ಭೂಮಿ, ನದಿ–ನೀರು, ದೇವತೆ ಎಂದೆಲ್ಲ ಸಂಕೇತಿಸುವ ಸಮಾಜ, ಅವಳನ್ನು ಸಹನೆಯ ಸಾಕಾರ ಮೂರ್ತಿಯಾಗಿಯೂ, ಗುಣವತಿ–ಶೀಲವತಿಯಾಗಿಯೂ ಕಾಣಲು ಬಯಸುತ್ತದೆ. ಹೆಣ್ಣಿನ ಪಾವಿತ್ರ್ಯತೆಗೆ ಪ್ರಾಶಸ್ತ್ಯ ಕೊಡುವ ಕಾರಣಗಳಿಗಾಗಿ ಪುರಾಣಗಳ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಪೂಜ್ಯ ಸ್ಥಾನವನ್ನು ನೀಡಲಾಗಿದೆ. ಆದರೆ ಈ ಗೌರವ ಆದರದ ಹಿಂದೆ ತಾಳ್ಮೆ, ತ್ಯಾಗ, ಶೀಲ ಮೃದು ಮತ್ತು ಕೋಮಲತ್ವಗಳ ಅಳತೆಗೋಲಿನಲ್ಲಿಯೇ ಹಿಡಿದಿಡುವ ತಂತ್ರ ಅಡಗಿದೆ. ಆದ್ದರಿಂದಲೇ ಹೆಣ್ಣು ಅಂದ ತಕ್ಷಣ ಅಬಲೆ–ಮುಗ್ಧೆ ಎಂಬ ಅನಿಸಿಕೆಗಳು ಆರೋಪಿತವಾಗಿದೆ. ಧೈರ್ಯ ಮತ್ತು ದಿಟ್ಟತನಗಳಿರುವ ಹೆಣ್ಣು ಬಜಾರಿ–ಗಂಡುಬೀರಿ ಎನಿಸಿಕೊಳ್ಳುತ್ತಾಳೆ. ಸ್ತ್ರೀ–ಪುರುಷರಿಬ್ಬರೂ ಸೃಷ್ಟಿ ಹಾಗೂ ಸಮಾಜದ ಎರಡು ಕಣ್ಣುಗಳೆಂದರೆ ತಪ್ಪಾಗಲಾರದು. ಆದರೆ ಲಿಂಗ ಭೇದದ ಕಾರಣದಿಂದಾಗಿಯೇ ಪುರುಷನಿಗೆ ಸಿಗುವ ಪ್ರಾಶಸ್ತ್ಯ ಮಹಿಳೆಗೆ ಲಭಿಸುವುದಿಲ್ಲ. ಮಾತೃದೇವೋಭವ ಎಂಬ ಮರ್ಯಾದೆಯನ್ನು ಕೊಡುವ ಸಮಾಜ ಪುರುಷ ಪ್ರಧಾನವಾದ್ದರಿಂದ ಎಲ್ಲ ಹಂತಗಳಲ್ಲಿಯೂ ಹೆಣ್ಣಿನ್ನು ನಿಯಂತ್ರಿಸುವ ಶಕ್ತಿಯಾಗಿ ಪುರುಷನ ವ್ಯಕ್ತಿತ್ವವನ್ನು ರೂಪಿಸಿರುತ್ತದೆ.

ಒಂದು ಕಾಲದಲ್ಲಿ ಪ್ರಾಣಿ ಹಂತದಿಂದ ಬೇರ್ಪಟ್ಟು ಮನುಷ್ಯ ಪ್ರತ್ಯೇಕ ಸಮಾಜವನ್ನು ರೂಪಿಸಿಕೊಂಡಾಗಲೂ, ಗಂಡು–ಹೆಣ್ಣಿಂಬ ಭೇದವಿಲ್ಲದೆ ಶ್ರಮ ಹಾಗೂ ಸಾಮಾಜಿಕ ಸ್ಥಾನಮಾನಗಳಲ್ಲಿ ಸಮಾನತೆಯನ್ನು ಉಳಿಸಿಕೊಂಡಿದ್ದರು.ದುಡಿಮೆಯ ಪ್ರತಿಫಲ ಯಾರಿಗೆ ಸಲ್ಲಬೇಕು ಅಥವಾ ತಾನು ಸಂಪಾದಿಸಿದ ಆಸ್ತಿ ಯಾರಿಗಾಗಬೇಕು ? ಎಂಬ ಯೋಚನೆಗಳು ಎದುರಾದಾಗ ಗಂಡು ಹೆಣ್ಣಿನ್ನು ನಿಯಂತ್ರಿಸತೊಡಗಿದ. ತನ್ನೊಬ್ಬನ ಸಂತಾನವನ್ನು ಹೆರುವ ಖಾಸಗಿ ಆಸ್ತಿಯಾಗಿ ಹೆಣ್ಣನು ಹೆಂಡತಿಯಾಗಿ ಮಾಡಿಕೊಂಡ. ಅಂದಿನಿಂದ ನಿರ್ಬಂಧಗಳ ಕೋಟೆಯಲ್ಲಿ ಹೆಣ್ಣು ಕೊಳೆಯ ಬೇಕಾಯಿತು. ಪುರುಷನ ಪ್ರಗತಿಗೆ ಬೆಂಬಲವಾಗಿ ಸಹಕರಿಸುತ್ತಾ; ತೆರೆಮರೆಯ ಬೊಂಬೆಯಂತೆ ಅದೃಶ್ಯಶಕ್ತಿಯಾಗಿ ಪ್ರೊತ್ಸಾಹಿಸುತ್ತಾ; ಮನೆತನದ ಮರ್ಯಾದೆಗಾಗಿ ಶ್ರಮಿಸುತ್ತಾ ಸಾರ್ಥಕತೆಯು ಸಮಾಧಾನವನ್ನು ಪಡಬೇಕಾಯಿತು. ದುಡಿಮೆಗೆ ತಕ್ಕ ಪ್ರಾಶಸ್ತ್ಯ ದೊರೆಯದೆ ಅದು ಅಗಣ್ಯವೆನಿಸಿ ಅಲಕ್ಷ್ಯ ಕಂಡು ಬಂದಾಗ ಅವಳಲ್ಲಿ ಸಹಜವಾಗಿಯೇ ಕೀಳರಿಮೆಯುಂಟಾಗಿ ಇತಿಮಿತಿಗಳಲ್ಲಿ ಬದುಕುವಂತಾಯಿತು.

ಬಾಲಕರಿಲ್ಲದ ಬಾಲೇದು ಯಾತರ ಜನ್ಮ ಬಾಡಿಗಿಎತ್ತು ದುಡಿದಂಗ ಬಾಳೆಲೆಯ ಹಾಸ್ಯುಂಡು ಬೀಸಿ ಒಗೆದಂಗ ಎಂಬ ಜನಪದ ಗೀತೆಯ ಸಾಲುಗಳನ್ನ ಅವಲೋಕಿಸಿದರೆ ಪುತ್ರಸಂತಾನವನ್ನು ಪಡೆದರೆ ಮಾತ್ರವೇ ಹೆಣ್ಣಿಗೆ ಸಮಾಜದಲ್ಲಿ ಸ್ಥಾನ ಇಲ್ಲವೆಂದರೆ ಅವಳ ಆಸ್ಥಿ ಮತ್ತು ದುಡಿಮೆಗೆ ಪರರು ವಾರಸುದಾರರಾಗು– –ತ್ತಾರೆ, ಎಂಬ ಆತಂಕವಲ್ಲದೆ ಗಂಡು ಮಕ್ಕಳಿಂದ ವಂಶೋದ್ಧಾರ ಹಾಗೂ ಸದ್ಗತಿ ಸಾಧ್ಯವೆಂಬ ನಂಬಿಕೆ ಬೇರೂರಿರುವುದನ್ನು ಕಾಣುತ್ತೇವೆ.(ನ ಪುತ್ರ ಗತಿರ್ನಾಸ್ತಿ:) ಈ ಕಾರಣಗಳಿಂದಾಗಿಯೇ ಗಂಡು ಕುಟುಂಬದ ಆಸ್ತಿ ಎಂದು

ಪರಿಗಣಿತನಾಗುತ್ತಾನೆ. ಆದ್ದರಿಂದಲೇ ಸಂತಾನಾಪೇಕ್ಷೆಯಲ್ಲಿ ಗಂಡನ್ನು ಬಯಸುತ್ತಾರೆ. ಗರ್ಭಾವಸ್ಥೆಯಲ್ಲಿ ಹೆಣ್ಣೆಂಬ ಸುಳಿವು ಸಿಕ್ಕಿದರೇ ಸಾಕು ಭ್ರೂಣ ಹತ್ಯೆ ಸಂಭವಿಸಿ ಬಿಡುತ್ತದೆ. ಕೆಲವರು ಶಿಶು ಹತ್ಯೆಗೂ ಹೇಸುವುದಿಲ್ಲ. ಈಎರಡು ಗಂಡಾಂತರಗಳನ್ನು ದಾಟಿ ಮಗಳಾಗಿ ಬೆಳೆದ ಹೆಣ್ಣು ಅಣ್ಣ ತಮ್ಮಂದಿರೊಂದಿಗೆ ಬೆಳೆಯುತ್ತಿರುವಾಗಲೇ ತಾರತಮ್ಯದ ನೊಗಕ್ಕೆ ಕೊರಳನ್ನು ನೀಡಬೇಕಾಗಿರುತ್ತದೆ. ಆಟ–ಪಾಟ ಒಡಾಟಗಳಲ್ಲಿ ಅವಳಿಗೆ ಇತಿ–ಮಿತಿಯ ನಿರ್ಬಂಧಗಳಿರುತ್ತದೆ. ಮುಂದೆ ಮದುವೆಯಾಗಿ ಒಬ್ಬರ ಮನೆಗೆ ಹೋಗುವವಳು ಅಂತಲೇ ಅವಳನ್ನು ಕುಟುಂಬ ಹೊರೆಯಾಗಿ ನೋಡುತ್ತಾ ಇರುತ್ತದೆ. ಮದುವೆಯಾದರೆ ಮುಗೀತು ಕೊಟ್ಟ ಹೆಣ್ಣು ಕುಲಕ್ಕೆ ಹೊರತು ಅವಳ ಸಾವು–ನೋವಿಗೆ ತಾವು ಹೊಣೆಯಲ್ಲ. ಹಣೆ ಬರಹಕ್ಕೆ ಹೊಣೆ ಯಾರು ? ಎಂದು ಜಾರಿಕೊಳ್ಳುತ್ತಾರೆ.

ಗ್ರಾಮೀಣ ವಲಯದಲ್ಲಿ ಬಹುಪಾಲು ಹೆಣ್ಣುಮಕ್ಕಳಿಗೆ ವಿದ್ಯಾಭ್ಯಾಸ ಗಗನಕುಸುಮವಾದರೆ, ನಗರ ಪ್ರದೇಶಗಳಲ್ಲಿ ಓದಿಸುವಾಗಲೇ ಹೆದರಿಕೆ ಕಾಡುತ್ತಾ ಇರುತ್ತದೆ. ತುಂಬ ಓದಿದ ಮೇಲೆ ತಕ್ಕ ವರ ಸಿಗಬೇಕಲ್ಲ ಅವನಿಗೆಷ್ಟು ವರದಕ್ಷಣೆ ಕೊಡಬೇಕು ? ಎಂಬ ಲೆಕ್ಕಾಚಾರ ಶುರುವಾಗುತ್ತೆ. ಅದು ಸಾಧ್ಯವಿಲ್ಲವೆನ್ನುವಾಗ ಹೆಣ್ಣಿನ ವಿದ್ಯಾಭ್ಯಾಸಕ್ಕೆ ದೂರ ಪಾರ ಕಳಿಸಿ ಅವ್ಳಿಗೆ ಏನಾದ್ರೂ ಹೆಚ್ಚು ಕಮ್ಮಿ ಆದರೆ ಯಾರು ಮದುವೆ ಆಗ್ತಾರೆ ಎಂಬ ಹೆದರಿಕೆ ಒಂದೆಡೆ ಕಾಡಿದ್ರೆ; ಅವ್ಳು ಓದಿ ಉದ್ಧಾರ ಮಾಡೋದು (ನಮ್ಮನ್ನು) ಅಷ್ಟರಲ್ಲೇ ಇದೆ ಎಂಬ ಧೋರಣೆಯೂ ಬೆಳೆಯುತ್ತದೆ. ಮೂರು ತಿಂಗಳ ಮಗುವಿನಿಂದ ಹಡಿದು ಸಾಯುವ ಮುದುಕಿಯವರೆಗೂ ಲೈಂಗಿಕ ಅತ್ಯಾಚಾರಗಳು ಹೆಣಿನ ಪಾಲಿಗೆ ಶಾಪದ ಸರಮಾಲೆಗಳಾಗಿರುವುದನ್ನು ನಾವು ಗಮನಿಸುತ್ತಲೇ ಇದ್ದೇವೆ. (ಸತ್ತ ಶವವನ್ನು ಸಹ ಕೆಲವರು ಬಿಟ್ಟಿಲ್ಲ).

ಹೆಣ್ಣಿನ ಶೀಲದ ಪ್ರಶ್ನೆ,ಕುಟುಂಬದ ಮರ್ಯಾದೆ ಸಮಾಜದಲ್ಲಿ ಅವರ ಭವಿಷ್ಯ ಎಂಬ ಬಾಯಿಮಾತುಗಳಿಗೆ ಬಂಧಿಗಳಾಗುತೇವೇ ಮತ್ತೊಂದೆಡೆ ಪುರುಷನ ಅಂತಸ್ತು(status), ಅಧಿಕಾರ ಪ್ರಭಾವ (influence) ಗಳುಕೂಡ ನೀತಿಬಾಹಿರ ಪ್ರಕರಣಗಳನ್ನು ಮುಚ್ಚಿಹಾಕುತ್ತದೆ. ಸಮಾಜವೇ ಗಂಡನ್ನು ನಾಯಿ ಎಂದು ಹೆಣ್ಣಿನ್ನು ಮಡಿಕೆ ಎಂದೂ ರಹಸ್ಯವಾಗಿ ಸಂಕೇತಿಸಿ ಅತ್ಯಾಚಾರ ಪುರುಷನ ಸ್ವಭಾವಸಿದ್ದ ಗುಣವೆಂದು ರಿಯಾಯಿತಿ (consetion) ನೀಡುತ್ತದೆ. ಆದರೆ ಹೆಣ್ಣಿನ ಬಾಳನ್ನು ನತದೃಷ್ಟವೆಂದು ಸಮಾಜ ಬಾಹಿರವೆಂದು ಪರಿಗಣಿಸುತ್ತದೆ.

ಮದುವೆ ಎಂಬ ಮಾರುಕಟ್ಟೆಯಲ್ಲಿ ಮಾರಾಟದ ವಸ್ತುಗಳಾಗುವ ಗಂಡುಗಳಿಗೆ ಹೆಚ್ಚಿನ ವಿದ್ಯಾಭ್ಯಾಸ,ಉನ್ನತ ಉದ್ಯೋಗ, ವಿದೇಶವಾಸ ದಂತಹ ಅರ್ಹತೆಗಳು ವರದಕ್ಷಣೆಯ ನೆಲೆಯನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ. ಸುಖಾಪೇಕ್ಷಿಗಳಾದ ಹಣವಂತರಿಗೆ ತೊಂದರೆಯಲ್ಲವಾದರೂ ಮಧ್ಯಮ ವರ್ಗದ ಹೆಣ್ಣು ಮಕ್ಕಳಿಗೆ ಇದರಿಂದ ತೊಂದರೆ ಹೆಚ್ಚಾಗುತ್ತದೆ. ಪುರುಷನೆಂಬ ಕಾರಣಕ್ಕೆ; ಕನ್ಯಾಸೆರೆಯನ್ನು ಬಿಡಿಸುತ್ತಿದ್ದಾನೆಂಬ ನೆಪಕ್ಕೆ ವರದಕ್ಷಿಣೆಯನ್ನು ಎಲ್ಲ ವರ್ಗಗಳಲ್ಲೂ ಬಹುಪಾಲು ಪುರುಷರು ಜನ್ಮಸಿದ್ಧ ಹಕ್ಕು ಎಂದು ಅರ್ಥೈಸಿಕೊಂಡಿದ್ದಾರೆ. ಆದ್ದರಿಂದಲೇ ಈ ಪಿಡುಗು ಅರ್ಹತೆಗೆ ಅನುಗುಣವಾಗಿ ಅಂಟುಕೊಂಡಿದೆ. ಈ ಕಾರಣದಿಂದಲೇ ಬಹಳಷ್ಟು ಹೆಣ್ಣು ಮಕ್ಕಳು ಮದುವೆಯಾಗದೆ ಶಾಪಗ್ರಸ್ತರಂತೆ ಬಾಳಬೆಕಾಗುತ್ತದೆ. ಎಕೆಂದರೆ ಮದುವೆ ಮತ್ತು ತಾಯ್ತನಗಳೇ ಹೆಣ್ಣಿನ ಜೀವನದ ಪರಮೋಚ್ಚ ಸಾರ್ಥಕಗಳೆಂದು ಸಮಾಜ ಮೌಲೀಕರಿಸಿರುವುದರಿಂದ ಮದುವೆಯಾಗದ ಹೆಂಗಸರು ಅವಹೆಳನದಲ್ಲಿ ತಪ್ಪಿತಸ್ತರಂತೆ ತಲೆತಗ್ಗಿಸಿ ಬದುಕಬೇಕಾಗುತ್ತದೆ.

ಅತ್ತೆ–ಮಾವಗಂಜಿ ಸುತ್ತೇಳು ನೆರೆಗಂಜಿ ಮತ್ತೆ ಆಳುವ ದೊರೆಗಂಜಿ ಗಂಡನ ಮನೆಯಲ್ಲಿ ಬಂಧಿಯಾಗಿ ಬದುಕುವ ಗೃಹಿಣಿಯ ಬವಣೆ ಹೇಳತೀರದ್ದು. ಹೊಸ ಪರಿಸರ – ವಾತಾವರಣ, ಕುಟುಂಬ ವ್ಯವಸ್ಥೆ, ಆಹಾರ ಪದ್ಧತಿ ರೀತಿ–ನೀತಿ ಸಂಪ್ರದಾಯಗಳಿಗೆಲ್ಲಾ ತಾನೊಬ್ಬಳೇ ಹೊಂದಿಕೊಳ್ಳಬೇಕು. ಪ್ರೀತಿಯ ಹಂಚಿಕ್ಕೆ ಹೊಂದಾಣಿಕೆಗಳಿಂದಾಗಿ ಅತ್ತೆ ಹಾಗೂ ನಾದಿನಿಯರ ಈರ್ಷೆ, ಆರ್ಥಿಕಹೊಂದಾಣಿಕೆಗಳ ಹಾತೊರೆಯುವಿಕೆಯಿಂದ ಮಾವ–ಭಾವ ಮೈದುನರ ಅಸಹನೆ ; ದಾಂಪತ್ಯ ಜೀವನದ ಪ್ರೇಮ–ಕಾಮಗಳ ಆಗರವಾಗಿ ಗಂಡನ ವರ್ತನೆ ಸಂತಾನ–ನಿಯಂತ್ರಣ ಇತ್ಯಾದಿಗೆ ತಾನೊಬ್ಬಳೇ ಹೊಂದಿಕೊಳ್ಳಬೇಕಾಗುತ್ತದೆ. ಅತ್ತೆ ಮಾವನಿಂದ ಹಿಡಿದು ತನ್ನ ಗಂಡ ಮಕ್ಕಳು ಮರಿಯವರೆಗೆ ಸೇವೆ ಮಾಡಿ ಸಂತೈಸಿದರೂ ಸಾರ್ಥಕತೆಯ ಅವಕಾಶಗಳು ಕಡಿಮೆಯೆಂದೇ ಹೇಳಬೇಕು. ಬೆಲೆ ಇಲ್ಲದ ದುಡಿಮೆಯಲ್ಲೂ ಪತಿಯೇಪರದೈವವೆಂಬ ಆರಾಧನೆ : ದೀರ್ಘಸುಮಂಗಲೀಭವ (ಸಾಯುವವರೆಗೂ ಮುತ್ತೈದೆಯಾಗಿತೇ ಬಾಳಬೇಕೇಂಬ ಹಾರೈಕೆಗಳೆ ಹೆಣ್ಣನ್ನು ವಂಚಿಸುವ ಸೌಭಾಗ್ಯಗಳು. ಇಂತಹ ಅಸಹಾಯಕ ಬದುಕಿನಲ್ಲಿ ಹೆಣ್ಣಿನ ದೈನ್ಯತೆ – ಹೆಣ್ಣಾಗಿ ಹುಟ್ಟೋಕಿಂತ ಮಣ್ಣಾಗಿ, ಮಣ್ಣಿನಲ್ಲಿ ಮರವಾಗಿ ಬಂದು ಹೋಗುವವರಿಗೆ ನೆರವಾಗಿ ಸಾರ್ಥಕವನ್ನು ಪಡೆಯಬೇಕು ಎನಿಸುತ್ತದೆ.

ಉದ್ಯೋಗಸ್ಥ ಮಹಿಳೆ ಕೌಟುಂಬಿಕ ಹೋಂದಾಣಿಕೆಯೊಂದಿಗೆ ಹೊರಗೆ ದುಡಿಯುವ ಹೆಚ್ಚುವರಿ ಹೊಣೆಯನ್ನು ಹೊರಬೇಕಾಗುತ್ತದೆ. ದುಡಿಯುವ ಪರಿಸರದ ಶೋಷಣೆ ಹಲ್ಲೆ ಅತ್ಯಾಚಾರಗಳನ್ನು ದಿಟ್ಟತನದಿಂದ ಮೆಟ್ಟಬೇಕಾಗುತ್ತದೆ. ಈ ದಿಟ್ಟತನವೇ ಕಟ್ಟಿಕೋಂಡವನಿಗೆ ಕಣ್ಣುಕುಕ್ಕುವಂತಾಗಲೂಬಹುದು, ವೇತನವಿಡೀ ಗಂಡನ ಕೈಗೇರಿ ; ಖರ್ಚಿಗೆಂದು ಕೈಚಾಚಿ ನಿಲ್ಲುವ ಅನೇಕ ಮಡದಿಯರು ಬಾಡಿಗೆಎತ್ತಿನಂತೆ ಶ್ರಮಿಸುತ್ತಿರುವುದು ಶೋಚನೀಯ ಪ್ರತಿತಿಂಗಳಿನ ಸಂಬಳಕ್ಕಾಗಿಯೇ ಮದುವೆಯಾಗುವ ಪುರುಷರು ಹಲವರು ವರದಕ್ಷಣೆಗೆ ಪರ್ಯಾಯ ಯೋಜನೆ ಹಾಕಿಕೊಂಡಿದ್ದಾರೆ.

ಆಧುನಿಕ ತಂತ್ರದ ಗೃಹ ಬಳಕೆಯ ಸಲ್ಯಕರಣೆಗಳು ಮಹಿಳೆಯರ ಶ್ರಮವನ್ನು ಕಡಿಮೆ ಮಾಡಿ ಸೋಮಾರಿಗಳನ್ನಾಗಿ ಮಾಡಿವೆಯೆಂಬ ಆರೋಪವಿದೆ. ಆದರೆ ಸ್ವಶಕ್ತಿಯಾದ ಒಂದೆರಡು ಕೆಲಸಗಳನ್ನು ದಿನವಿಡೀ ನಿಭಾಯಿಸುತ್ತಿದ್ದುದರ ಬದಲು ಹತ್ತಾರು ಕೆಲಸಗಳನ್ನು ಒತ್ತಡಗಳೊಂದಿಗೆ ಪೂರೈಸಬೇಕಾಗಿರುವ ಅನಿವಾರ್ಯತೆಯನ್ನು ವರವೆಂದು ಕರೆಯಬೇಕೋ ಶಾಪವೆನ್ನಬೇಕೋ? ತಿಳಿಯದು.

ಬಾಲ್ಯವಿವಾಹ ಸತಿಪದ್ಧತಿಯಾಂತಹ ಅನಿಷ್ಟ ಸಂಪ್ರದಾಯಗಳು ತೊಲಗಿದವೆಂದು ಮಹಿಳೆಯರು ಸಮಧಾನ ಪಡುವುದರೊಂದಿಗೆ ವಿಧವಾವಿವಾಹ ಹಾಗೂ ಅಂತರ್‌ಜಾತಿಯ ವಿವಾಹಗಳಿಗೆ ಮಾನ್ಯತೆ ದೊರೆತಿದೆಯೆಂದು ಸಂತೋಷ ಪಡಬಹುದಾದರೂ ಸಂಚಿನಸುಳಿಗಳ ಬಗ್ಗೆ ಎಚ್ಚರ ತಪ್ಪಬಾರದಷ್ಟೇ. ವಿಧವೆಯ ಮೊದಲನೆಯ ಗಂಡನ ಆಸ್ತಿ, ವೇತನದ ಉಳಿಕ್ಕೆ ಎಲ್.ಐ.ಸಿ. ಪೆನ್‌ಷನ್ ಉದ್ಯೋಗ ಈ ಎಲ್ಲಾ ಲೆಕ್ಕಾಚಾರಗಳಿಗೆ ತಳಹಯಾಗಿರುತ್ತದೆ.

ವಿದ್ಯಾವಂತ ಯುವಕರಲ್ಲಿ ಅಂತರ್‌ಜಾತಿಯ ವಿವಾಹಗಳಿಗೆ ಸ್ಪಂದಿಸುವವರ ಬಹುಪಾಲು ಕೆಳಜಾತಿಯ ಯುವಕರೆಂಬುದು ಸ್ಪಷ್ಟ ಹಾಗು ಸ್ವಾಗತಾರ್ಹ ಆದರೆ ಈ ಕ್ರಾಂತಿಯಿಂದ ಎಲೋ ಒಂದೆಡೆ ಕೆಳಜಾತಿಯವರು ವಂಚಿತರಾಗುತ್ತಿರುವುದು ಗಮನಾರ್ಹ. ಜಾತಿ ಬಣ್ಣ–ಬೇಡಗುಗಳ ಶೋಷಣೆಗೆ ಬಲಿಯಾದ ಕೆಳಜಾತಿಯ ವಿದ್ಯಾವಂತ

ಹೆಣ್ಣುಗಳು ತಮ್ಮ ಜಾತಿಯ ಯುವಕರ ಸಾಧನೆಯನ್ನು ಪ್ರೋತ್ಸಾಹಿಸುತ್ತಾ ತಾವು ನಿಟ್ಟಿಸುರಿಟ್ಟು ನರಳುತ್ತಾರೆ.

ಹೆಣ್ಣು ವಂಶೋವಾನವಿಡೀ ಪುರುಷಾವಲಂಬಿಯಾಗಿರಬೇಕೆಂಬ ಧರ್ಮವನ್ನು ಸಾರಿದ ಮನುವನ್ನು ಶಪಿಸಬೇಕೋ ಹೆಣ್ಣಿನ ಸ್ವಾತಂತ್ರ್ಯ ಅಂದರೆ ಲೈಂಗಿಕ ಸ್ವೇಚ್ಛೆ ಎಂದು ಆಶಿಸುವ ಆಧುನಿಕ ವಿಶ್ವಾಮಿತ್ರರನ್ನು ಶ್ಲಾಘಿಸಬೇಕೋ? ವ್ಯವಸ್ಥೆಗಳಲ್ಲಿ ಬದಲಾವಣೆಗಳಾದರೂ ಹೆಣ್ಣಿನ ಅವಸ್ಥೆ ಮಾತ್ರ ತಟಸ್ಥವಾಗಿರೊದೇಕೆ? ಇದಕ್ಕೆ ನನ್ನಲ್ಲಿ ಉತ್ತರವಿಲ್ಲ. ಆರ್ಥಿಕ ಮತ್ತು ಸಾಮಾಜಿಕ ವಲಯಗಳ ಕಪಿಮುಷ್ಟಿಯಿಂದ ಹೆಣ್ಣು ಪಾರಾಗಬೇಕಿದೆ ಎಂದು ಹೇಳಬಹುದು.

ಮಹಿಳೆಯನ್ನು ಕುರಿತು ಗ್ರಹಿಕೆಗಳು – ಲೇಖನ ಸಾರ

ಮನುಷ್ಯ ಇತರ ಪ್ರಾಣಿಗಳಿಗಿಂತ ಭಿನ್ನ. ಪ್ರಾಣಿ ಸಮುಹಕ್ಕಿಂತ ಪ್ರತ್ಯೇಕವಾದ ಸಮಾಜದ ಸೃಷ್ಟಿ ಮಾನವನದು. ಪರಸ್ಪರ ಹೊಂದಾಣಿಕೆ ಸಹಕಾರಗಳಿಗನುಗುಣವಾಗಿ ಸಂಘಜೀವನವೇರ್ಪಟ್ಟಿದೆ. ಆರ್ಥಿಕ ಭದ್ರತೆ ಮತ್ತು ದೈಹಿಕ ಅವಶ್ಯಕತೆಗಳ ಹಿಡಿತಕ್ಕಾಗಿ ಸಂತಾನಕ್ಕೆ ಪಿತೃತ್ವದ ಅಧಿಕೃತೆಗಾಗಿ ಕುಟುಂಬ ವ್ಯವಸ್ಥೆ ರಚನೆಯಾಯಿತು. ದುಡಿಮೆ ಹಾಗೂ ಸಂತಾನದ ಬಗ್ಗೆ ಪುರುಷ ತನ್ನ ಹಕ್ಕನ್ನು ಸ್ಥಾಪಿಸಿದ ನಂತರ ಕುಟುಂಬದಲ್ಲಿ ಮಾತೃಪ್ರಾಧಾನ್ಯತೆ ಮರೆಯಾಯಿತು. ಪುರುಷನ ನಿಯಂತ್ರಣಕ್ಕೊಳಗಾಗಿ ಮಹಿಳೆ ಬದುಕತೊಡಗಿದಳು. ಚರಿತ್ರೆಯೋಂದಿಗೆ ಸಾಮಾಜಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಮತ್ತು ಆರ್ಥಕ ಸಂಬಂಧಗಳಲ್ಲಿ ಚಲನಶೀಲತೆ ಮುಂದುವರಿದಂತೆ ಹೆಣ್ಣಿನ ಇತಿ–ಮಿತಿಗಳು ಬಲವಾಗುತ್ತ–ಬದಲಾದಂತೆ ಅವಳಿಗೆ ಭದ್ರ ಚೌಕಟ್ಟನ್ನು ಹಾಕಿಕೊಟ್ಟರು.

ಜಾತಿ–ವರ್ಣ–ವರ್ಗಗಳು ತಲೆದೋರಿದಂತೆ ವಿಭಿನ್ನ ಸಂಪ್ರದಾಯಗಳು ಮತ್ತು ಧಾರ್ಮಿಕ ಅಸ್ತಿತ್ವಗಳು ಮಹಿಳೆಗೆ ಪೂರಕ–ಮಾರಕಗಳಾದವು. ಆಧುನಿಕ ಯುಗವೆಂದು ಕರೆಸಿಕೊಳ್ಳುವ ಇಂದಿನ ಸಮಾಜದಲ್ಲಿ ಮೊದಲಿನಿಂದಲೂ ಬಂದ ಶೋಷಣೆಯನ್ನು ಮಿರುತ್ತ–ಮುರಿಯುವ ಅಥವಾ ಮತ್ತೊಂದು ರೂಪದಲ್ಲಿ ಮುಂದುವರಿಸಿಕೊಂಡು ಹೋಗುವ ಸ್ಥಿತಿಗಳು ಏರ್ಪಟ್ಟಿವೆ. ವಿದ್ಯಾಭ್ಯಾಸ ಉದ್ಯೋಗ ಮತ್ತು ಆರ್ಥಿಕ ಭದ್ರತೆಯಂಬ ನೆಲೆಗಳಲ್ಲಿ ಮಹಿಳೆಗೆ ಅನುಕೂಲ ಮತ್ತು ಪ್ರತಿಕೂಲತೆಗಳೆರಡೂ ಲಭಿಸಿವೆ. ಇಲ್ಲಿ ಪುರುಷನ ದೃಷ್ಟಿಯಲ್ಲಿ ಮಹಿಳೆ ರೂಪಿತವಾಗುವುದು ಒಂದು ಅಂಶವಾದರೆ ಸ್ತ್ರೀಯ ಪ್ರತಿಕ್ರಿಯೆಯಲ್ಲೂ ಸ್ತ್ರೀಯ ಬಗ್ಗೆ ಇರುವ ಪರಿಕಲ್ಪನೆಗಳನ್ನು ಮತ್ತೊಂದು ಅಂಶವಾಗುತ್ತದೆ. ಇಂಥ ಬೆಳವಣಿಗೆಯಲ್ಲಿ ಹೆಣ್ಣಿನ ಬಗ್ಗೆ ಸಮಾಜ ಪ್ರತಿಕ್ರಿಯಸುವ ಬಗೆಗಳು ಮತ್ತು ಗ್ರಹಿಕೆಗಳನ್ನು ಬೆಳಕಿಗೆ ತರುವುದು ಅಧ್ಯಯನದ ಮೂಲಕ ಸಾಧ್ಯ. ಲಿಖಿತ ಹಾಗೂ ಮೂಖಿಕ ಮೂಲಗಳಿಂದ ಈ ಅಧ್ಯಯನ ನಡೆಸಬೇಕಾಗುತ್ತದೆ. ಅಲ್ಲದೆ ವಿಭಿನ್ನ ಧರ್ಮ–ಜಾತಿ–ವರ್ಗಗಳಿಗೆ ಸಂಬಂಧಿಸಿದಂತೆ ಮಹಿಳೆಯ ನೆಲೆಗಳನ್ನು ಕುರಿತು ಕ್ಷೇತ್ರಕಾರ್ಯವನ್ನು ಮಾಡಬೇಕಾಗುತ್ತದೆ. ಪ್ರಾದೇಶಿಕ ಭಾಷಿಕ ಧಾರ್ಮಿಕ ಸಾಮಾಜಿಕ ಸಾಂಸ್ಕೃತಿಕ ಆರ್ಥಿಕ ಹಾಗೂ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಮಹಿಳೆಯ ಮುನ್ನಡೆ ಹಿನ್ನಡೆಗಳಿಗೆ ಎದುರಾಗುವ ಸವಾಲುಗಳು ಹಾಗೂ ಸಮಸ್ಯೆಗಳ ಬಗ್ಗೆ ಗಂಭೀರವಾಗಿ ಪರಿಗಣಿಸಬೇಕಾಗುತ್ತದೆ.

S.C. A. M:-4

WOMEN EMPOWERMENT THROUGH ENTREPRENEURIAL ACTIVITIES OF SELF HELP GROUPS

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Introduction: Empowerment of women and gender equality recognized globally as a key element to achieve progress in all areas. It is one of the eight millennium goals to which world leaders agreed at the Millennium Summit held at New York in 2000 (Bhagyalakshmi, 2004). Empowerment in the context of women's development is a way of defining, challenging and overcoming barriers in a women's life and environment. It is an active, multidimensional process which should enable women to realize their full identity and power in all spheres of life.

Women constitute nearly half of the nation's population and play an important role in household and agricultural activities. But majority of the women living in rural areas are illiterates and are below poverty line having poor economic status. Besides this, in comparison to urban women, rural women have limited access to all kinds of resources such as education facilities, transportation, training facilities, credit, technology etc. Hence there is need to change their capacity to work, increase knowledge, enrich their skills and improve their economic status by providing them the required resources. According to FAO, the most disadvantaged section of society is the women; they are the 'silent majority' of the world's poor. Seventy percent of the world's poor are women. They face peculiar social, cultural, educational, political and allied probles. Studieshave shown that rural women help in producing up to 80 percent of food in developing countries, yet they are entitled to only a fraction of farm land, and access to just 10 percent of credit and five percent of extension advice (Agrawal,2003). In almost all the societies, women have less power than men, have less control over resources and receive lesser wages for their work. They remain as an 'invisible' work force.

The new millennium has thrown many challenges subjecting many nations to undergo transformation cutting across their established traditions and culture. New issues have to be addressed to effect social and economical progress of our nation. The most important one is women's empowerment through SHGs which is the pressing need of the day. Empowerment as a concept was introduced at the International Women's Conference in 1985 at Nairobi. Surekha and Rajamanamma (1999) described empowerment as an important process through which women are enabled to realize

their full identity and power in all spheres of life. Women development in recent years emphasized on providing equal opportunities to women by removing gender bias, empowering women and creating self-reliance among them. In the recent years empowerment of women has been recognized as a central issue in determining the status of women. The participation of women in SHGs has made a significant impact on their empowerment both in social and economic aspects.

Entrepreneurship development and income generating activities are a feasible solution for empowering women. It generates income and also provides flexible working hours according to the need of home makers. Economic independence is the need of the hour. Participation in income generating activities helps in the overall empowerment of women. Empowering women through education, ideas, consciousness, mobilization and participatory approach can enable them to take their own decisions, make them self-reliant and self-confident.

Material and Methods: The study was conducted in Bidar district in which self Help Groups were formed under District Cooperative bank were selected randomly for the purpose of study. Two Groups were selected randomly for the study. In this way eight villages were selected for the investigation.

Results and Discussion: Table.1 revealed that vermicelli making, Rava making and Chilli pounding were group entrepreneurial activities taken up by majority of the SHG members. The reason may be that were was more demand for these products i.e. good market and more profit. For this very reason the women were attracted to this enterprise. The machines were given free of cost to the beneficiaries and training was also provided on the use of these machines. Tailoring was also one of the income generating activities which was taken up by 15.8% of the respondents regularly and the reason may be that most of the women members are interested in tailoring because it is an enterprise which women can take up in their own house and work at their own pace of time. Another reason is that, most of the young girls after their high school or college prefer to get training on tailoring. This is most common in almost all the villages because within a short duration they can learn and can earn more money. Young girls can also stitch their own clothes and money saved can be considered as money earned. Papad making and Roti making are taken by 10% of the respondents regularly because these are individual activities and the respondents may be having the feeling that individual activities are more better than group to perform these activities. And also these activities are not time bound and whenever the women members are free they can take-up these activities. From Table 3, it can be pointed out that majority (96.7) of the SHG members utilized the profit earned on regular household expenditure, followed by children's education (51.7%). Since they are housewives, they have greater responsibility in running the family and looking after daily expenditure. The respondents also reported that there is smooth running of the family without any problem because they were utilizing the profit on regular household expenditure. Before earning any income, SHG member's contribution towards their childrens education was very poor and was taken care by their husband only. But after joining SHGs and taking up economic activity earnings allowed them to contribute on their childrens education. They also know the importance of education in life and they do not want their children to be like themselves i.e., illiterates. Hence, their contribution towards children education was good. Only 5.0% of the respondents reported that the profit earned sometimes was also given to their husbands. The reason is because if they do not give the money they were not allowed to join SHGs and the other reason is that they had faith over their husbands that the money was utilized for right purpose only. With respect to level of income of the SHG members Table 4 depicts that 95.00 per cent of the respondents reported their income level was increased only after joining the project.

Thus the study concludes that the project EWIA has become dias for women for their overall empowerment.

References:

Surekha Rao, K. and Rajamanamma, J., 1999, *Empowerment of rural women through DWCRA programmes.* National Conference on empowerment of women for National Development, Dhule, pp. 101-107.

BEVENAHALLI, A., 2005, A critical analysis of swa-shakti programme in Karnataka. *M.Sc. (Agri) Thesis,* University of Agricultural Sciences, Dharwad.

BHARATHAMMA, G.U., 2005, Empowerment of rural women through income generating activities in Gadag district of north Karnataka. *M.Sc. (Agri.) Thesis,* University of Agricultural Sciences, Dharwad

BHARATHI, R.A., 2005, Assessment of entrepreneurial activities promoted under NATP on empowerment of women in agriculture. *M. Sc. (Agri) Thesis,* University of Agricultural Sciences, Dharwad.

PRITA, 2001, A study on the performance of SHGs in Dharwad district. *M.Sc. (Agri.) Thesis,* University of Agricultural Sciences, Dharwad

RITU JAIN, KUSHAWAHA, R.K. AND SRIVASTAV, A.K., 2003, Socio-economic impact through self-help groups. *Yojana,* **47**(7): 11-12.

AGRAWAL,S.(2003). Technology Model for women's empowerment. *Kurukshetra*. May:18-28.

Table 1. Activities performed in the meeting

Sl. No	Activities	Rankings												Mean Ranking
		1		2		3		4		5		6		
		F	%	F	%	F	%	F	%	F	%	F	%	
1	Discussing family problems	97	80.8	22	18.3	1	0.8	-	-	-	-	-	-	1.20
2	Discussions on savings	8	6.7	57	14.5	9	7.5	13	25.0	16	13.3	-	-	2.91
3	Exchange of loans	1	0.8	7	5.8	84	70.0	26	21.7	2	1.7	-	-	3.18
4	Discussing problems on enterprises	-	-	31	26.8	25	20.8	46	38.3	18	15.0	-	-	3.43
5	Discussing problems on Agricultural & allied areas	-	-	1	0.8	1	0.8	18	15.0	84	70.0	16	13.3	4.94
6	Singing Bhajans	16	13.3	-	-	-	-	-	-	-	-	104	86.7	5.33

Table 2. Entrepreneurial Activities performed by SHG members

S.No	Entrepreneurial Activities	Respondents					
		Regularly		Occasionally		Never	
		F	%	F	%	F	%
1	Vermicelli making	48	40.0	3	2.5	69	57.5
2	Rava making	25	20.8	2	1.7	93	77.5
3	Chilli Pounding	20	16.7	-	-	100	83.3
4	Tailoring	19	15.8	1	0.8	100	83.3
5	Papad Making	12	10.0	1	0.8	107	89.2
6	Roti making	11	9.2	2	1.7	107	89.2
7	Bakery Unit	3	2.5	-	-	117	97.5
8	Grocery shop	5	4.2	-	-	115	95.8
9	Kitchen gardening	2	1.7	-	-	118	98.3
10	Bangles Selling	2	1.7	-	-	118	98.3
11	Vegetable vending	2	1.7	-	-	118	98.3
12	Goat rearing	1	0.8	-	-	119	99.2

Table.3 Activities Undertaken by SHG'S members

Sl.No	Activities	Successful SHG (n=56)		Unsuccessful SHG (n=56)		Total (n=112)	
		F	%	F	F	%	F
I	**Farm Activities**						
	Agriculture	27	48.21	22	39.28	49	43.75
	Dairy	25	44.64	15	26.79	40	35.71
	Sheep rearing	14	25.00	9	16.07	23	20.53
	Goat rearing	10	17.86	8	14.29	18	16.07
II	**Non Farm Activities**						
	Pickle making	1	1.79	-	-	1	0.89
	Papad making	1	1.79	-	-	1	0.89
	Bakery items	1	1.79	-	-	1	0.89
	Roti making	4	7.14-	-	-	4	3.57
	Chutney making	1	1.79	-	-	1	0.89
	Vermicelli making	3	5.36	-	-	3	2.68
	Masala powder	1	1.79	-	-	1	0.89
	Flour milling	1	1.79	-	-	1	0.89
	Broom stick making	1	1.79	-	-	1	0.89
	Tailoring	4	7.14	1	1.79	5	4.46

	Bangle sale	2	3.57	1	1.79	3	2.68
	Agarbatti	4	7.14	1	1.79	5	4.46
	Soap/detergent	3	5.36	-	-	3	2.68
	Petty shop	3	5.36	1	1.79	4	3.57
	Vegetable vending	1	1.79	-	-	1	0.89
	Beauty parlour	1	3.57	-	-	1	0.89
	Flower selling	2	1.79	-	-	2	1.79
	Doll making	1	1.79	-	-	1	0.89
	Book shop	1	1.79	-	-	1	0.89
	STD shop	1	1.79	-	-	1	0.89
	Cane juice shop	1	1.79	-	-	1	0.89
	Bun sale	-	-	1	1.79	1	0.89
III	**Not undertaken activity**	2	3.57	10	17.86	12	10.71

Table 4. Utilization of profit earned by SHG members.

Sl.No	Item	Respondents	
		Frequency	Percentage
1	Regular House hold expenditure	116	96.7
2	Education of children	62	51.7
3	Health purpose	29	24.2
4	Celebrating festivals	27	22.5
5	Consumption of nutritious foods	23	19.2
6	Marriage of children	20	16.6
7	Renovation of House	7	5.8
8	Giving it to Husband	6	5.0

S.C. A. M:-5

STUDY ON FAMILY VIOLENCE AND ITS EFFECT ON MATERNAL HEALTH OF MARRIED ADOLESCENT GIRLS

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Introduction: Family violence is the most pervasive yet least recognized human rights abuse. It is also a profound health problem, damaging the physical health of the victims and eroding their self-esteem. Violence against women/adolescent girls refers to any type of harmful behaviour directed at women/ adolescent girls. The effects of violence can be devastating to the victim's reproductive health as well as to other aspects of physical and mental well being. Women/married adolescent girls with a history of physical abuse or any other type of gender violence are also at increased risk for unintended pregnancy, adverse pregnancy outcomes and sexually transmitted infections.

Family violence has been defined, as any act occurring between two individuals who live or have lived together that is perceived to be intended to cause physical or psychological harm. The UN special report on Violence against women defines domestic violence as "violence that occurs within the private sphere, generally between individuals who are related through intimacy, blood or law" (UNIFEM, 2001). Domestic violence encompasses, but is not limited to "physical, sexual and psychological violence occurring in the family, including battering, sexual abuse of female children in the household, dowry related violence, non-spousal violence and violence related to exploitation" (Coomaraswamy, 1996). Violence can also be perpetuated by creating complete dependence of the women on the male head of the family for meeting personal needs such as purchase of basic requirements like food and clothing, mobility, and for all dealings in the public sphere.

According to UNICEF (2000), 20 to 50% of the women of 15-49 years have experienced domestic violence. Family/ domestic violence in different forms such as physical cruelty, mental cruelty, sex selective abortion, battering, female infanticide, differential food and medical care for girls, child marriage, sexual harassment, dowry abuse so on are very common in Indian families. All these practices does affect the physical, mental wellbeing and maternal health of the young married women/ adolescent girls. Hence the present investigation has been taken up with the objectives.

1. To study the prevalence, types and reasons for family violence.
2. Relation between physical violence experienced and bad habits of their husband.
3. Relation between family violence and maternity problems of married adolescent girls.

Methodology: The present study was conducted during 2004-05 in Ranebennur taluk of Haveri district. The study comprised of 150 samples. Pre tested interview method was used for gathering information. Out of 106 villages, the samples were selected from 14 villages by lottery method. Multistage technique was used to collect the samples. In each selected villages the total number of married adolescent from low income group families in their reproductive years who are staying with their husband were listed to form sampling frame. Thus a total of 150 adolescents were selected as the final sample. In-depth interview method was used for gathering information.

Results and Discussion: In the present study the prevalence of violence was found to be extremely high (80.0%). Respondents suffered either mental cruelty or physical cruelty or both. Only 20 per cent of them did not face any type of cruelty/violence (Table 1). The results of Kilaru et al's (2002) study was consistent with present study, they revealed that, 10 to 69% of the women and adolescent girls had experienced physical violence from a male partners.

When the prevalence of mental violence faced by the respondents was closely examined, it was found that, more than half (56.75%) of the respondents reported one or more type of mental violence. Mothers-in-law were reported to be finding faults with respondents in whatever work they did (31.8%). This was the major type of mental cruelty reported by the respondents. Respondents worried regarding running the family as their husband was a drunkard (23.5%). This worry was due to the heavy responsibilities, respondents shouldered to earn money for running the family. Other forms of violence reported by the respondents were ridiculing / scolding by mother-in-law whenever they tried to take rest. They were also scolded whenever they miscarried. Respondents felt bad because they were not allowed to express their opinions and decisions. Thus being ruled by despotic mothers-in-law was the main reason for them to adjust to life at in-laws family (Table 2). However early marriages pushed the adolescent girls in difficulties. Young married women were dependent on their husbands for social status. They had limited contact with their marital home. During the early days of marriage, newly married and their husbands may have been under the authority of the husband's parents and other older relatives and thus had a limited autonomy to make decisions about their personal lives. The similar opinion was explained by the respondent which was quoted by the author (George 2003).

Other form of violence found was physical violence. When the prevalence and reasons for such violence was examined, it was found from the table 3 that, half (52%) of the respondents faced physical violence. Among them 51.2 per cent of respondents battered by their mothers-in-law and more than half (71.7%) of them were battered by their husband for various reasons. Out of 51.2 per cent of the respondents, 29.5 per cent of them battered by their in-laws for their perception that respondent was not giving enough respect to them followed by (21.7%) those who battered by their mothers-in-laws for not bringing enough dowry. Similarly out of 71.7 per cent of the respondents, 39.7 per cent of them battered by their husband for bringing less dowry and 32.0 per cent were battered for not having a male child. The denial of freedom to seek medical treatment as their husband and mother-in-laws had no time to take them to health centre (53.8%), followed by those who reported that, their mothers-in-law and husband perceived that the treatment was considered to be costly (38.5%) and their husband did not like to seek treatment often (35.9%). The reason could be that all the respondents of the present study were young, married at an early age and had no freedom to discuss their health problems with their husband and in-laws. In addition, respondents did not have enough knowledge about the pregnancy and delivery problems. All these factors made them to suffer quietly. CEDPA's 2001, study found that, among married young women aged 15-19 years, decision making and freedom of movement is very low with only 38.6 percent involved in decision making about their own health. The condition of the present study is also similar to this study.

The relation between physical violence experienced and bad habits of their husband were presented in the table 4. Results found that, the bad habit of playing cards was found to be negatively and significantly correlated with the physical violence experienced by the respondents. Similarly the bad habit of taking wife's earning without her knowledge was found to be positively significantly correlated with the physical violence. No studies were available regarding relation between physical violence experienced and bad habits of their husband. Hence no comparative discussion could be presented here.

Another kind of mental cruelty/violence suffered by the respondents was that, they were prevented from visiting their parents whenever they wanted and even during festivals or marriages or functions. When the reasons for such restrictions were examined, it was found that, more than half (63.3%) of the respondents were restricted mainly by their mothers-in-law. The major excuse given by the mothers-in-law as reported by the respondents that, if she was allowed to visit her parents there would be none to attend the household

chores (45.3%) during festivals. However respondents were allowed only once in a year (15.8%) to visit their parents. Some of their mothers-in-law demanded that, parents themselves should come and visit their daughters instead of their daughter-in-law going to visit their parents (15.8%). Few of the respondents reported that they should return on the day and date specified by their in-laws. These respondents reported that, their mothers in law restricted their visit to parents as they brought less dowry (Table 5).

Table 6 depicts the relation between family violence and maternity problems of respondents. It could be seen from the same table that, physical violence and mental violence was found to be positively significant with perinatal problems among respondents and only the physical violence was found to be significant with postnatal problems of respondents at 5 % level. However, the problems faced by respondents during prenatal period were found to be non-significant with type of violence. Similarly the problems faced by respondents during post natal period were found to be non-significant with mental violence faced by them.

Conclusion: No educational programme for adolescent girls really succeeds unless it is comprehensive. To improve the health it is necessary for any intervention programme to involve adolescent girls, their parents, if married their in-laws, the young men who married them and the community. In the present study the prevalence of domestic violence was found to be high. Hence there is a need for an awareness programme for in-laws and young men regarding the damaging effect of domestic violence on mental and physical health of married adolescent girl and her progeny.

References:

1. CENTRE FOR DEVELOPMENT AND PRODUCTION ACTIVITIES, 2001, Adolescent girls in India choose a better future ; an impact assessment. The Centre for Development and Population Activities, pp. 1-21.

2. COOMARASWAMY, 1996, Report of the Special Rapporteur on violence against women: its causes and consequences. United Nations. Economic and Social Council.

3. GEORGE ANNIE, 2003, Newly married adolescent women : experiences from case studies in urban India, in Bott, S. et al. (Eds.), Adolescent sexual and reproductive health : evidence and programme implications for South Asia. World Health Organisation, Geneva

4. KILARU, A., BROOKES, M., GANAPATHY, S. AND MATTHEWS, Z., 2002, Maternal health care in South India: do adolescents seek more care than older women? Opportunities and Choices Working Papers, zm2@socsci.soton.ac.uls. 8: 1-17.

5. POPULATION REPORTS, 2000, ending violence against women. 27: 4.

UNIFEM, Biennial Report (2001) www.unifem.org.

Table 1: Prevalence of violence among respondents

N=150

	Number of respondents	Frequency	Percentage
I.	Reporting violence	120	80.0
	Not reporting violence	30	20.0
II.	Respondents who		
	suffered mental cruelty*	45	36.6
	Respondents who suffered physical cruelty*	41	33.3
	Respondents who suffered both mental and physical cruelty*	38	30.9

Note: * Respondents reported more than one type of violence

Table 2: Types of mental violence faced by respondents

N=85

		Frequency	Percentage
I.	Number of respondents reporting	85	56.75
II.	Types of mental cruelty		
1.	In-laws finding faults in her work	27	31.8
2.	Lack of freedom of expressing	22	25.9
3.	Worry of running the family due to drunkard husband	20	23.5
4.	Scolded/ridiculed for taking rest during pregnancy	15	17.6
5.	Should obey the mother -in-laws despotic orders	13	15.3
6.	Scolding because she had abortion	13	15.3
7.	Get hurt due to bad . habits of husband	12	14.1

Note: Respondents reported more than one problem.

Table 3: Physical violence faced by respondents and reported reasons

N=78

Sl.No.		Frequency	Percentage	
I.	No. of respondents who faced physical violence	78	52.0	
	No. of respondents who did not report	72	48.00	
II.	**Type of violence and reasons reported**			
	Battered by mothers-in-law			
	1. Not bringing enough dowry	17	21.7	
	2. Perception that respondent is not giving enough respect to elders	23	29.5	51.2%
	Battered by husband			
	1. Bringing less dowry	31	39.7	
	2. Not having a male child	25	32.0	71.7%
	Lack of freedom to seek medical treatment			
	1. Mothers-in-law and husband did not get time to take her for treatment	42	53.8	
	2. Treatment considered to be costly by mothers-in-law and husband	30	38.5	
	3. Husband did not like to seek treatment often	28	35.9	
	4. No permission is granted till the health problem become severe	26	33.3	

Note: Respondents reported more than one reason

Table 4: Relation between physical violence experienced and bad habits of their husband

Bad habits of the respondents husband	r' values physical violence experienced by the respondents
Drinking	0.074 NS
Smoking	-0.078NS
Playing cards	-0.184*
Taking wife's earning without her knowledge	0.167*

Note: * Significant at 0.05 level
NS - Not Significant

Table 6: Relation between family violence and maternity problems of respondents

Type of violence	'r' values		
	Prenatal Period	Perinatal Period	Postnatal Period
Physical violence	0.115 NS	0.166*	0.167*
Mental violence	0.075 NS	0.168*	0.143NS

Note: * Significant at 0.05 level
NS - Not Significant

Table 5: Respondent's reasons regarding restrictions to visit their parents

N = 95

Sl. No.	Restriction on visiting parents*	Frequency	Percentage
I.	No. of respondents who were free to visit their parents	55	36.7
	No. of respondents who faced restrictions to visit their parents	95	63.3
	Total	150	100.0
II.	Types of restrictions **		
1.	Not allowed during festival due to lot of work	43	45.3
2.	Have to visit parents only when in-laws permit which was rare	25	26.3
3.	Allowed only once in a year to visit parents	15	15.8
4.	In-laws say "let your parents only visit you if they want	15	15.8
5.	Told to return on the day and date specified by in-laws	14	14.7
6.	In-laws restrict since she brought less dowry	14	14.7

Note: * Restrictions referred to visits during festivals/marriages/functions
** Respondents gave more than one response.
*** 133 respondents lived with their in-laws

THEME 10

PSYCHO-SPIRITUAL & PHILOSOPHICAL SCIENCES (PATANJALIYAM)

Sl No	Title of the Paper	Author's	Page No
1	CREATION OF THE UNIVERSE -STUDY OF CONSCIOUSNESS AND COSMOS	Dr. D. S. Anaveker	214-220
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P.S.P.S:-1

CREATION OF THE UNIVERSE -STUDY OF CONSCIOUSNESS AND COSMOS

Dr. D. S. Anaveker
"Manas" Kodibag,Karwar- 581303.

In Cosmology, theories abound. So also in the field of other sciences! But if the case is put up in any other field that doesn't use their idiom, they are discarded without a second thought. It is particularly sad for us who's history of scientific approach to everything in life goes back to many millennia. It is not just that we have forgotten it. The fact is that we are totally blinded by the west. After 60 years, we are still their slaves. We must earn out intellectual freedom soon. Otherwise we will loose even our ancient heritage to them.

Newton's law assumes that all matter possesses innate mass-m in the equation – F = ma. To solve the problem of an inertia and gravity, scientists have come up with a new hypothesis of zero point field. This is in the face of the fact that mass is hypothetical like Dark Matter, Big Bang, Black Holes and Dark Energy or Vacuum Energy Density - an illusion

Vedas, Patanjali and J. Krishnamurti go into the fundamental truth about the cosmic energy and existence of universe to give a deeper meaning to the physical facts. On the basis of it, all the problems in these intellectual theories can be faced squarely. But the truths are not theories. One can go into it and solve these problems with one's own clarity. One doesn't admire the scientists the less for it, but they should not claim their own methods to be the only tools to come upon these truths.

Perhaps they have to leave them behind and follow this science of "No Mind" for the proof.

At Cern in Switzerland, the experiments carried out to solve the mystery of creation have failed. While trying to solve this riddle, many more questions have come up due to various theories like those of and to solve them, still more other theories. Due to the lack of awareness of our own knowledge, our scientists and younger generation is also getting caught up in this web of materialism.

Look carefully at the laws of relativity and Einstein's famous equation and Psycho-spiritual part of Patanjaliam,our ancient Upanishadic Rishis or spiritual Gurus and J. Krishnamurti. When observer and observed are one, what remains is pure or inertial observation. This state comes to Yogis when their minds are completely free. In this state, there are no divisions of space and time. The space shrinks to a point and what remains of time is the present moment. In a state of Samadhi, there is a subtle understanding about very subtle things. Yogi travels till the time of primordial universe and beyond, before the creation starts. It is a realm of unknown beyond thought. The whole universe is represented by a dot, a point. Such pictures appear to Yogis in meditation. But they do not know their meaning. They are termed as Logos of creation. The free mind can travel even faster that the speed of light. It can go beyond where light cannot reach. It reaches the primordial universe instantaneously. This empirical knowledge can be explained in scientific idiom if the yogi has such an inclination. So it can solve the problems created by the scientists while trying to explain Big- Bang. There will be no need to assume different types of hypothetical particles of dark matter and dark energy.

In my paper on the "Creation of Infinite Universes" that was presented in 2nd world conference of Ved-Vijnan held in Banaras in Feb/2007, I have mentioned our ancient seers describing the reality underlying the creation and matrix giving rise to existence looking like

"The sea on fire" and "The ocean of nectar" which creates infinite universes.

I think we should look into it seriously in order to solve these problems ourselves. With scientific analysis of the visions of creations in Samadhi seen by yogis, we can reach the Theory of Everything based on the knowledge of the inner workings of the Universe. It is time we go beyond Einstein and Newton, from intellectual field to the field beyond human intelligence and beyond mind which is the wisdom of Super-Intelligence of Nature.

CREATION of the UNIVERSE

The universe till date is augmented in the frame of knowledge with a dogma. On the whole it is a flip-flop between argument and understanding. There are two celebrated thoughts, one that of science, in particular physics and other is of The Vedas. It is the same world understood or interpreted in two different frames of references. Physics deals with creation by using concepts like matter, energy and their medley with considerable rigidity. It brings theories in focus under the heads of Macro, Maso and Micro with support of a language called 'Mathematics'. On the other hand, the Vedas probe creation through unique entity called 'I', the consciousness

In a way, the finer tourniquets of physics like quantum mechanics and Vedas do show a common point of intersection - 'The Observer'. Observer and observable are the concepts that are discussed to lengths in theoretical physics giving mathematical interpretations like 'Real nature of Hamiltonian-the energy'… and so on. The conflict prevails. While Vedas start with observer and observable arguments and surpass them as it comes to an end- Vedanta, the end of knowledge. Here the observer becomes inertial, so what remains is the pure observation. These singularities of science bending towards metaphysics is deeply probed here.

The empirical knowledge of metaphysics with the application of scientific knowledge of laws of physics to it may lead us to a better understanding of The Creation of universe. The relationship between the two holds the key to the mystery of creation

Volumes are written on the study of consciousness from Patanjali to J. Krishnamurti

We are forgetting great thinkers who are telling the timeless truth. The truth of what they have written can be tested by anyone, all by oneself. The purification of mind through awareness of thoughts leads to the activation of Kundalim, the yogic power. Asking the forgiveness of my late guru J. Krishnamurti, I will still say that I have followed him for about forty-five years, though he refused to accept any followers. Based on this study of consciousness, I am giving you a proof for what I am talking at the very beginning-

PHOTOGRAPHS.

Some people close to me were struck suddenly one day when they noticed a change on my forehead. Photographs of my forehead were taken regularly after that. I am showing you some of them. So out of curiosity, we studied more about Kundalini charkas. Everything is explained very scientifically in Patanjali Yoga. But I would like the brain specialists to give their opinions regarding photographs of these phenomena. They cannot deny the reality that is presented before them. So they are trying to find out any physiological or anatomical base for it in the brain if there is any. I have got my eyes checked by an ophthalmologist to rule out any known physiological malady and from skin specialist to rule out any dysfunctions of skin over my forehead. I am presenting the visions of creation that I have got during the last 12 years. Based on them, I am making certain statements to present the Theory of Everything.

PROCESS OF CREATION

The process of creation seems to be the same in all fields of existence, no matter of what proportion, dimension or on which plane of existence! This is a fact in nature every where, in trees, animals and humans. Creation starts from one cell or one seed or one particle of matter. There are innumerable ova ready for fertilization. There are innumerable sperms capable of causing fertilization. But only one pair is able to combine together to start creation. Thousands of seeds are ready to form a tree and they die out except the lucky ones that get a chance for re-creation. This process goes on continuously in all the species. So also in the creation of the universe, only one-minute chaitanya-kan or light particle forms a disc of cosmos by receiving energy in its center. It expands and creates its own space. But this process is not limited to one event. Beyond matter, the pure energy exists in the space, repeating it. This one may call as the theory of creation**.**

1. The Chaitanya- kan or particles are born in void on 7th plane. These particles are in motion always. Cosmos has tremendous speed right from its primordial stage. One of the particle has both matter and energy in its womb which is seen to be in tremendous speed form the stage of primordial universe. It comes to the 6th plane which is space.

The primordial universe has a capsule surrounded by space and another capsule outside this space. The energy is provided from this space for further creations in the cosmos. The speed of cosmos and of its further creations is spiral and around its own axis. This speed is present at the most subtle level in each further creation including human beings belonging to the biological creation. These two forces namely the initial force of the primordial cosmos and its anti-force are represented in the most subtle forms of matter like atom, electrons and protons. This spiral speed is also felt at a very subtle level in awakening of Kundalini. There is another force that we call gravitational force is in reaction to this original inherent speed, an anti-force because creation is maintained on duality. It keeps universe going.

2. The matter gets dissolved in the void. Black holes are not the store-houses of dense matter. They are voids. Material rules of physics cannot be applied to them. Everything dissolves in a void and is born in a void. First the matter and then light are born and then they follow the material rules. Cosmos has a void at the center which goes on in further creations in the cosmos. That means in galaxies and stars etc. These pure voids are present in the space of cosmos besides cosmic dust. Many cosmic creations are going on off and on, at random from the energy source into these voids.

3. With whirl-wind, the bright flame appearing in the black void breaks into fire-balls that develop into galaxies and stars with a spiral speed around their axis. This process goes on over millennia. They become solidified and slowly cool down. We call them planets. A biological creation occurs on some of them after that. In the process of creation, sound appears at the stage of biological creation. It is heard only on the 3rd plane where biological creation is active.

Gravitational Force:-

Gravitational force is an anti-force, in reaction to the force from the 7th plane by element of wind of creation. Creation is the play of five original elements of nature

1. Void - Energy originates in the space void and enters the space with force.
2. Speed of Wind with which energy is driven into space.
3. Light + Heat
4. Water
5. Earth.

In space, energy and matter form Brahmand or an Egg of cosmos or the Primordial Universe from which universe is born. With original wind force, the universe starts growing or expanding. The opposing force to it keeps the creation together. Because it is a weaker force, the universe goes on expanding. In creation, there always is a duality. . From Pure Energy, Matter is formed. From one chaitanya particle, two are created.. This starts Creation. Two opposite units is the basis of the whole creation. i.e.

male and female. This duality keeps the creation going.

The Fountainhead of the 7th plane which is in fact Void sends energy particles with tremendous force in the space which is the 6th plane. What we call the Gravitational force is the reactionary force to the original speed of the primordial universe, an anti-force. It is not an original force secondary to the mass.

So all matter is the creation of energy. The smallest or the basic energy particle of primordial universe represents the whole energy in the universe. In this field, Einstein's and Newton's laws are not applicable. From the smallest to the largest, every part and particle of creation tends to dissolve into void after living its life. It comes out of O and it goes back into O. All matter finally turns into energy before disappearing into O. So this is the ultimate reality which is Nothingness or Void or O or Brahman or God.

After emptying of the mind of its contents, through the void in one's consciousness, one can realize the original void. One gets an understanding through subtle perception that this is the source of all creation, the cosmic energy itself. In nature, it is creation of universe. Perhaps, we can call it The Creator or God. Every living being tries to evolve to reach this state. This is the meaning and purpose of life. Even primordial universe shows the same fact. After being born with its own tremendous speed from void, it tends to spread out and moves ahead. But since its inherent tendency is to go back to its original source, all things are pulled back towards its center and dissolve in void. The manifestation of this phenomenon is this gravitational force.

Physics cannot reach where matter is absent. So this field is beyond the scope of intelligence of the brain. It is beyond physics and mathematics. Physics has reached the event horizon and thinks it may solve the problems of gravity and inertia. But both these forces were existing beyond that line from where it became perceptible. This is the primary force of the primordial universe or vacuum energy force which expands it and force of gravity is secondary to it which holds it together. In the subtle stage of the universe, they are also subtle forces like sub-atomic forces of protons and electrons in an atom and magnetic and electrical forces outside the atoms. On large proportions, it is cosmic energy in chaitanyakan or dark energy or vacuum energy and the gravitational force the measure of which is mass though it is not secondary to mass.

Unified Theory

Forces involved: -

The universe was not born with a big bang. Had it been so, the similar type of creation would be seen in other creations like galaxies, stars etc. There are examples of destruction of stars with explosions, but not creation. On the other hand, galaxies are seen in different stages of creation at the peripheries of huge voids. This substantiates our claim

1. Gravitational force: —

If we consider the fact that the universe was born with tremendous force with a push of the wind element,(We can call it push of God) then we will have to accept that the gravitational force is in reaction to it – an anti-force. This force became apparent at the very beginning of creation. It developed from subtle sub-atomic forces, then electro-magnetic forces to the gravitational force. Physics has reached the level of zero point field. They feel that the force coming from this field may solve the problems of gravity and inertia. What science doesn't know is that this is the force that was into existence since and before the primordial universe was born.

.Let us see how: -

2. Electro-Magnetic forces: —

Between the two original forces, the magnetic force developed due to attraction and repulsion between them. With the same process, electrical force also was created.

The universe developed to its present size as it went on expanding right from the beginning. Initially, from the one particle of matter, it developed like a child in a womb. At that time, this force was at a subtle level to hold the clouds of hydrogen together. It was in the form of Electro-Magnetic force. These forces held the creation together.

The atom clouds, atoms and even sub-atoms had manifested this force. As the creation went on expanding and required more sturdy force, the gravitational force became apparent. The force is the same original one, but it manifested itself according to the need of the size and stage in creation.

3. Spiral speed : —

The primordial universe moved with the original speed of cosmic energy particle. This continued while it developed and expanded. Later on, galaxies, stars and planets also moved with the same spiral speed. It was spiral in nature. Sub-atomic particles move around the nucleus in the same way. Every ingredient in creation retains every aspect of the primordial universe.

4. Slow and Strong reactions: —

When the primary material particle multiplied to form many and joined to form heavier particles i.e. He from H, energy was released. When destruction was involved, slow energy disintegration occurred, again energy was released. This conversion from energy to matter and vice versa is a continuous process in the universe so long as the matter exists. When only energy remains, it dissolves into void as the life or manifestation of energy particle is momentary, transient and fleeting.

All these forces are the forms of the same original force; - that of the element Wind.

It changes its intensity and manifestation according to the necessity. Gravitation force is the reactionary force. Both together are responsible for the expansion and at the same time contraction of the universe. When the purpose of the creation is over, the force of the Wind goes back into the Void and universe comes back to the stage of one particle. It dissolves into void.

The play of God ends.

Science, Consciousness and Brain physiology

Science is working on 3rd dimensional plane. So it still divides time and space in dimensions. All the present attempts to solve the mystery of creation are from this plane. The brain intelligence is responsible for it. The cosmos seen by the scientists through the Hubble telescope is from this plane of

existence. According to their mathematical calculations they have gone back fifteen billion years with the help of Hubble telescope. What they cannot see is where the light cannot reach. It is in field of the unknown. It is in the area beyond human intelligence.

In a discussion on consciousness in the book "Ending of Time" J. Krishnamurti and David Bohm have stated that in a process of awareness (or in meditation according to Patanjali), the brain cells undergo mutation. One gets direct perception of universe. The sensitivity of the sense organs increases. They can perceive beyond their normal range of functioning. Seeing, hearing, smelling and speech perception occurs on a higher plane. So the speech without language or perception of different smells without any object and seeing manifestations not perceived by ordinary human beings becomes normal activity for them. Most recent research in study of brain cells shows plasticity to establish this fact.

NMR Spectroscopy of brain along with EEG recordings in different states of consciousness have established certain changes like increased circulation, opening of new synapses and new connections in the specific areas and release of endorphins. Linking of left hemisphere with analytical capacities and right hemisphere of brain with intuition is made possible. In males left and in females right side of brain is seen to be more prominent.

It is also an accepted fact in medicine that only ten percent of the brain is functioning. The remaining part of the brain is dormant. With the constant superficial activities of brain through thoughts, memories, idea, images and imaginations, the other parts are dominated. When the brain becomes completely still, there is peace and bliss. The dormant centers in it get activated and brain starts functioning on a higher level. This is the effect of awareness, meditation on the brain. On this plane, creativity occurs. Yogi can observe the creation and beyond.

A mind which is not held by a single thought is free of past, present and future. It is Timeless. Such an observer is not under any force. He is totally free. Here, the observer becomes the observed. There is no distance between the observed and observer. He can reach instantaneously at the level of Primordial universe and beyond. For him, the dimensions shrink to a point and time has collapsed. This is how he can cross the barriers of Time and Dimensions. He is a man mentally free of this world.

The process of creation is not a matter of a second. The time scale is also in terms of cosmic time. The process of creation in the universe is continuous without beginning and end. Once the universe comes into existence, process of creation in it at different levels goes on. At a time, many such universes are existing. Some are being born and some are being destroyed. So it is a continuous process. The proof for it is against the experimental frame in Yoga. It is the capacity of a Yogi at Adnya-chakra to see beyond. Testing it by brain specialists adds to the proof. –

VOID

(not Black holes.)

Shiva's black flame:- This is the Void in which there is destruction of everything. It is this annihilation that leads to void, zero - o, nothing! Out of this void comes the chaitanya particle that forms universe. Then all that is created enters it and dissolves in it. The main fountain of energy springs from infinite void on the 7th plane of existence. That is the fountainhead of energy that is responsible for the creation, maintenance and destruction of billions and billions of universes. This void is represented in each primordial universe. The same void in turn goes ahead in every further creation.

Big-bang, Dark energy, Dark matter.

They are working on the assumption that Big- Bang was a reality. Science cannot go beyond O. It does not have a hold on infinity. It doesn't fit into the theory of relativity. So this model suits them. But it cannot give them all answers. Dark matter is not proved and its existence is also hypothetical. This assumption is not necessary any more if gravitational force can be explained as an anti-force to the speed of the primordial universe.

Universe is not created with a big bang, neither has the creation started in a static phase. Before birth itself, universe was under tremendous speed. Naturally, there was created an opposing force to hold the universe together which may be called gravitational force. If this factor of the speed with which the universe is born is considered, dark matter does not have to be imagined. This is both the Dark matter and Dark energy.

Energy

The next element is Energy. From void, the fountainhead of energy there is a continuous spray of bright light particles (Chaitanya-kan) spreading in all directions and disappearing. In between, a few black dots like sparks are also seen appearing and disappearing. Some of the chaitanya particles are converted into discs into which the energy dots or black dots enter and creation starts. The force with which these particles come out is maintained in space and is continued throughout the creation. The energy keeps springing out of the void whenever necessary.

The Wind Element

The wind element gives a push to the fountain of light energy particles. We may call it the GOD's pat. Thus primordial universe has a speed even before it is born. Its direction is not straight but has a bent. So then it becomes a spiral force and the axis of the universe is bent around which all the objects in its further creations move. So all galaxies have spiral movements and not circular. From the largest i. e. galaxies, stars and planets to the most subtle life force in human beings i. e. Kundalini, everything moves with the spiral force and fast speed. This force keeps the universe expanding. So another force develops at the same time as an anti-force to keep the creation together. As everything tends to move away

from each other due to the expansion force, this anti-force tends to keep everything together. Irrespective of the distance, these forces reach at any given point in the universe instantaneously. They are the part of wind element. They are formed before light appeared. So they do not follow the rules of matter. They are applicable to everything in the universe, from the smallest atom to the biggest star. If we consider the origin of these two forces, we will understand that hypothetical dark matter is not necessary for the explaination of the cosmic events.

Sound:-

All assumptions, calculations and rules of science stop at a certain level where light and material intelligence does not reach.

The sound comes from there. It is called "Nadbrahma" — Sound without source or sound of silence. Creation is not instantaneous. Do the galaxies create sound? Are they born with explosions? The creation is like that which is in galaxies,- the same process, from largest to the smallest, from galaxies to the primordial universe.

CONSCIOUSNESS and COSMOS (T. O. E.)

Everything that is present in the universe is also present in a human being. He is a mini form of universe. He is a representative of everything in the nature. The five elements make up his body namely: Earth, Water, Fire, Wind and Space. The Energy puts life in him. The consciousness – particular mind as we know is made up of its contents – memories, thoughts etc. If it is emptied of its content, then mind is represented by Void. This void is same as the void from which energy and matter arise to make up the universe. Thus he is a replica of the whole creation in body and of creative energy in his mind.

The man with a mind or consciousness that is empty of its contents is the ideal inertial observer whom Einstein found impossible to find. He fits into the requirement of physicists on who's mind no forces of the universe can act. The free mind of this observer need not ride on the beam of light. It reaches anywhere instantaneously as he has zero weight of his mind. He doesn't need to travel also as he is present here, there and everywhere at the same moment. Yogis have these experiences. They travel back in the past till the creation is in a stage of primordial universe instantaneously. He can see the fountain of energy. He sees energy coming out of fountain-head in a void.

One of the Chaitanya particles gets transformed into energy disc and a dot of matter with the original void in the center. This energy creates universe with matter. Alternately, energy disc receives in its center a particle of matter from another chitanya particle to create universe. This particle has void in the center and has its own capsule. It is surrounded by energy with its own capsule. Thus, the primordial universe looks like an Eye. Eye has a pupil in the center, an iris with matter from pupil to the capsule and a capsule. Outside this capsule is energy like cornea of an eye surrounded by the capsule. Perhaps this is the Third Eye of a Yogi who receives the ultimate knowledge about universe, existence and its source. This stage comes when the void in his consciousness gets in touch with the original void through which cosmic energy creates matter and creation starts. So this is the ultimate reality which is Nothingness or Void or O. The whole creation occurs on the higher and subtle three planes. The life forms are present on the lower four planes. Below these + 7 planes of existence, there are – 7 planes of existence. After the creation of the cosmos, in what is called as empty space of Shiva's Black Flame or void in the cosmos, a bright flame, white and blue in colour appears from which creations inside the cosmos go on. A void 160 million light years wide is seen at the edges of which are galaxies in the different formative stages.

Biological creation occurs according to the life conditions which differ on each plane of existence. The life forms thrive according to them. Those on the higher planes are superior to us. Those on the lower planes have – ve tendencies and qualities. Each life form tends to develop in such a way that its final goal is to reach the source from which it arose ultimately – 7^{th} plane or $+7^{th}$ plane (i.e. total 14 planes) - Void and Cosmic energy. According to the development of +ve or - ve tendencies of the being represented by the remains of consciousness made up of ideas and desires, life forms keep traveling between these fourteen planes of existence.

The cause- effect cycle goes on life after life till ultimately, one can see this play of existence and is out of it after getting out of the net of consciousness. Then one can help others to see this and be free of this perpetual drama of suffering which is sustained by the force of desires.

This is the Theory Of Everything.



Photo No. 1
1. A figure of Trishul
2. A horizontal coil of snake with hood



Photo No. 2
1. 3 coils of snake & hood with ½ coil
2. Petals : 2 large petals on and around the eyebrows
3. Muscular development at both ends of the eyebrows, below and above



Photo No. 3
1. An appearance of glow on forehead like a crescent of a moon
2. Small petals at the center and two large petals over eyebrows with glow.
3. Three small petals in place of coil looking like helix.



Photo No. 4 : Tri - dev
1. Lotus with helix at the center.
2. Two large petals.
3. Crescent of moon with a glow in the center.
4. Three horizontal bars seen inside the crescent.



Photo No. 5 : Taken without flash

A glow seen becomes prominent during meditation or while talking of higher matters

Kundalini corresponds to the Autonomic Nervous System. The chakras correspond to different nerve plexuses. Yogic power awakens due to meditation and ascends from first to the seventh charka.

6th is Adnya charka —

This makes cosmic connection possible. It is connected with Space and Cosmos. This is the 6th plane of existence. Creation takes place here. So secrets of cosmos and creation are revealed to the Yogi when he reaches this plane.

7th is Sahasrar charka —

It represents the void or Shiva's Black Flame and Pure energy.

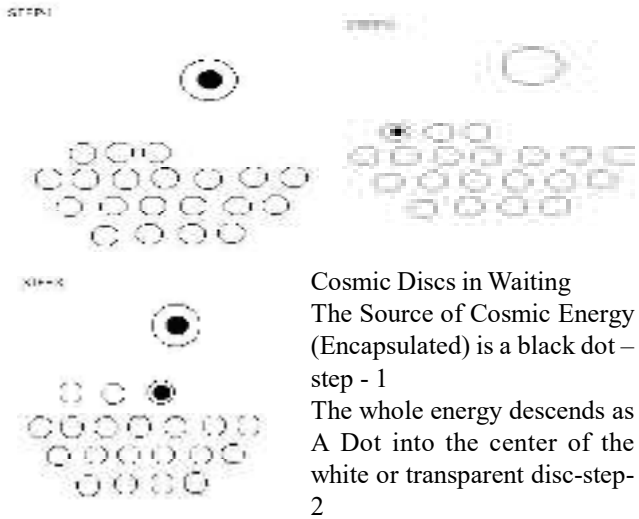
Thus the deity of Shiva is the symbolic representation of these stages.

Shiva was the Yogi Shiva. As Nataraj, he makes a dance of destruction.

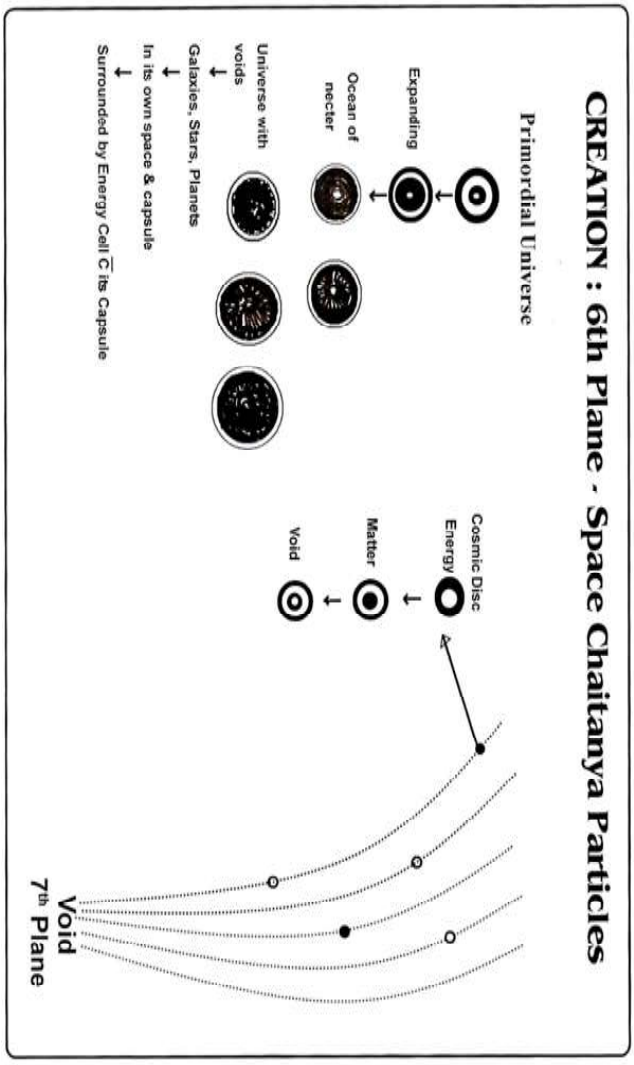
A yogi perceives the original void through the void of his consciousness.

Spurts of chaitanya-kan are ejected into space from void to form the cosmos.

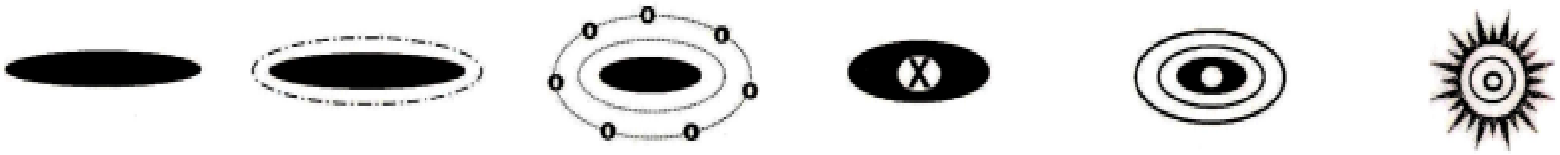
The following are the logos of creation: —



Cosmic Discs in Waiting
The Source of Cosmic Energy (Encapsulated) is a black dot – step - 1
The whole energy descends as A Dot into the center of the white or transparent disc-step-2
The WHOLE of Energy fills up the capsule again – step - 3



VOID OR SHIVA'S BLACK FLAME – CREATION



Darker than darkness

Surrounded by bright yellow ring

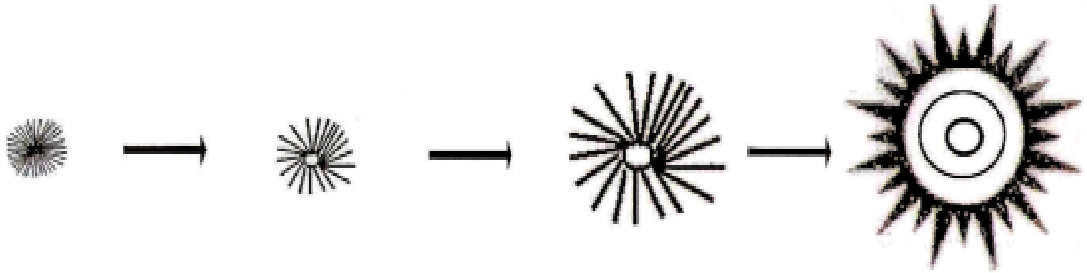
Dark Dots representing Creations

Bluish White Bright flame visible part of Creation inside the void

White Blue Light expanding outside

Void C̄ blue & White circles spreading

The Smallest Particle :



P.S.P.S:-2

PSYCHOLOGY BEHIND THE CONCEPT "PATIVRATA" IN PURANAS

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The Puranas depict an ideal family. The wife of the householder is the centre of the family system. If the house to be an ideal home it depended on the ideal wife who is the most obedient one and worships her husband as lord. She lives for her husband. Her every act is motivated to gain good things for her husband.

The puranas are replete with the stories of ideal womanhood. That woman who thinks her husband as the supreme being on earth, who trained in her, thought, speech and action as devoted to her husband, one who works and treats even a bad husband as lord, with qualities of tolerance,patience, forbearance, represents the ideal womanhood. She is the pativrata. Many stories encircle the ideal womanhood.
The women who are liked by Visnu are 'devoted to their husband, dedicated their life to their husband, surpass in their devotion to their husband and one who are devoid of jealousy.

Puranas repeatedly declare that the husband is everything for a girl. ' He is her salvation, he is the life and wealth. He is the bridge in the ocean of life and he is the source of dharma, artha and kama. Husband is the God Narayana. All the acts and all the vows of a woman are futile if done without his consent. It is well known that the son is the most loved one among all the relatives but he is only a part of of the husband and husband is greater than a hundred sons.' **Ref ; Brahma Vaivartha purana. Brahma Kanda CH.9.**

Lopamudra, the wife of Agastya was seen as an embodiment of the conception of an ideal woman who always follow her husband. Agastya is said to be a very happy man and a man of merits because of his wife. Agastya was worshipped not only for his penance and generocity but for having a wife like Lopamudra.

The high respect and worship of husband reaches an extremity when it is said that the wife should follow a husband though he is of bad charcter, a person with constant sickness, cruel and poor. The wife who discard a husband who may be of good qualities or bad qualities, will go to Kalasutra named hell and suffers there till the sun and moon are on earth.

Puranas refer to the stories of Sita, Anastiya, Saibya, Madalasa, Savitri, Sandill, Tulsi, Chandramati, Saci and others as embodiment of the duties of Pativrata or a devoted wife. Many times they may appear to commmon people an extrimity of devotion, an idealism and uthopian stories.

The service to the husbands gave them an unique power. They can change the universal phenomena Ruta which is the strongest and even gods are unable to go against their will. The woman gets the half of the good deeds of their husbands by serving the husband. There is no separate sacrifice or pitruyajna for a woman. She conquers the sacred worlds above by her service to husband.

The exposition of the duties of husband is also complimentary, Puranas have a balanced view in regarding the duties of husband towards a wife.

Madasala, the daughter of Visvavasu was abducted by Vajraketu, a demon. Rtudvaja protects her from the demon, loves her and marries her. Madalasa's friend patalaketu requests Rtudvaja to listen to her advices so that he can have a comfortable life with Madalasa.

She says" I should not instruct men like you who are of scholarly capacity, who knows everything. I am not commanding you but out of friendship for Madalasa. I am just reminding you. O! you the killer of foes, it is the duty of a husband to protect and feed his wife, since the wife is always companion in life to husband in acomplishing dharma, artha and karma. Oh! king, how can a man earn dharma and artha without a wife?

' It is the duty of Grhasta to serve the Gods manes, servants and the guests with his wife. Even he earns money if there is no wife to manage it., what is the use? Such wealth will perish and even a bad wife may show negligence in preserving the wealth earned. Therefore it is through the joint venture of husband and wife the three fold dharma, artha, karma is fullfilled.

Puranas are our friends. They never laydown hard core ijuctions, but the stories covey a wish, a view of the puranas. We find in these stories a legacy of Hindu code of conduct. Indira had to lose his throne when he killed Visvarupa, his teacher and had to resort to exile. He returns to heaven by the help of demon Mahasani and with recommendations of Varuna. Saci knowing Indra's plight, who was insulted often by Mahasani, advises him to perform penance in the Dandakarnanya forest on the banks of river Gautami, she explains the place of a wife in man's life. It is the wife who helps the man in alll his acivity. Even small workscannot yield fruits without her co-operation. If anywork is accomplished by the manwithout her, it yields only half fruit and never the whole sucess. That is why the puranas declare the wife as betterhalf, A wife is called,??? since the husband is reborn as the son from her womb.(see Manu,9.8)

In Varaha purana (ch 228) there is the story of Nimi's son Miti and his wife. They wanted to perform a yaga. As a part of the yaga, they had to grow crops in the field. They came to a far off all places to cultivate the land. Due to the intolerable heat of the sun the wife felldown on earth. Whilefalling she just gazed the sun and sun felldown from heaven loosing his lustre. At that time he presented a water pot (Kundika), an umbrella (Chatra) and foot wear (paudaka or uphana) and saved himself from her curse. Even the sungod has to bow down his head before he power of a pativrata. Varahapurana,(ch.209) has an 'eulogy' of pativrata.

The story of savithri is well known She chooses Satyavan as her husband. Though she comes to know that the life span of Satyavan is only one year after her marriage with him ,she marries him.She follows him when he was captured by death .Her devotion towards the husband can be seen in her conversation with Yama "For woman husband is god Husband is the ultimate aim of life and wealth. Therefore a pativrata should follow him. whatever a father,a brother, or a son gives it is limited but what is given by husband is immence .It is the duty of the wife to follow the husband.wherever he goes. **Ref:Skanda purana. Naga kanda.ch.207.**

The story of Brnda or Tulasi is an example of the power a devoted wife gets by following her husband. Vrnda was the daughter of apsara swarna and sage krunca .She marries Jalandara. Jalandara was a powerful Rakshasa king .he wages war with Shiva. It is her power of a devoid wife, Pativrata sakti that protects her husband and even Siva finds it difficult to conquer him. Knowing the consequence of war Vishnu enters the scene. He approaches Tulsi in the disguise of Jalandara.Tulsi, thinking him as his husband units with him in sexual pleasures and loses her *pativratasakti.* Shiva kills Jalandara in the war. Tulsai comes to know the deception of Visnu and she curses him. "Your wife will be abducted by one who is in the disguise of a mendicant, just as I was deluded by you." **Ref ; Padmapurna Uttarkhanda CH. 14 - 35.** Vrinda by yoga and scared knowledge destroying the sensual urges and wordly interests, leaves her ephemeral body consumed by the yogic fire.

Even gods are helpless in front of these devoted wives. Though they had such powers they suffered, because of the faults committed by their husbands.

In the case of Sita's purificatory act by Agni, it is Rama's Interests to protect the puriety and fame of his family, that acted as a blow to Sita's self respect. Interpretations of the intention of Rama, may differ but the fact remains that Rama wanted to test the puriety of his wife and it was through *Agni pravesa.* Agni manifests himself in person to prove her purity and declares that it in only because of the power of her devotion to husband. Rama was able to kill Ravana. **Ref ; Skanda purana Brahmakanda CH. 14 - 50.**

The Hind family is patriarchal and preference and promience given to the male member in the society , which has opened an opportunity to think that the concept of ideal womenhood has thwarted the freedom of women and made her as a victim of many sufferings. But the devotion towards husband has yielded some good things for the woman. It has given her life of comfort and has lessened the burden of responsibility. She lives under the guidance of the husband who protects controls and comfort her. This sense of securiety made the indian woman to accecpet the order of her lord and husband. She is not an earning member in the sense that of bringing economic help. Her realm is the work within the family where she is the mistress in her house she is the queen heaving everything under her control.

Nature has gifted the woman to bear the progeny this sole act of nature cannot be shared by any man. This gift has given her an additional responsibility of upbringing the child. It is the mother who helps the child in all walks of life as an adviser, a well wisher, a protector and there is an unfathomable that exists in mother towards child. Therefore, to fulfill this responsibility, a woman has a special talent which man cannot have. If a father rears and helps child in the absence of the mother, the society lauds him and admires him as an ideal, but if a woman in the absence of her husband brings up the child it is accepted as her duty.By worshipping her husband a pativrata is exempted from many religious worships directly.

Why this concept of a devoted wife and one husband for a lady tilll her death is given so much importance! a man can marry more than one or he can marry another girl with the permission of First wife while she is living. The significance of pativarata is expressed in the law of Telegony. The law of telegony says -

Woman is the medium of progeny. Man disperses and woman absorbs. Woman's organisam is permentaly affected by man's connection, as she is innoculeted by his seed. **Ref ; Narianka, Gorakpur Page - 311**.

It is the woman who gives a pure generation to the future and not the man so her sacredness was protected with atmost care.

As Manu says the ideal family life for both husband and wife is" there should be mutual fidelity between the husband and wife till death. This should be known as the primary duty of the husband and wife in brief. **Ref ; Manu 9.101**.

THEME 11

SPEECH, LANGUAGE, HEARING SCIENCES AND DISORDERS (PANINIYAM)

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INVITED LECTURE

MULTIDISCIPLINARY INTEGRATION IN LANGUAGE SCIENCES

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Language is a unique gift to human beings. Language with the primary skills of speaking and listening, and secondary skills of reading and writing is a tool of communication and essential interaction between human beings. It has several features like *Duality of patterning* (A system of sounds with a system of meaning), *Interchangeability/dyadic*, *Arbitrariness* (There is no fundamental association with word and its meaning), *Displacement* (Language can be used to talk about topics not currently being experienced), *culturally Transmitted,* etc.

The field of language sciences deals with research about biological, psychological and linguistic bases of language development and use. The "linguistic bases of language" concerns the representation of linguistic knowledge that underlies language development and use. This is important for speech – language pathologists (SLPs) and audiologists because a complete understanding of the factors that support language development should be the basis for everything that is done in language assessment and intervention. The "biological bases of language" primarily concerns about the role of heredity and biology. The "psychological bases of language" primarily concerns the representation of linguistic knowledge that underlies language development and use. Social basis concerns about pragmatics, differing contexts, bilingualism and multilingualism, etc.

Language develops in gradual hierarchical steps from infancy to puberty. A child born has no language but communicates his/ her basic needs through cry. Speech, i.e., vocal language develops naturally without any formal training.

A child is presumed to be born with an innate capacity to acquire language, primarily vocal. Biologically she/he is endowed with special neural and structural physical equipment needed for listening and understanding (ears and hearing system) and speaking (respiratory, laryngeal, articulatory mechanism, etc…). These are according to the nativistic and biologic maturational theories. There are groups of theories like learning theories which are also called behavioristic/ stimulus – response – reinforcement (SRR) theories according to which children learn verbal behavior (language) like any other aspect of behavior.

Several explanations or theories like biological maturation, linguistic, behaviourism, information processing, cognitivism and social interaction theories were formulated to explain the aspects of child language acquisition.

The Biological basis of Language

Humans appear to have a special ability to learn language easily and quickly. There are a number of indications that our ability to learn our first language so effortlessly is related to our biology. Some of these indications include, the fact that some language functions are localized in certain areas of the brain, the fact that complex language appears to be unique to humans, and the fact that some language disorders are hereditary.

Species Specificity

Language is a species-specific behavior for only in human beings and made possible by an innovative and complex central nervous system and a body structure that makes this high form of communication possible. The human nervous system [Central Nervous System (CNS) + Peripheral Nervous System (PNS)] is specially equipped to handle sequentially complex aspects of language. Not only the nervous system but the listening apparatus (external ear and hearing system) and vocal structures of respiration like larynx, nasal and oral system, the phonatory, articulatory equipment etc., are all "designed" to facilitate speech and language processing.

The chief proponent of biological theories of language acquisition was Lenneberg (1967). He identified several neurobiological correlates and proposed them as support for language acquisition. These are cortical maturation, cerebral dominance / language lateralization, equipotentiality of the two hemispheres, plasticity of the cerebral hemispheres and critical period.

Methods to study Language and Brain Relationship

Advances in brain imaging techniques like CT Scan, PET, SPECT, MRI and fMRI have made it possible for researchers to investigate the parts of the brain that are involved in various finer activities. This new information, together with years of studies of the speech and language behaviours that change after brain damage, suggests that certain parts of our brains are finely specialized for language.

MRI and especially functional magnetic resonance imaging (fMRI) are playing an important role in the next stage of aphasia treatment research. MRI has become the tool of choice for examining the structural abnormalities in aphasia and in other disorders. Differing pulse sequences allow for the evaluation of acute changes in the brain following infarction, and the evolution of the infarction. These structural and corresponding functional alterations in the brain can be related to the clinical characteristics of aphasia. A further value has developed with the employment off MRI to determine how various brain stimulation methodologies enhance brain plasticity, thereby improving the effectiveness of language treatment programmes and extent of recovery from aphasia the patient will achieve.

One such technique is Functional MRI (fMRI), which relies

on the magnetic properties of blood to enable scientists to see images of blood flow in the brain as it is occurring. Thus researchers can make "movies" of changes in brain activity as patients perform various tasks or are exposed to various stimuli. This technique allowed researchers to study the development of brain and its association to development of language.

In most people, language functions are lateralized to the left hemisphere. There are three areas in the left hemisphere that are especially important for language: Broca's area, Wernicke's area and the Arcuate fasciculus. *Broca's area* is responsible for planning speech and for some aspects of grammar. *Wernicke's area* is responsible for language comprehension and many semantic functions. Arcuate fasciculus connects the two areas. It is likely that we are genetically predisposed for establishing certain patterns of neural development and certain areas of localization. There are many instances in which the parents of children who have language delays and disorders report that they had learning difficulties themselves. It is possible that slower neurological development and/or less efficient patterns of neural activation of language centres could be inherited.

Heredity:

There are a group of children who have unusual difficulty learning language despite adequate hearing, vision, intelligence and social experiences. These children have a condition known as "Specific language impairment (SLI)". Studies of SLI in identical and fraternal twin pairs have found nearly twice as many identical twin pairs with SLI as fraternal twin pairs with SLI.

In summary, some aspects of our biology prepare us to learn and use language, especially when other important social and intellectual supports are available. Adequate biological support for language may be important, but biology is not the only factor that is critical for language development. Biology matters, but it is only important with respect to the way it interacts with other factors such as socialization, psychological learning mechanisms, and prior knowledge.

Heredity, learning mechanisms, experience, and prior knowledge combine to influence language development and use. The best evidence is that there are biological, psychological, and linguistic mechanism that is involved in dynamic relationships that influence language development and use. Findings of brain localization, species specificity, and hereditary influences on language disorders suggest that some aspects of our biology prepare us to learn and use language.

The Psychological Bases of Language

The extent to which general cognitive mechanisms support language development is often debated. Some scholars believe language learning requires the same sorts of psychological processes that are involved in many other kinds of learning. Other scholars believe language acquisition requires additional mental mechanisms that are specialized for language learning. Nearly everyone agrees, however, that language learning makes some use of the mind's information processing system.

Information processing usually refers to the means by which mental representations are derived from environmental stimulation (information) and modified mentally to influence knowledge and actions (processing). The information processing functions that are thought to play a critical role in language development and use are attention, perception and memory. It is said that success in language learning and use might depend heavily on attention, perception, and memory processes.

According to Massaro and Cowan (1993), there are three important assumptions in information processing explanations of cognition. First, information processing approaches assume that the mind processes mental representations, which are bits of knowledge. Most information processing theorists believe these bits of knowledge are the production of communication between neurons. Brain is comprised of literally billions of neurons that communicate with each other via electrical impulses. These impulses are carried from one cell body to another by the axons and dendrites. Neurons interact by driving up or driving down the activation levels of other neurons. All this electrical activity results in mental images, which are representations of visual, auditory and haptic (touch) experiences.

The smallest unit of mental representation is called a proposition. You know that 'a' is proposition. You put many propositions together to form a network. If we asked you to think of as many words as you can start with the letter *a*, you would answer to our question by activating a network. Two types of proposition networks that play important roles in language development are called schemas, which represent large concepts, and scripts.

The second important assumption in information processing accounts of cognition is that the brain processes information in different ways. Sometimes, it occurs in a serial manner and sometimes, it occurs in parallel manner. The third important assumption in information processing theories is that individuals have different capacities for mental activities.

Speech is not only perceived according to its features and categories. We also use contextual cues during speech perception. Listeners can do this quite easily because our general knowledge of semantics and syntax contributes to our interpretation of perceptual features. When higher level language concepts influence perception, it is called top-down processing.

Some children and adults with language disorders have perceptual difficulties. Children with perception problems appear to process information slowly or incompletely. Difficulties processing rapidly incoming information or incomplete mental representations of sounds could interfere with language development. There are also a number of adult pa

tients who have difficulty recognizing speech even though they can recognize nonspeech sounds, and they can produce sounds. Adult patients with speech perception problems usually have brain lesions in their left temporal lobes. When perception influences higher level language and thought, it is called bottom-up processing.

The dynamic relationships between sensory memory, long term memory, working memory, and central executive functions is input. Working memory is often described as the storage and processing functions within long-term memory that are active at a given moment. Working memory is not seen as a distinctly different kind of memory. Rather, it is the portion of long term memory that is busy processing information. This processing involves simultaneously encoding information, storing it, retrieving related information that has already been stored, and/or reporting it. Learners represent information in their minds (encoding), hold it for immediate or later use (storage), access the information when they need it (retrieval) and communicate what they have remembered (reporting). The connections between these phases represent interdependencies among encoding, storage, retrieval and reporting.

The memory model assumes a general memory capacity that limits the amount of encoding, storage, retrieval and reporting that can be accomplished at any given time. This general capacity is thought to result from the dynamic relationships between information processing functions, language abilities and knowledge.

Information processing

Two functionalists models of language acquisition. One is called the competition model (Bates & Macwhinney, 1987; MacWhinney, 1987). This model will give you an idea of how learners come to attend to the most reliable cues to accurately interpret the language around them. We will also discuss connectionist modelling (e.g., Plunkett & Marchman, 1993). Connectionism focuses on the way associations are formed between sound and meaning. This will give you an idea of how children come to represent language in the mind from a functionalist perspective.

Linguistic Bases of Language acquisition

Some scholars believe language is a special ability that humans are innately endowed with. The quickness and ease at which some children acquire their native language have led a number of scholars to argue that children are born with some sort of a universal grammar.

Proponents of this view are sometimes called nativists. UG (universal grammar) contains a basic design for grammar that permits a child to learn which ever language for language (or languages) he or she is exposed to. Innate learning mechanisms enable young language learners to crack the grammatical code of their language quickly and easily.

Three main reasons that nativists believe humans have innate linguistic knowledge are:

1. Minimal input is needed to learn language
2. Learners rely on grammatical input and minimal correction or negative input, and
3. Most children tend to learn language quickly.

Is it possible that children who are just learning language do something quite similar? Perhaps they can interpret the grammatical roles of unknown words based on some sort of innate knowledge of the way language works.

The second important point is that children learn based on input. It is interesting that children do not seem to benefit from negative input or correction from adult speakers. Young children produce many "errors" as they are learning to speak. Some that we touched on in chapter 2 were frequent omissions of morphemes (e.g., *yesterday he jump*) and mispronunciations of words (i.e.,/tot/ instead of coat).

Mechanisms such as bioprograms and maturation are thought to be the key elements in language acquisition. Obviously, children are not born speaking. So, you may be wondering just what a universal grammar is. Universal grammar (UG) can be thought of as a blueprint for languages. This means that languages share common elements and will behave in a systematic ways. If you have studied a foreign language, you that many languages share the same kind of words. Word types such as nouns, verbs, and words that mark grammatical relations such as articles, prepositions and grammatical morphemes are commonly found in the world's languages. Languages behave in systematic ways that are not entirely dissimilar from one another.

On the other hand, there are also systematic differences between languages. English is a language that requires the use of subjects. Universal grammar (UG) also serves as a guide or blueprint for language acquisition. If we look at children acquiring languages such as English, German, or French, we see that learners of these languages make similar kinds of errors as they acquire their native language. For example, most children learning English do not start to use tense marked forms on a regular basis until they are around 3 years old. One current theory proposed by Wexler (1994) is that children go through a stage, called optional infinitive, during which they do not realize that tense marking on verbs is required. Because they think tense is not required, they use unmarked or infinitive forms.

Nativists suggest there is some type of language acquisition mechanism or device that propels the language acquisition process. However, within this school of thought, there is ongoing debate over the nature of this mechanism. Some theorists support what is referred to as the principles and parameters approach (e.g., Hyams, 1986; Lust, 1999). They suggest that children have access to linguistic knowledge (i.e., grammatical principles) from the outset, but that they need input from the environment to determine what the parameters of the language should be. Proponents of this type of language acquisition device stress the importance of ex

posure to the native language.

From this theoretical perspective, it would be expected that children would make consistent use of the structure in question once it was triggered. In contrast, other theorists (e.g., Borer & Wexler, 1992) argue that some aspects of UG only become available to the child as he or she matures. Children start out with an incomplete version of UG that matures into a full adult version of UG. This process has been likened to a tadpole turning into a frog (Gleitman, 1981). The transition from the use of unmarked verb forms to marked verb forms, discussed as part of the optional infinitive hypothesis, is proposed to result from such mechanism. Wexler (1999) suggests that children do not have accesses to the aspect of UG that guides verb marking until a certain level of maturation occurs. It is also likely that innate learning mechanisms enable language learners to crack the grammatical code of their language quickly and easily. There may be some type of a language acquisition device that helps children learn language quickly and easily. On the other hand, it may be possible for children to reach the same levels of language knowledge simply by making multiple associations between language form and language meaning. These associations enable learners to build representations of phonological, semantic and grammatical processes.

Finally, it is likely that some aspects of language learning, especially grammatical morphology and syntax, benefit from innate linguistic knowledge. We explained how this knowledge may consist of a universal grammar (UG). The UG may rely on input from the environment to drive development, or it may rely on internal maturational mechanisms to take effect. This is known as the nativists' perspective.

Linguistics and Other disciplines

Anthropological linguistics is the study of the relation between language and culture along the relations between human biology, cognition and languages. This strongly overlaps the field of linguistic anthropology which is the branch of anthropology that studies humans through the language that they use.

Psycholinguistics: The boundary between linguistics and psycholinguistics is difficult, perhaps impossible, to draw So too is the boundary between psycholinguistics and psychology with lots of language experiments

Descriptive (or synchronic) linguistics/dialectology: Describing dialects (forms of a language used a specific speech community). This study includes phonology, morphology, syntax, semantics and grammar.

Historical (or diachronic) linguistics: Describing changes in dialects and languages overtime. This study includes the study of linguistic divergence and language families, comparative linguistics, etymology and phonology, language attraction/language loss is recent phenomenon.

Geolinguistics is the study or science of linguistics in relation of geography. It is concerned with the analysis of the distribution patterns and spatial structures of language in contact

Ethnolinguistics: Analyzing the relationship between culture, thought and language

Sociolinguistics: Analyzing the social functions of language and the social, political and economic relationships among and between members of speech communications

Computational Linguistics: By computational linguistics is meant no more than the use of electronic digital computers in linguistic research. At a theoretically trivial level, computers are employed to scan texts and to produce, more rapidly and more reliably than was possible in the past, such valuable aids to linguistic and stylistic research as word lists, frequency counts, and concordances. Theoretically more interesting, though much more difficult, is the automatic grammatical analysis of texts by computer. Considerable progress was made in this area by research groups working on machine translation and information retrieval in the United States, Great Britain, the Soviet Union, France, and a few other countries in the decade between the mid-1950s and the mid-1960s. But much of the original impetus for this work disappeared, for a time at least, in part because of the realization that the theoretical problems involved in machine translation are much more difficult than they were at first thought to be and in part as a consequence of a loss of interest among linguists in the development of discovery procedures. Whether automatic syntactic analysis and fully automatic high-quality machine translation are even feasible in principle remains a controversial question.

Applied areas of such research

One linguist has put forward the theory that the most basic distinctions in language are those that are acquired first by children and are subsequently most resistant to disruption and loss in aphasia. This, though not disproved, is still regarded as controversial (Caramazza, et al, 1981). Two kinds of aphasia are commonly distinguished. In motor aphasia the patient manifests difficulty in the articulation of speech or in writing and may produce utterances with a simplified grammatical structure, but his comprehension is not affected. In sensory aphasia the patient's fluency may be unaffected, but his comprehension will be impaired and his utterances will often be incoherent.

A most recent study on understanding of human brain function (Sahin, Steven Pinker, 2009) addressed to understand the nature of Broca's area. The Procedure, called Intra-Cranial Electrophysiology (ICE), allowed the researchers to find that Broca's area actually consists of several overlapping parts, performing distinct computational steps. The task involved both reading and speaking, and it was found that aspects of word identity, grammar and pronunciation are all

computed within Broca's area. It is now clear that Broca's area has several roles, in both expressive and receptive language and helps to dispel commonly taught notion that Broca's area handles expressive language and Wernicke's area handles receptive language only.

Functional MRI (fMRI)

Relies on the magnetic properties of blood to enable scientists to see images of blood flow in the brain as it is occurring. Thus researchers can make "movies" of changes in brain activity as patients perform various tasks or are exposed to various stimuli. This technique allowed researchers to study the development of brain and its association to development of language. MRI and especially functional magnetic resonance imaging (fMRI) are playing an important role in the next stage of aphasia treatment research. MRI has become the tool of choice for examining the structural abnormalities in aphasia and in other disorders. Differing pulse sequences allow for the evaluation of acute changes in the brain following infarction, and the evolution of the infarction. There are a group of children who have unusual difficulty learning language despite adequate hearing, vision, intelligence and social experiences. These children have a condition known as "Specific language impairment (SLI)".

Studies of SLI in identical and fraternal twin pairs have found nearly twice as many identical twin pairs with SLI as fraternal twin pairs with SLI. In language assessment whether automatic syntactic analysis and fully automatic high-quality machine translation are even feasible in principle remains controversial. Language scientist has to consider several variables in research: individuals/group, age, sex, literacy, SES, race/community, ecological factors/ manner of acquisition, etc. Sociolinguistics & Bilingualism-Indian Scenario

Bilingualism – Scope, Definition and Heterogeneity

When one hears the term bilingualism automatically tends to think that it refers to the ability of knowing how to communicate in the languages. However, evidence shows that there exist many individual differences between ability and use that vary across a bilingual continuum.

Linguistic Competence

Some bilingual individuals are able to speak and write in both languages (productive competence), others are able to understand and read (receptive ability only). Some are at an early stage of acquiring a second language, they can understand it but cannot speak it, some are in the middle, and others are at the end or ideal bilingualism stage: Balance bilinguals (a person equally fluent in two languages). Therefore defining exactly who is or is not bilingual is essentially elusive and ultimately impossible. Language scientists have to take note of this and such issues in their Research work. To make matters even more difficult, and without exactly defining bilingualism, dimensions and labels are added to the discourse. For example a person who learns two languages from birth is called **simultaneous bilingual,** as opposed to a person who learns a second language after he she is three years old which is called **consecutive / successive bilingual.** With proper instruction and time, a person can continue to improve in the areas where fluency or competence is lacking; **bilingualism** and **multilingualism** are not **static conditions.**

Measurement

In a similar fashion, as dimensions categorization and labeling cannot fully describe the extent of bilingualism, so all the assessment tools fail to give an accurate estimate of bilingual individual competence. Bilinguals are measured both for their proficiency and use of their languages

Socio-Linguistic Background of Bilingualism in India

Demographics of India

India has 22 constitutionally accepted languages (Official) out of which, four are classical languages. There are about 1652 languages / dialects spoken in and around the country. The major language families in India include

· Indo – Aryan (74.3%, 209 languages), Hindi, Gujarathi, etc…
· Dravidian (23.9%, 73 languages), Telugu, Kannada, Tamil, etc…
· Austro – Asiatic (1.2%, 1268 languages), Khasi, Munda, etc…
· Tibeto – Burman (0.6%, 350 langauges), Tibetian, Manipuri, etc.

Some languages have scripts while many do not have. Indian multilingualism is characterized by a very interesting scene: More languages are now involved as participants in the current increase in bilingualism and tri-lingualism; More than one script is used to write many languages, and many scripts used to write a single language. Many Indian languages share a similar set of linguistic features across the language families, etc. Statistics is difficult to be obtained with accuracy as operational definitions themselves are not clear.

Nature of bi/multilingual exposure in children:

The language that the children get exposed to would usually follow simultaneous or successive pattern. Simultaneous exposure would have mother tongue +, father tongue + regional language in the picture. Simultaneous exposure of these two or more languages with English playing as a very significant role in the middle and upper middle class home situation has become very common in the urban India. Successive bi/multilingualism would involve two languages at home initially and then exposure to school languages. They include usually medium of instruction along with the second (Regional/ Kannada/sanskrit for eg) and third language (National Language, Hindi) in the Regional context like Mysore in the State of Karnataka, of South India. The situation of simultaneous exposure is emerging as a rule rather than exception for several reasons.

URBAN AND RURAL DISTRIBUTION

India is a country of mainly villages. In this rural background also multiethnic and multicultural plurality of languages is nurtured. In the rural set up also, once the child becomes the part of socialization process, as there is extreme emotional bonding in the neighbourhood and therefore an extended family situation arises, the mother tongue as well as the other tongue of the neighbours/ caretakers is nurtured.

Home Environment:

Marriages in cross-cultural and cross-linguistic contexts have become quite common in India with increasing globalization. This is significantly so in the middle and upper class of socio-economic strata. In this group, English automatically assumes the rule of commonest link language. Inter-language marriages therefore give rise to bi/multilingual household where the children are born into bi/multilingual context.

Some languages have scripts and some do not have like Kodava, Tulu, Konkani in Karnataka and the Regional language Kannada is fostered more as that is the script used in written communication with the former languages. So a child already exposed to 2 or 3 languages in the oral context in the home environment, gets into to the instructional context of the 1st, 2nd, 3rd languages. They are usually combinations of regional, national, and global (link) language. Medium of instruction is English/Regional languages. A language scientist has to take into consideration all these issues.

Language influences in Multilingual context of India

Dravidian languages for example, are another major class of languages spoken by more than 200 million people. The Dravidian languages have remained an isolated family to the present day and currently it is mainly occupied the southern portion of India. (Tamil, Kannada, Malayalam etc). Dravidian languages have interesting structures compared to less morphologically complex languages like English. For example, compounding is relatively frequent, Postpositions serve the functions prepositions serve in other languages, scrambling of word-order is possible, and left- branching structures are more frequent.

Hindi on the other hand belongs to Indo – Aryan groups of language and is the national language of India and is written left to right in a script called *Devangari*

Hindi is highly phonetic; i.e. the pronunciation of new words can be reliably predicted from their written form and this is in strong contrast to English.

English (Indian English) of course, is highly prevalent in India, and for this reason Hindi learners may well be extremely fluent. Nevertheless, native-English speakers often have difficulties understanding them because of the combination of the pronunciation problems listed above, along with the use of Hindi accent and intonation patterns. While we have to develop Indian norms for English (the way it is being used), these multilingual influences also have to be studied and norms have to be developed for such data by a language scientist.

SUMMARY

Research in language sciences has to consider several factors/variables in various combinations (for 1652 languages!) for guiding SLPs. Healthy convergence of different fields can lead to greater heights if there is concerted effort to transcend the narrow, traditional boundaries of our academic training (neurologists, psychologists studying language etc) for resolving language related issues leading to powerful insights within this broader interdisciplinary approach. The background of numerous languages and dialects in India provide a tremendous potential for obtaining normative data for different languages/dialects while comparing with English (anglo-centric data) is making this discipline and effort a Herculean yet highly challenging and enriching task with life time of research ear marked for all of us.

References:

Allen, J. P. B. and S. Pit Corder (ed.). Techniques and Experimental Methods: The Edinburgh Course in Applied Linguistics, Volume-4, Oxford University Press, London, 1977.

Allen, J.P.B. & Paul Van Buren - Eds.]. Chomsky. Selected Readings. London. Oxford University Press. 1975.

Bates, E., & MacWhinney, B. (1987). Competition, variation, and language learning. In B. MacWhinney (Ed.), mechanisms of language acquisition (pp. 157-193). Hillsdale, NJ: Lawrence Earlbaum.

Borer, H., & Wexler, K. (1992). Bi-unique relations and the maturation of grammatical principles. Nature language and linguistic theory, 10, 147-189.

Fodor, J.A., Bever, T.G., and Garrett. M.F. (1974). *The Psychology of Language,* Mc-Graw – Hill: New York.

Gleitman, L. (1981). Maturational determinants of language growth. *Cognition,* 10, 103-114.

Hyams, N. (1986). Language acquisition and the theory of parameters. Dordrecht, The Netherlands: Reidal.

Linguistics**.** (2009). In *Encyclopædia Britannica*, from Encyclopædia Britannica Online: http://www.britannica.com/EBchecked/topic/342418/linguistics.

Lust, B. (1999). Universal grammar: The strong continuity hypothesis in first language acquisition. In W.Ritchie & T. Bhatia (Eds), *Handbook of child language acquisition.* San Diego: Academic Press.

Massaro, D. W., & Cowan, N. (1993). Information processing models: Microscopes of the mind. *Annual Review of Psychology,* 44, 383-425.

Wexler, K. (1999). Maturatuion and growth of grammar. In W.Ritchie & T. Bhatia (Eds), *Handbook of child language acquisition.* San Diego: Academic Press.

S.L.H.D:-1

GENDER DIFFERENCES IN COMMUNICATION DISORDERS: A META-ANALYTIC STUDY

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INTRODUCTION:

Meta-analysis is a mathematical means for synthesizing independent research findings scattered throughout a body of literature. The units of observation in a basic meta-analysis are the outcomes of tests of a specified null hypothesis as reported in a collection of primary studies (Robey, 1998).

A gender difference is a distinction of biological and/or physiological characteristics typically associated with either males or females of a species in general. The existence of a gender difference does not necessarily identify whether the trait is due to nature or environment. Some traits are obviously innate (for example, reproductive organs), others obviously environmental (for example, given names), while for others the relationship is either multi-cause or unknown. From the viewpoint of evolutionary psychology (championed by Buss, 2003; Pinker, Morris & Dennett, 2003) modern humans have inherited natural traits that were adaptive in a prehistoric environment. Physical health point of view, from conception to death, but particularly before adulthood, females are less vulnerable than males to developmental difficulties and chronic illnesses. This could be due to females having two x chromosomes instead of just one, or in the reduced exposure to testosterone. (Harper , Howing, Holm & Dubanovsky ,1965; & Mc Coby ,1966)

In the big five personality traits, women score higher in Agreeableness (tendency to be compassionate and cooperative) and Neuroticism (tendency to feel anxiety, anger, and depression).Demographics of MBTI (Myers-Briggs Type Indicator, Jung, 1921) surveys indicate that 60-75% of women prefer feeling and 55-80% of men prefer thinking. Males are generally more aggressive than females (Coi & Dodge 1997, Maccoby & Jacklin 1974, Buss 2005). There is evidence that males are quicker to aggression (Frey et al. , 2003) and more likely than females to express their aggression physically (Bjorkqvist et al. , 1994).

Female brains are more compact than male brains in that, though smaller, they are more densely packed with neurons, particularly in the region responsible for language. Also, females have language functions evenly distributed in both cerebral hemispheres, while in males they are more concentrated in the left hemisphere.

Researchers are interested to know the differences between genders in various communication disorders. This knowledge will help us in systematic assessment of these disorders. Further it will aid in better intervention plans serving also as good prognostic indicator. In the present study 1000 research works have been reviewed across childhood to adulthood for various communication disorders. Differences in gender have been indicated in most of the studies. Researchers also emphasize that gender difference is an important factor to be considered while dealing with these disorders.

GENDER DIFFERENCES IN COMMUNICATION:

The influence of gender differences begins very early in life. All of us have different styles of communicating with other people. Our style depends on a lot of things: where we are from, how and where we were brought up, our educational background, our age, and it also can depend on our gender. Generally speaking, men and women talk differently although there are varying degrees of masculine and feminine speech characteristics in each of us. But men and women speak in particular ways mostly because those ways are associated with their gender.

The styles that men and women use to communicate have been described as “competitive vs. cooperative”. Men often seek straightforward solutions to problems and useful advice whereas women tend to try and establish intimacy by discussing problems and showing concern and empathy in order to reinforce relationships.

According to Jennifer (1986) who studied men-only and women-only discussion groups, found that when women talk to each other they reveal a lot about their private lives. They also stick to one topic for a long time, let all speakers finish their sentences and try to have everyone participate. Men, on the other hand, rarely talked about their personal relationships and feelings but competed to prove themselves better informed about current affairs, travel, sport, etc.

The self-confidence which the sexes hold for their abilities in three types of communicative tasks was the topic for a study by Clark (1993). These tasks involved comforting, persuading, and justification. Since a person’s feeling of self-efficacy for a task is important to actual performance, the application of findings in this area could prove important for strengthening perceived weaknesses for either sex in one of these abilities. Clark found that some difference did exist in expectations for success in the domains studied. Men anticipated more success than they actually achieved in the area of justification (of decisions). Women anticipated more success in comforting of others, and achieved more successful results than did men. Significantly, women’s performances was rated higher than men’s in all domains measured, leading to the possible conclusion that women are generally seen as more competent in communicative tasks which are perceived as interpersonal.

In a study whose findings supported stereotyped expectations for nonverbal communicative behavior, Briton and Hall (1995) found that women were expected by members of both sexes to display greater skill at sending and receiving nonverbal messages. In this case, the researchers expected to

find such differences since women have been observed to use certain nonverbal expressions more than men (smiling and laughing) and were found to be better interpreters of facial expressions. Participants also rated men higher on expected use of dysfluencies such as stammering and interjections on interruptions, being restless, speaking too loudly, and on touching themselves during conversations.

In summary, it would appear that gender differences in communication are commonly expected to exist at many levels. Research confirms the existence of these expectations, without question. In some types of communication, these differences are shown to actually exist, and in others they are shown to be insignificant or nonexistent.

Of particular interest is the question of how the genders are perceived to express themselves differently in the form of communications disorders both congenital and acquired, if at all and whether or not actual differences exist according to scientific research. This paper has as its goal of meta-analytic study of research works related to gender differences in communication disorders both childhood and adult.

METHOD:

Included in the study are reviews of 1000 research works carried out in the field of audiology and speech-language pathology seeking gender differences in the communicative disorders. Both childhood and adulthood disorders were reviewed. Most of the studies indicated that there was a significant difference between the genders. Each disorder has been reviewed separately for various skills and evidence based research.

RESULT:

Meta-analysis findings across various communication disorders for tracing gender differences should varying results. Most of the childhood disorders were found to be dominant in males as compared to females. Whereas, adult communication disorders showed varying results for the gender ratio. Details for each disorders is been discussed.

MENTAL RETARDATION:

Gender is a critical determinant of mental health and mental illness. The morbidity associated with mental illness has received substantially more attention than the gender specific determinants and mechanisms that promote and protect mental health and foster resilience to stress and adversity.

LaVeck and LaVeck (1977) found that males are more susceptible for mental retardation compared to that of females. It is commonly accepted that more males than females are found in the population with mental retardation. Acccording to DSM IV (American Psychiatric Association, 1994) notes that "mental retardation" is more common among males, with male-to-female ratios of approximately 1.5 to 1. (Roelveld, Zeihuis & Garbreels, 1997; Stromme & Hagberg ,2000).

Other childhood disorders and their prevalence data is shown in table 1.

Table 1: Sex ratios for selected behavioral and mental disorders.

DISORDERS	SEX RATIO (MALE TO FEMALE)
Childhood	
Mental Retardation	1.5 to 1
Reading disability	1.5-4 to 1
Stuttering	3 to 1
Autism	4-5 to 1
Attention deficit disorder	4-9 to 1
Tourette's syndrome	1.5- 3 to 1
Substance-related disorder	
Alcohol, amphetamines, maujuana	M>F
Hallocinogens	3 to 1
Nicotine	M>F
Opioid	3-4 to 1

Hartung & Widiga (1998) Gender differences in the diagnosis of mental disorders: conclusions and controversies of DSM IV

DOWN'S SYNDROME:

Among the syndrome associated with Mental retardation, most common is Down's Syndrome. It has been argued that the Y chromosome is primarily responsible for males being more susceptible to mental illness' such as Down's syndrome. The male: female ration is 2-5:1 (Robert, 1979; and Epstein, 2006).

Richard (1982) explored reasons that boys are more likely than girls to be labeled as mildly mentally retarded. The reason behind that is, the master trait "boy" is associated with auxiliary traits (such as unpredictability and unmanageability) that resemble the auxiliary traits connected with mental retardation (such as maladjustment behaviors). So they often are diagnosed as having mental retardation with the milder degree, which is more of behavioral indicator. (LaVeck & LaVeck, 1977; & Coe, Matson, Russell, Slifer, Capone, Baglio & Stallings, 2004).

AUTISM:

More males than females are diagnosed with autism and Asperger syndrome. It is not difficult to demonstrate the fact that there are more boys with autistic spectrum disorders than girls. In epidemiological research Wing (1981) found that among people with high-functioning autism or Asperger syndrome there was as many as fifteen times as many males as females. On the other hand, when she looked at individuals with learning difficulties as well as autism the ratio of boys to girls was closer to 2:1. This would suggest that, while females are less likely to develop autism, when they do they are more severely impaired.This is also been supported by Kanner, 1943; Rimland, 1964; Lord , & Revicki , 1964;

Wing, 1981; Richard, 1982; Holtmann , Bölte S, & Poustka, 1982; Lord, & Schopler, 1987 ; Lord , Schopler & Revicki , 1999; Bernard , Rimland Skuse, 2000; Skuse, 2000; Catherine Lord , Schopler & Revicki ,2005; Baron-Cohen, Knickmeyer & Belmonte ,2005.

ASPERGERS SYNDROME:

Cohen, 1986 believes that autistic individuals and people with Asperger syndrome (AS) are examples of people with an "extreme male brain." In Kanner's 1943 study of a small group of children with autistic syndrome there were four times as many boys as girls. Similar findings were found in Wing, 1981; Lord and Schopler, 1987; and Copley, 2008.

Although there are 4 boys for every girl diagnosed with Asperger's Syndrome (AS), high-functioning girls with autistic spectrum disorders may not be as easy to recognize due to a number of differences in their social interactions and behavior. This results from the fact that girls are more inclined to adopt effective strategies to hide their differences in social situations. (Asperger, 1944; Gillberg, 1989; Ehlers & Gillberg 1993; McLennan, Lord & Schopler, 1993; Attwood, 2000; Mackintosh & Myers, 2006).

RETT SYNDROME:

Rett syndrome is a neurological and developmental disorder that mostly occurs in females. Most cases of Rett syndrome are caused by a mutation on the MECP2 gene, which is found on the X chromosome. Children with Rett syndrome have loss purposeful hand movement and speech (Rett, 1966 ; Aicardi, Dias, and Ramos 1983; Rett, 1986. ;Amir, Veyver, Wan, et al, 1999; Chen, Akbarian, Tudor & Jaenisch 2001; Hagberg, Hanefeld, Percy, & O. Skjeldal 2001; Moldavsky, Lev & Lerman-Sagie 2001; Magalhaes, Kawamura & Araujo 2002; Veyver & Zoghbi, 2002; Yasuhara & Sugiyama, 2002 ; Ausio, Levin, Amorim, et al, 2003. ; Bumin, Uyanik, Yilmaz, et al. 2003; Isaacs, Murdock, Lane &Percy 2003 ; Kadyan,. Clairmont, George & Johnson 2003. ; Liebhaber, Riemann & Baumeister 2003).

PERVASIVE DEVELOPMENTAL DISORDER OTHERWISE NOT SPECIFIED (PDD NOS):

Males with autism (with the PDD-NOS) were more frequent than females, particular at higher IQ levels. Sex differences were primarily confined to IQ; sex differences in other metrics of severity of autism were not prominent. (Volkmar , Szatmari , Sparrow, 1993; Volkma & Fred, 1993; Koyama1 , Kamio1, Inada1 & Kurita, 2008).

SPECIFIC LANGUAGE IMPAIRMENT:

At a population level, females are stronger empathisers and males are stronger systemisers. The reason behind it is females score higher on self-report scales of empathy, on samples ranging from school-age children to adults. Empathy scales include measures of perspective taking, orientation towards another person, empathic concern, and personal distress.

Baron-Cohen's EQ SQ Theory (2003) claims that, in general, men are better at systematizing (the desire to analyze and explore systems and rules) and that woman are better at empathizing (the ability to identify with other people's feelings). The "extreme male brain theory" posits that specific language impairment represents an extreme of the male pattern (impaired empathising and enhanced systemising) leading to specific language impairment. This is been supported by Baron-Cohen, Knickmeyer and Belmonte 2005**;** Jentschke, Koelsch, Leonard, Eckert, Given, Virginia and Eden, 2006; Sallat, and Friederici 2008).

HEARING IMPAIRMENT:

The average, annual prevalence rate for moderate to profound hearing loss is 1.1 per 1000. The prevalence rate increased steadily with age. Ninety percent of all cases for which the type of loss was recorded were sensorineural. The highest rate was seen among male children (1.4 per 1000). Thirty percent of case children had another neurodevelopmental condition, most frequently mental retardation. Male children also experienced the highest rate of presumed congenital hearing impairment. The mean age at which children with presumed congenital hearing impairment first met the surveillance case definition was 2.9 years. A probable etiology could only be found for 22% of cases born in the study area. (Naarden, Decouflé, & Caldwell, 1993 ; Wilson, et. al 1998; Duijvestijn , Anteunis , Hendriks & , 1999; Penningsa, et al., 2004).

CLEFT LIP AND PALATE:

Cleft lip and/or palate (CL/CP) is the most common craniofacial malformation with an estimated incidence of approximately 1 in 700 to 1 in 1000 live births among Caucasians. CL/CP may occur as an isolated finding or may be found in association with other congenital malformations. Sex ratios varied for different types of cleft lip and palate (Burdi & Silvey, 1969; Niswander , Chung , Maclean & Dronamraju 1972; Heyes , 1980 ; Miura, 1984; Myrianthopoulos, 1986)

DELAYED SPEECH AND LANGUAGE:

Boys more often than girls are affected by all the developmental disorders of childhood, which is even true in delayed speech and language development. Speech delay was 1.5 times more prevalent in boys than girls. (Shriberg, Lawrence, Bruce; McSweeney & Jane, 1999).

CEREBRAL PALSY:

Studies have reported gender-based brain structure differences in children born very prematurely. Premature males have significantly less white matter than age/sex-matched controls while there is no difference in white matter volume between premature females and age/sex-matched controls (Hagberg, 2006). Males have a higher incidence than females of several brain-based developmental disabilities including mental retardation, autism, attention deficit hyperactivity disorder and cerebral palsy **(**Johnston**,** 2007**)**.

LEARNING DISABILITY:

Differences in the etiology of learning disabilities as well as general sex differences in learning styles in boys versus girls may explain the male preponderance in the prevalence of learning disabilities. (Hier. 1979. Leinhardt, Gaea; Seewald, Andrea 1982; Zigmond & Naomi, 1982; Nass 1993).

MISARTICULATIONS:

Boys required significantly more often (34%) speech therapy than girls (14%) for problem with articulations (Bottell & Clark, 1992). The most resistant to the treatment was the /r/ sound, since 64% of previously treated children still misarticulated it. Also the /s/ and /l/ sounds were rather resistant to treatment because the /s/ sound was still misarticulated by 38% and the /l/ sound distorted by 35% of treated subjects.

PHONOLOGICAL DISORDERS:

A robust finding in studies of familial speech and language disorders has shown a higher prevalence of phonological disorders in males than in females, ranging from a 2:1 to a 3:1 ratio (Neils & Ara, 1986; Tallal et. al., 1989; Tomblin, 1989). Explanations for this increased prevalence in males include referral bias (Shaymitz, et. al, 1990), immunoreactive theories (Robinson, 1991), difference in rates and patterns of neurological maturation (Plante, 1990), variation in cognitive phenotypes (Bishop, North & Donlon, 1995) and difference in genetic transmission of the disorders. Sex differences were reflected in the incidence but not the severity or type of phonological disorders present. These findings suggest a familial basis for at least some forms of severe phonological disorders. **(**Lewis & Ekelman, 1989 ; Majeres 2007).

STUTTERING:

The epidemiological studies of people who stutter at many ages and in many cultures put the ratio at about three male stutterers to every one female stutterer. However that ratio may increase as children get older (Porfert & Rosenfield, 1978). Other studies show difference in this ratio. Male : female ratio of 2.1:1 (Ambose, 1992b), 3:1 to 5:1(first grade to fifth grade by Bloodstein, 1995) and 1.65 :1 to 2.8:1 (Mansson, 2000). West, 1931 presented data indicating that change in sex ratio was the result of an increasing proportion of boys beginning to stutter in late preschool and early school age years.

APHASIA:

Prevalence of aphasia is found to be varying in nature. There is no significance difference between the genders in the occurrence of this disorder. Although no initial sex difference was found in severity of language disorders, females within the global aphasic group showed significantly greater improvement in three tests of language comprehension. (Pizzamiglio, Mammucari & Razzano, 1985; Pedersen, Jorgensen & Roquer 1986; Campello & Gomis, 2003; Nakayama, Raaschou & Olsen, 2004).

SCHIZOPHRENIA:

Schizophrenia is another disease that affects men and women differently. Differences include age of onset, symptoms and the time course of the disease. In addition, structural brain differences are apparent. According to Cahill (2004), "men with schizophrenia show significantly larger ventricles than do healthy men, whereas no such enlargement is seen in women with schizophrenia." Also few studies suggest that the determinants of gender differences occur during the premorbid period and are manifest early in the development of the disorder Aleman, Kahn, Selten, 2003; Goldstein, 1993; Hafner, Maurer,Loffler and Rossler , 2003). Clinical gender differences in schizophrenia have especially been confirmed regarding age at onset. Less consistent are the findings concerning differences in symptoms and course of the disease. (Hafner & colleagues, 1998; Riecher-Rossler & Hafner, 2000, Riecher-Rossler & Hafner, 2000; Riecher-Rossler & Hafner, 2000).

ALZHEIMER'S DISEASE:

The prevalence of Alzheimer disease is higher in women than in men. In the age group 65-69 years 0.7% of women and 0.6% of men suffer from the disease with increasing frequencies of 14.2% and 8.8% in individuals aged 85-89 years. The incidence is also higher in demented women. In Austria 74.1% of Alzheimer patients older than 60 years are women. Several studies report more pronounced language, mnestic, semantic and orientation deficits in women, but methodological shortcomings might be responsible for this finding. .(Schmidt et. al, 2008 ; Laws et al. 2009; Raghavan , et. al, 2009). Women are not at higher risk of developing dementia, but there is a hint that different genetic processes may be involved for women than for men. (Gatz, Fiske, Reynolds, Wetherell, Johansson & Pedersen, 2004)

DEPRESSION:

Depression is found to be most common in females. Although artefactual determinants may enhance a female preponderance to some extent, gender differences in depressive disorders are genuine. At present, adverse experiences in childhood, depression and anxiety disorders in childhood and adolescence, sociocultural roles with related adverse experiences, and psychological attributes related to vulnerability to life events and coping skills are likely to be involved. Genetic and biological factors and poor social support, however, have few or no effects in the emergence of gender differences (Piccinelli, 2000). Many factors unique to women are suspected to play a role in developing depression. Research is focused on understanding these factors, including: reproductive, hormonal, genetic or other biological factors; abuse and oppression; interpersonal factors; and certain psychological and personality characteristics. But, the specific causes of depression in women remain unclear.

DISCUSSION:

Gender determines the differential power and control men and women have over the socioeconomic determinants of their mental health and lives, their social position, status and

treatment in society and their susceptibility and exposure to specific mental health risks. In the present meta-analytic study of 1000 reviews it was found that abundance of males can be seen at both more severe and milder level of mental retardation and across studies performed many years apart and with differing methodologies. Sex differences in the major categories of childhood behavior disorders and is most relevant to the issue of continuity between child and adult disorders. It was found that males were dominant than females in most of the childhood psychopathologies. Gender differences occur particularly in the rates of common mental disorders - depression, anxiety and somatic complaints.

Overall males tend to be more susceptible to organic damage than girls, whether through hereditary disease, acquired infection or other conditions. Since it is now almost universally accepted that there is an organic cause for most of the communication disorders, it should not be surprising that boys are more vulnerable to it than girls.

Other reports demonstrated that major differences between male and female neurons grown separately in cell culture, suggesting that sex differences in the fetal or neonatal period result from intrinsic differences in cell death pathways. This new information indicates that there are important neurobiological differences between males and females with respect to their response to brain injuries. This would account for the differences between them in various disorders.

On the other hand lower overall verbal ability as well as an inability to spare certain language skills effectively in the face of either unfavorable cerebral asymmetries or early life left hemisphere insults may partially explain the excess of developmental language disorders (and dyslexia in particular) in boys.

Depression is not only the most common women's mental health problem but may be more persistent in women than men. More research is needed.

Evidence for sex differences in cognitive function decline and dementia is mixed. This is in part because population-based data comparing the cognitive function decline in men and women are mainly cross-sectional.

CONCLUSION:

More male preponderance than female is identified among developmental and childhood disabilities with respect to communication disorders. Out of 1000 studies except for the studies on Rett's Syndrome supported this view. In adult disorders, they remain equivocal. That is, stuttering alone is the adult disorder which has more prevalence rate in men compared to women. Whereas other studies indicate that depression and Alzheimer's disease affect more women than men. But other acquired disorders such as Aphasia and Schizophrenia occur both in males and females variably. Major domains of difference included age of onset, prognosis, familial inheritance and neurological maturation in children and severity, prognosis and etiological factors in adults with communication disorders.

REFERENCES:

Andre A, Kahn, R. S., Selten, J. P. (2003). Sex Differences in the Risk of Schizophrenia Evidence from Meta-analysis. Archives of Genetic Psychiatry. 60, 565-571.

Baron-Cohen, S., Rebecca, C. K., Belmonte, K. M. (2005). Sex Differences in the Brain: Implications for Explaining Autism. Science. 310. 5749, 819 – 823.

Baglio, C. & Stallings, S (1999). Behavior Problems of Children with Down Syndrome and Life Events. Journal of Autism and Developmental Disorders. 29, 2 , 149-156.

Buss, D. M. (2003). The evolution of desire: Strategies of human mating. New York: Basic Books. (ISBN 0-465-02143-3).

Clark, R. A. (1993). Men's and women's self-confidence in persuasive, comforting, and justificatory communicative tasks. Sex Roles. A Journal of Research, 28, 553-568.

Epstein, C. J. (June 2006). Down's syndrome: critical genes in a critical region. Nature 441 (7093): 582–3.

Ehlers, S. & Gillberg, C. (1993): The Epidemiology of Asperger syndrome. A total population study. Journal of Child Psychology and Psychiatry. 34 (8), 1327-1350.

Geary, D. C. (2002). Sexual selection and sex differences in social cognition. In A. V. McGillicuddy-De Lisi & R. De Lisi (Eds.), Biology, society, and behavior: The development of sex differences in cognition (pp. 23-53). Greenwich, CT: Ablex/ Greenwood.

Harper, E. B., Howing, W. K., Holm, G. & Dubanovsky, I. (1965) Young Children's Yielding to False Adult Judgment. Child Development, 17, 175-183.

Hartung, C. M. & Widiga, T. A. (1998). Gender differences in the diagnosis of mental disorders: conclusions and controversies of DSM IV. Psychological Bulletin, 123 pg. 260.

Hier, D. B. (1979). Sex differences in hemispheric specialization: Hypothesis for the excess of dyslexia in boys . Annals of Dyslexia. 29, 1, 135-141.

Mc Coby, E. E. (1966).The Development of Sex Differences. Stanford University Press, Stanford, California.

Nass, R. D. (1993). Sex differences in learning abilities and disabilities. Annals of Dyslexia. 43, 1, 134- 142.

Robey, R. (1998). A meta-analysis of clinical outcomes in the treatment of aphasia. Journal of Speech, Language and Hearing Research, 41, 172-187.

Wing, L. (1981) Sex ratios in early childhood autism and related conditions. Psychiatry Research, 5, pp. 129-37.

Volkmar, F. R., Szatmari, P. & Sparrow, S. S. (1993). Sex differences in pervasive developmental disorders. Journal of Autism and Developmental Disorders. 23(4), 579-91.

(Note: only selected references have been included. For detailed references can contact the authors)

S.L.H.D:-2

BENCHMARK FOR SPEAKER IDENTIFICATION USING GLOTTAL SOURCE PARAMETERS IN HINDI SPEAKERS

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Human beings have many characteristics that make it possible to distinguish one individual from another. Some individuating characteristics can be perceived very rapidly such as facial features vocal quality and behaviors. Voice is the very emblem of the speaker, indelibly woven into the fabric of speech. In this sense each of our utterances of spoken language carries, not only its own message, but through ones accent, tones of voice and habitual voice quality also. It is also an audible declaration of our membership of a particular regional group, of our individual physical and psychological identity, and of our momentary mood. Thus the voice of an individual is said to be having its own characteristics and distinct distinguishable quality.

Studies concerned with methods for identifying persons are important because of the legal ramifications and because of the forensic involvements associated with the application of these studies. Finger printing, photographic and anthropometric techniques are the most commonly used methods of identification. In the present era of widely used telephone, radio and tape recorder communication, the voice of an individual is often the only available clue for identification. The problem that speaker recognition possesses is essentially different from the problem of any type of technique of identification using clues that are invariant. Indeed the voice of an individual is far from being invariant. Usually no person utters the same word twice with all characteristics being exactly the same.

Speaker recognition is any decision making process that uses speaker dependent features of the speech signal (Hecker, 1971). Atal (1976) suggests that speaker recognition is any decision making process that uses some features of the speech signal to determine if a particular person is the speaker of a given utterance. Nolan (1983) identified two classes of speaker recognition - speaker identification and speaker verification. Speaker recognition includes two sub-fields (a) naive speaker recognition and (b) technical speaker recognition. Technical speaker recognition is usually called as "Speaker Identification by expert" which uses specialized techniques (Nolan, 1983). Hecker (1971), Bricker & Pruzansky (1976) identified three methods of speaker recognition (a) by listening (b) by visual inspection of spectrograms and (c) by machine.

In speaker verification an identity claim from an individual is accepted or rejected by comparing a sample of his speech against a stored reference sample by the individual whose identity he is claiming (Nolan, 1983). An utterance from an unknown speaker has to be attributed, or not, to one of a population of known speakers for whom reference samples are available. Here only two types of decision are possible, either the unknown sample is correctly identified or it is not. The goal of speaker identification is to determine which one of a group of known speakers' best matches the test speech sample. Speaker identification can be constrained to a known phrase (text-dependent) or totally unconstrained (text-independent).

Speaker identification by listening is far from being 100% accurate. It is entirely a subjective method, an expert witness using only this method would be not so able to justify his conclusion in a court of law. However speaker gender identification judgments can be made fairly accurately by listening -96% correct (the voiced tape), 91% correct (the filtered tape), and 75% correct (the whispered tape) (Lass, Hughes, Bowyer, Waters, and Bourne 1976). However certain vocal disguises markedly interfere with speaker identification by listening. Nasal disguise was the most effective (Reich and Duke, 1979).

Speaker identification based on Visual inspection of spectrograms is the second method of speaker recognition based upon the visual examination and comparison of the spectrograms. Spectrogram is a three dimensional (time, amplitude, and frequency) display of speech sounds. These were used in attempts to identify unknown speakers by matching their speech/ voice patterns with those of known speakers (or suspects). However the spectrograms of different utterance of the same word or phrase by the same or by the different speakers are never exactly alike. Earlier studies on use of this method has indicated mean error percentage of 6 % (Tosi, 1968)and 21% (Stevens, Williams, Carbonell, and Woodsi, 1968).These scores depended upon the talker, the subject, and the phonetic content and duration of the speech material.

Extracting speaker dependent parameter from the signals and analyzing them by machines is an objective method. This can be ***semi-automatic or automatic***. In the semi-automatic method, there is extensive involvement of the examiner with the computer, whereas in the automatic method, this contact is limited. In the semi-automatic speaker identification (SAUSI), the examiner selects unknown and known samples (similar phonemes, syllables, words and phrase) from speech samples, which have to be compared, i.e. computer processes these samples, extracts parameters and analyzes them according to a particular program. The examiner makes the interpretation. In the automatic method the computer does all the work and the participation of the examiner is minimal. For

the purpose of automatic identification, special algorithms are used which differ based on the phonetic context. This method is used very often in forensic sciences but factors such as noise and distortion factors of voice and other samples need to be controlled. In such case a combination of subjective and objective methods should be used. In the past pitch, intensity, phonemic voicing patterns (Hecker, 1971), long-term speech spectra (Hollien and Majewski, 1977), fundamental frequency (Abberton and Fourcin, 1978), Cepstral parameterization (Plumpe, Quatieri and Reynolds, 1999), fundamental frequency, the third and fourth formants, and the closing phase of the glottal wave (Lavner, Gath and Rosenhouse, 2001), and four formants (F1, F2, F3, F4), the amount of periodic and aperiodic energy in the speech signal, the spectral slope of the signal and the difference between the strength of the first and second harmonics (Carol Epsy-Wilson, Sandeep and Vishnubhotla, 2006) have been used. Pamela (2002) studied the reliability of voice prints. Within the preview of her study, it was suggested that two samples can be considered to be from different speakers when more than 67% of measurements are different in natural speaking condition. But the validity of this method is still in question. Jakhar (2009) used quefrency for benchmarking and obtained benchmark of 88.33 %(live vs. live), 81.67% (mobile phone vs. mobile phone) when 5 Hindi speakers were considered. Prasanna (2009) used formants F1- F2 for benchmarking and obtained benchmark of 70% for vowel /i: /, 65% for vowel/a: / and benchmarking for other vowels were below chance level when 5 speakers were considered. However, question regarding the most appropriate speech parameter for semi automatic/automatic speaker identification in real forensic condition are still far from being answered. To prove that the suspect is a criminal, it needs to be verified beyond reasonable doubt that the voice of the criminal and voice of the suspect are the same. Success in this task depends on extracting speaker-dependent features from the speech signal that can effectively distinguish one speaker from another. It is not known as to what percent matching would indicate similarity/dissimilarity of speaker or benchmarking of various features is not established. In this context, the present study was planned. The aim of the present study was to determine the ***benchmark for speaker identification using glottal source parameters in field recording condition***.

Method

Subjects: Ten normal Hindi speaking male subjects in the age range of 21-40 years participated in the study. The participants passed at least 10th standard. All speakers will belong to same dialect. The inclusion criteria of subjects are (a) no history of speech, language and hearing problem (b) normal oral structures and (c) no other associated psychological and neurological problems.

Material: The long vowels /a: /, /i: /, /u: / occurring in nine Hindi words were selected; these were embedded in three sentences in word - medial position. Table 1 shows material used in the study. The material was taken from the databank prepared by Jakhar (2009).

Sl. No	Sentences
1	/ham ga:y ka du:dh pi:te hai/
2	/gi:ta ne pu:ja ka ka:m kiya/
3	/veh pu:re ti:s din ba:d a:ya/

Table 1: Test material.

Procedure: Subject's consent to participate in the study was obtained. Subjects were instructed to speak the sentence normally three times. Recording was done by using Olympus voice recorder and the data was transferred to computer memory using Cool edit software. Speech samples were digitized at 8000 Hz. Each word was truncated from the sentence and stored onto the computer memory.

Analysis: The vowels in the key words were perceptually judged for the proper occurrence and accuracy. The keywords in the sentence was displayed as a wave form and were acoustically zoomed to extract the source and the filter parameters using Acophone I and the SSL software (Voice and Speech Systems, Bangalore).The steady state of the vowel was displayed and analyzed using SSL software. The glottal source parameters open quotient and leakage quotient were extracted in 10 steady state points of each of the vowels. Open quotient is defined as the ratio of the glottal open time over the fundamental period (OT/TT). It is a dimensionless parameter, ranging from 0 ~no opening to 1 ~no or incomplete closure. Leakage quotient LQ is defined as TL/OL where TL is the interval from epoch to baseline and OL is the total pitch period. A vector of LQ and OQ was obtained based on which the benchmarking will be provided. In elementary mathematics, physics, and engineering, a vector (sometimes called a geometric or spatial vector) is a geometric object that has both a magnitude (and length), direction and sense, (i.e., orientation along the given direction).

For each vowel thirty values were obtained in a single recording and for three recordings, in total ninety values were obtained. In the present study two variables were considered i.e., vowels and number of known speakers. Percentages of correct identification of different number of known speakers were examined. The OQ-LQ values of first recording of all vowels were taken as that of known speaker and average of thirty values of second and third recording were taken that of unknown speaker. All five speakers were randomly listed as speaker 1 to speaker 5 and corresponding unknown speakers were assigned US1-US5. One unknown speaker was compared with the 5 known speakers. Closed set speaker identification task was performed, in which the examiner was aware that the "unknown" speaker was among the known ones. The OQ-LQ was plotted with on LQ vertical axis and OQ on horizontal axis. If the distance between the unknown and corresponding known speaker was less, then

speaker was deemed to be correctly identified, if the distance between unknown speaker and corresponding known speaker are more than the speaker was deemed to be not identified correctly. The percent identification was calculated using the following formula:

$$\text{Percent correct identification} = \frac{\text{Number of correct identification} \times 100}{\text{Number of total identification}}$$

Statistical analysis: For the purpose of statistics the OQ and LQ were multiplied to make a vector. The mean and standard deviation for vowels /a: /, /i:/ and /u:/ for each trial for all speakers were calculated and significant differences within and between subjects were calculated.

Results

The vowel /a:/ had highest OQ-LQ followed by /u:/ and /i:/ for all speakers in general. Speaker 2 had highest mean of LQ-OQ on vowel /a/ on three trials. For vowels /i/ and /u/ there is variability in mean across trials in all speakers as shown in table 1.

identification. If the distance between the unknown and corresponding known speaker was less, then speaker was deemed to be correctly identified, if the distance between unknown speaker and corresponding known speaker are more than the speaker was deemed to be not identified. Figures 3-6 show correct identification of speaker in field recording condition, and figures 6-9 show false identification in field recording condition

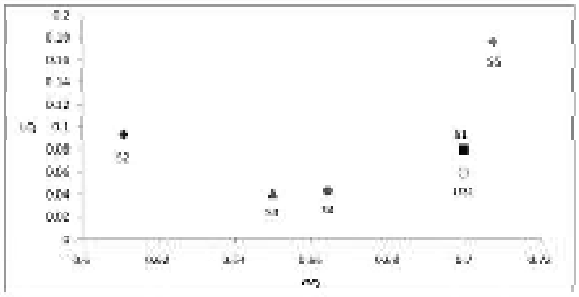


Figure 1: Correct identification of US1 with S1.

Speaker	a1	a2	a3	i1	i2	i3	u1	u2	u3
1	0.0562	0.041	0.045	0.022	0.026	0.023	0.0713	0.0497	0.058
	(0.021)	(0.012)	(0.041)	(0.016)	(0.022)	(0.02)	(0.03)	(0.0196)	(0.021)
2	0.0575	0.0559	0.056	0.028	0	0.034	107	0.0353	0.0654
	(0.03)	(0.026)	(0.023)	(0.029)	(0)	(.033)	(0.01)	(0.03)	(0.037)
3	0.0269	0.0235	0.025	0.0137	0.021	0.02	.101	0.0792	0.046
	(0.011)	(0.014)	(0.033)	(0.0177)	(0.024)	(0.032)	(0.046)	(0.014)	(0.009)
4	0.029	0.036	0.0364	0	0	0.0033	0.033	0.026	0.033
	(0.0156)	(0.0086)	(0.016)	(0)	(0)	(0.008)	(0.037)	(0.038)	(0.045)
5	0.131	0.177	0.051	0.018	0.0037	0.0058	0.07	.207	0.099
	(0.406)	(0.548)	(0.02)	(0.0122)	(0.37)	(0.03)	(0.036)	(0.008)	(0.028)

Table 2: Mean and SD of 30 observations (3words *10 observations) of OQ (LQ) for each vowels /a:/, /i:/, /u:/ for three trials

Within speakers: Results of Friedman test showed no significant difference for vowels /a: /, /i: / and /u: / (P>.05) within speaker, and significant difference across vowels /a: /, /i: /, and /u: / (p<05) within speaker across trials**.** The results of Friedman test showed (a) no significant difference for vowel /a: / across trials for all five speakers (P>.05), (b) no significant difference between two speakers (1&3) across trial for vowel /i:/, and (c) significant difference across trials for speakers (2, 4 &5). Pair wise comparison using Wilcoxon test indicated significant difference between two pairs of trials and no significant difference in one pair in all 3 speakers.

Results of Friedman test showed no significant difference for vowel /u:/ (p>.05) for two speakers (4&5) across recordings. Others speakers (1, 2&3) showed a significant difference across recordings. Pair wise comparison showed difference between two pairs in all samples except in speaker 2. **Between speakers:** The OQ-LQ was plotted with OQ on horizontal axis and LQ on vertical axis for a group of 5 known speakers versus one unknown speaker. A total of 30 figures (3 vowels *5 speakers *2 recordings) were plotted for speaker

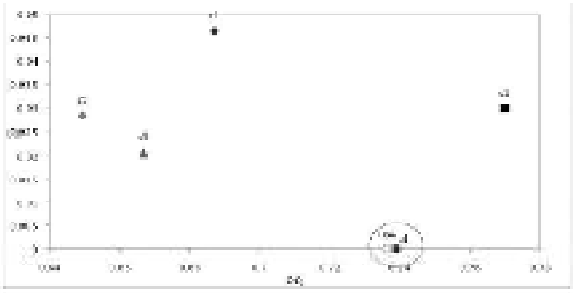


Figure 2: Correct identification of US4 with S4.

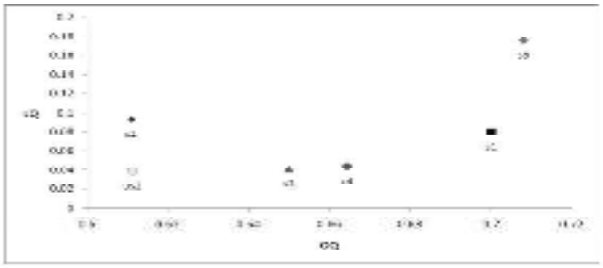


Figure 3: Correct identification of US2 with S2.

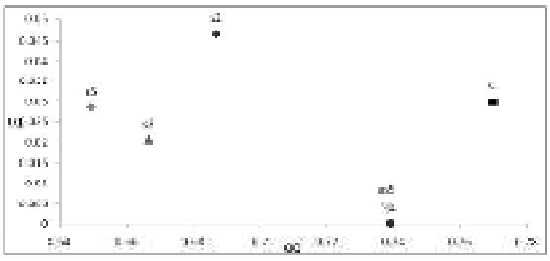


Figure 4: False identification of US5 with S4

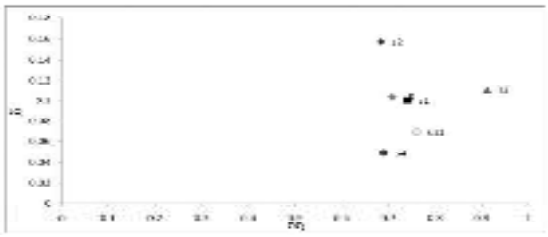


Figure 5: False identification of US1 with S4.

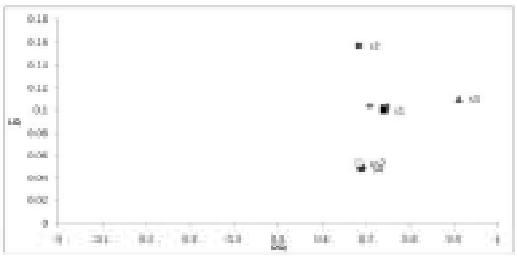


Figure 6: False identification of US2 with S4

The results indicated that the benchmarking depends on the vowels. The percent correct identification for 3 vowels /a:/, /i:/ and /u:/ is shown in Table 3.

% correct identification		
/a:/	/i:/	/u:/
50%	40%	20%

Table 3: percent correct identification of speakers in field recording.

Discussion : The present study investigated the acoustic similarity and difference within speaker in field recording condition. The results reveal several points of interest. In field condition within speaker the OQ-LQ was similar for 50%, 40%, and 20% for vowel /a: / /i: and /u: /, respectively. Benchmarking using vectors OQ * LQ were at chance/ below chance level for speaker identification. Plumpe, Quatieri and Reynolds (1999) reported that while traditional speaker identification systems rely on the vocal tract dynamics, addition of source information can prove to be valuable speaker-specific information. He suggested the use of parameters obtained from the time-domain glottal source description in speaker identification experiments. The results of the present study are not in consensus with the observations of Plumpe et.al (1999) as the benchmarking obtained was poor.

Jakhar (2009) used quefrency for benchmarking and obtained benchmark of 88.33 %(live vs. live), 81.67% (mobile phone vs. mobile phone) when 5 Hindi speakers were considered. Prasanna (2009) used formants F1- F2 for benchmarking and obtained benchmark of 70% for vowel /i:/ ,65% for vowel/a:/ and benchmarking for other vowels were below chance level when 5 speakers were considered. The benchmark in present study is poorer compared to that of Jakhar (2009) and Prasanna (2009).

The result of the present study has contributed to the field of speaker identification. In general it could be concluded that the vector OQ * LQ can not be considered as an efficient parameter for speaker identification in field conditions. However, the results cannot be generalized to other conditions and disguised speech. The results cannot be generalized as it depends on vowel, language and recording conditions. The present study used samples of field recording which might have added on to the disadvantage. However future studies in laboratory recording, inclusion of more subjects, and speaker identification under disguise conditions are warranted.

References

Abberton, E., and Fourcin, A. J. (1978). Intonation and speaker identification. *Language and Speech* .21: 305-318.

Atal, B.S. (1976).Automatic recognition of speaker from their voices, *Proc.IEEE* 64/4:460-75

Bricker, P. S., and Pruzansky, S.(1976). Speaker recognition: *Experimental Phonetics.* London: Academic Press.

Campbell, J. (1997). Speaker recognition: A tutorial. *Proc. of the IEEE*, 85:1437-1462.

Carol, Epsy-Wilson, Sandeep, M., and Vishnubhotla, S.A. (2006). *New Set of Features for Text-Independent Speaker Identification.* Institute for Systems Research and Dept. of Electrical & Computer Engineering, University of Maryland, College Park, MD, USA.

Hecker, M. H. L. (1971). Speaker Recognition: Basic considerations and methodology. *The Journal of the Acoustical Society of America. 49:138-138.*

Hollien, H. (1974). The Peculiar case of 'Voice print'. *The Journal of the Acoustical Society of America.* 56:210-213

Hollien, H., and Majewski, W. (1977). Speaker identification by long-term spectra under normal and distorted speech conditions. *The Journal of the Acoustical Society of America.* 62:975-980.

Jakhar, S.S. (2009). Benchmark for speaker identification using Cepstrum. Unpublished dissertation submitted to the University of Mysore.

Lass, N. J., Hughes, K. R., Bowyer, M. D., Waters, L. T., and Bourne, V. T. (1976).Speaker sex identification from voiced, whispered and filtered isolated vowels. *The Journal of the Acoustical Society of America.* 59: 675–678.

Lavner, Y., Gath, I., Rosenhouse, J. (2000). The effects of acoustic modifications on the identification of familiar voices speaking isolated vowels. *Speech Communication*, 30: 9-26

Lavner, Y., Gath, I., Rosenhouse, J. (2001). The Prototype

Model in Speaker Identification by Human Listeners. *International Journal of Speech Technology*, 4: 63-74.
Nolan, F. (1983). *Phonetic bases of speaker recognition.* Cambridge: Cambridge University Press
Pamela, S. (2002). Reliability of voice prints, unpublished dissertation submitted to the University of Mysore.
Plumpe, M., Quatieri, T., & Reynolds, D. (1999).Modeling of the glottal flow derivative waveform with application to speaker identification. *IEEE Trans. Speech and Audio Proc*, 1: 569-586.
Prasanna, L. (2009).Benchmark for speaker identification using glottal source parameter, unpublished dissertation submitted to the University of Mysore.
Rose, P. (2002).*Forensic Speaker Identification*. New York: Taylor and Francis.
Reich, A. R., and Duke, J. E. (1979). Effects of selected vocal disguises upon speaker identification by listening. *The Journal of the Acoustical Society of America*.66: 1023-1028.
Savithri, S. R. (2008). *Acoustic Similarities and difference within and between speakers*. AIISH Research fund Project.
Stevens, N.K., Williams, E. C., Carbonell, R.J, and Woodsi, B. (1968). Speaker Authentication and Identification: A comparison of spectrographic and auditory presentations of speech material. *The Journal of the Acoustical Society of America*.44: 1596-1607
Tosi, O. (1968). Speaker Identification through Acoustic Spectrography. *Logopedics Phoniatrics.*15; 138-145
Tosi, O., Oyer, H. J., Lashbrook, W., Pedrey, C., Nichol, J. and Nash, W. (1972). Experiments on voice Identification. *The Journal of the Acoustical Society of America*. 51: 2030-2043
Young, M.A. & Campbell, R.A. (1967). Effects of context on talker identification, *The Journal of the Acoustical Society America*, 42: 1250-1254.

Acknowledgments: The author would like to thank Mr. S. S. Jakhar for willingly sharing the database. She thanks Dr. Vijayalakshmi Basavaraj, Director, AIISH, Mysore for permitting her to conduct the study and Dr. S. R. Savithri, Prof. in Speech Sciences for her guidance.

S.L.H.D:-3

COMPARISON OF MARKEDNESS IN LEXICAL SEMANTIC ABILITIES IN NORMAL CHILDREN AND IN CHILDREN WITH HEARING IMPAIRMENT

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INTRODUCTION: Any patterns that are present but uncommon in the languages of the world (or in a specific language) are termed as markedness features (Veeman, 1998). The notion of markedness applied to the semantics of a particular language: using the term unmarked refers to the more general or expected element of a pair of opposites. In its most general sense, this distinction refers to the presence versus the absence of a particular linguistic feature (Crystal, 1980). A marked form is a non-basic or less-natural form. An unmarked form is a basic, default form. For example, lion is the unmarked choice of English – it could refer to a male or female lion. But lioness is marked because it can only refer to females.

The concept of markedness follows naturally from the concept of universals. Structures that are consistent with universals are considered unmarked, and those that are inconsistent with universals are considered marked. The markedness theory implies that the unmarked members should be easier to process, recall and learn and hence, acquired early in childhood. It is hypothesized that aphasics tend to lose the marked forms earlier and unmarked forms later. It is also claimed that unmarked forms are regained earlier and marked ones later. There have been very limited studies in the Indian context. Hence, the present study was undertaken.

The present study aims to investigate whether the so called marked words (semantically complex words) form a part of the vocabulary of normal children and those with delayed speech-language due to hearing impairment. Though the markedness theory is widely accepted theory in linguistics, its practical implications for language use and especially speech and language disorders are yet to be established .This study aimed at establishing the clinical relevance of the theory and the findings are likely to contribute immensely to our knowledge and understanding of linguistic behavior. A list of 84 pairs of marked and unmarked words was designed as stimuli for the task of naming. 20 children (age-range: 5- 10 years) in each of the groups of typically developing, and hearing impairment comprised the subjects of the study. The presence or absence of marked or unmarked forms in each of these groups were investigated.

REVIEW OF LITERATURE

Semantics (Greek semantikos, giving signs, significant, symptomatic, from sema, sign) refers to the aspects of meaning that are expressed in a language, code, or other form of representation. By the usual convention that calls a study or a theory by the name of its subject matter, semantics may also denote the theoretical study of meaning in systems of signs. Though terminology varies, writers on the subject of meaning generally recognize two sorts of meaning that a significant expression may have: the relation that a sign has (1) to objects and objective situations, and (2) to other signs, especially the sorts of mental signs that are conceived of as

concepts

Lexical semantics is a subfield of linguistics. It is the study of how and what the words of a language denote (Pustejovsky, 1995). Words may either be taken to denote things in the world, or concepts, depending on the particular approach to lexical semantics. Lexical semantics studies the meanings of words; the focus here is on 'content' words like tiger, daffodil, inconsiderate, and woo, rather than 'form' words / 'grammatical' words like the, of, than, and so on (Cruse, 2004). Lexical units are the words so lexical semantics involves the meaning of each individual word. . Lexical semantics is the one area of linguistics to which we can continually add throughout our lives, as we are always learning new words and their meanings whereas we can only learn the rules of our native language during the critical period .

Markedness: some views and observations

An analytic principle in linguistics whereby pairs of linguistic features, seen as oppositions, are given different values of positive (marked) and neutral or negative (unmarked). In its most general sense, this distinction refers to the presence versus the absence of a particular linguistic feature (Crystal, 1980). There is a formal feature marking plural in most English nouns, for example; the plural is therefore 'marked', and the singular is 'unmarked'. The reason for postulating such a relationship becomes clear when one considers the alternative, which would be to say that the opposed features simply operate in parallel, lacking any directionality. Intuitively, however, one prefers an analysis whereby dogs is derived from dog rather than the other way round- in other words, to say that 'dogs is the plural of dog', rather than dog is the singular of dogs'. Most of the theoretical discussion of markedness, then, centres on the question of how far there is intuitive justification for applying this notion to other areas of language (cf. prince/princess, happy/unhappy, walk/walked, etc.).

One of the earliest uses of the notion was in Prague school phonology, where a sound would be said to be marked, if it possessed a certain distinctive feature (e.g. +voice), and unmarked (used in cases of neutralisation) if it lacked it. Several other interpretations of the notion of marking are found in the literature, where the concept of 'presence vs. absence' does not readily apply. One interpretation relates marking to frequency of occurrence, as when one might say a falling intonation pattern was unmarked, compared with a rising one, because it is more common.

Criteria for Markedness: Markedness is one of the most widely, and wildly, used terms in linguistics, and its senses range from a very narrow, structure-based notion of relative complexity to an extremely open sense of "unusual" or "unnatural." A recent definition of markedness located somewhere in the middle of the continuum is put forward by Givón (1995), who writes that "three main criteria can be used to distinguish the marked from the unmarked category in a binary grammatical contrast:

(a) Structural complexity: The marked structure tends to be more complex (or larger) than the corresponding unmarked one.

(b) Frequency distribution: The marked category (figure) tends to be less frequent, thus
cognitively more salient, than the corresponding unmarked category (ground).

(c) Cognitive complexity: The marked category tends to be cognitively more complex—in terms of mental effort, attention demands or processing time—than the unmarked one." (Givón 1995). For instance, (Givón, 1991) claims that passive structures are more difficult to process than active structures

Of these three criteria, (a) is the least controversial and the most universally accepted: given the contrast between two (comparable) signs A and B, the more complex of the two is the marked one. The second and third items on Givón's list, however, are much less straightforward. Greenberg (1966) emphasized the importance of frequency for markedness, asymmetries, and he was the first to assign it an explanatory role in this context. "To some extent, we can equate the term 'unmarked' with 'regular', 'normal', 'usual'; and 'marked' with 'irregular', 'abnormal', 'exceptional', or 'unusual'" (Radford 1988:39). "...the typical pattern or property is called unmarked, the atypical one marked " (Archangeli 1992). Furthermore, Baayen et al. (1997), explicitly define "marked form" (of a singular-plural pair) as the form which occurs more frequently.

In another instance, Haiman (1985:148) rejects the identification of semantic markedness with semantic complexity: "a concept may be marked because it is relatively unfamiliar or infrequent" (his example is female hippo, which is not semantically more complex than mare). Levinson (2000:136) uses the expression "marked situation" in the formulation of one of his central principles, as a synonym of "abnormal", or "rare in the world". Categories that are cognitively marked tend also to be structurally marked." (Givon, 1991,1995) "[Iconicity of complexity] Marked forms and structures are typically both structurally more complex (or at least longer) and semantically more complex than unmarked ones. (Newmeyer, 1992)

According to Chomsky (1981), the theory of markedness "imposes a preference structure on the parameters of UG (Universal Grammar). In the absence of evidence to the contrary, unmarked options are selected". In other words, "the unmarked case of any parameter represents the initial hypothesis that children make about the language to be acquired" (Kean 1992; Haider 1993). In Chomsky & Halle (1968), the idea was proposed that markedness values are not just present in language – particular mental grammars, but are in some way defined at the level of the innate cognitive code for language (Universal Grammar or UG).

Therefore, markedness abilities give us an overview of semantic abilities of children in both normal children and in children with language disorders. But there is limited number

of studies on markedness abilities in Indian context and also there are no studies available for this in language disordered children. Therefore, there is a strong need to study the development of these markedness abilities in normal children and in children with hearing impairment.

Aim of the study : To study whether the so called marked words (semantically complex words) form a part of the vocabulary of children with hearing impairment and were compared with the normal subjects.

Thus, the current study attempts to answer the following research questions:

- Are the marked words selectively missing in the clinical population as against the unmarked ones?
- If the marked forms are present, does it imply that the unmarked forms are already acquired?
- Conversely, does the teaching of marked forms facilitate automatic acquisition of the corresponding unmarked ones?

METHOD

Subjects: A total of 95 children comprising of both normal children and children with HI were taken for this study. 75 normal children in the age range of 5 – 10 years were grouped into five groups with age interval of one year with each group consisting of 15 children. 20 children with HI in the age range of 5 – 10 years were categorized into five groups based on their chronological age with each group consisting of 4 children.

All the normal children were native speakers of Kannada and had English as their medium of instruction in school. Only children with congenital severe to profound sensorineural hearing loss (hearing loss above 70dBHL) and who were native speakers of Kannada were taken as second group.

Subject selection criteria:

- Children of all age groups must have Kannada as mother tongue.
- Use of Kannada extensively at home and other ambient.
- Degree of hearing impairment ranging from severe to profound in children with sensori-neural type of hearing impairment.
- These subjects were categorized for their socio status based on Socio Economic Status scale (Venkatesan,2004)

Material

The material consisted of a total of 210 stimuli which were printed on white cards (4 x 6''). The 210 stimuli were divided into four subsections like present tense (78), past tense (48), nouns (48) and adjectives/adverbs (36). All the responses were recorded on a response sheet and also recorded on a tape recorder for detailed analysis later. All the stimuli in the list had a semantically marked form and its corresponding unmarked form. Most frequent nouns, verbs, adjectives and adverbs were selected in proportion to their frequency of occurrence in consultation with two linguists and two speech language pathologists.

Procedure: Test administration included the presentation of the picture stimuli individually for all the subjects. The oral responses on the task of naming were recorded using a suitable tape recorder for the purpose of transcription (IPA). A score of zero was given for each incorrect response and a score of 1 was given to each correct response and the total scores were calculated for each subsection and also overall. The results were analyzed qualitatively and quantitatively.

RESULTS AND DISCUSSION

All the data was analysed and interpreted by using SPSS 10.0 software. The mean and standard deviation of each age group from the age range of 5 to 10 years were calculated for both normal children and children with hearing impairment.

The performance of the normal children across the age groups was analysed. Children of age 5 to 6 years obtained a mean score of 174.86 with standard deviation of 13.09. For the age range of 6 to 7 years had a mean score of 193.40 with the standard deviation of 30.06, for 7 to 8 years had a mean score of 192.46 with the standard deviation 5.11, for 8 to 9 years, the mean score was 195.26 with standard deviation of 3.411 and the age group of 9 to 10 years had a mean score of 202.73 with the standard deviation of 4.18 were obtained. The overall results showed an increase in mean scores as the age increases.

Table 1: Mean and S.D. of normal children and of children with HI.

Age Range	Normal children		Children with HI	
	Mean	S.D	Mean	S.D
5 – 6 years	174.86	13.09	105.00	21.32
6 – 7 years	193.40	30.06	92.00	33.11
7 – 8 years	192.46	5.11	120.75	38.98
8 – 9 years	195.26	3.411	125.25	15.28
9 – 10 years	202.73	4.18	148.75	23.66

The performance of the hearing impaired children across the age range of 5 to 10 years was analyzed. Children of age 5 to 6 years had a mean score of 105.00 with standard deviation of 21.32. For the age range of 6 to 7 years the mean score obtained was 92.00 with standard deviation of 33.11, children in the age range of 7 to 8 years had a mean score of 120.75 with the standard deviation 38.98, for 8 to 9 years, mean score was 125.25 with standard deviation of 15.28 and the children in the age group of 9 to 10 years had a mean score of 148.75 with the standard deviation of 23.66 were obtained. The overall results showed an increase in mean scores as the age increased.

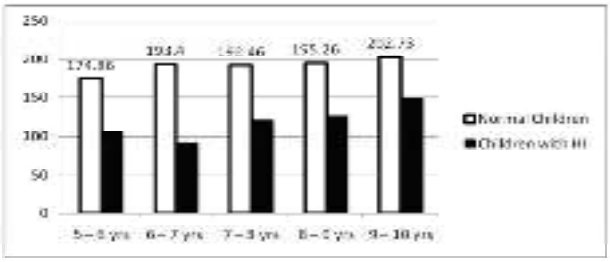


Figure 1: Graph representing mean values of normal children and children with HI

Independent sample t- test was done to compare the performance of two groups across each age range separately. Results showed that there was a significant difference between performance of normal children and children with HI across all age groups as shown in table

Table 2: Results of Independent Samples t–Test.

Age range	t	df	Sig. (2-tailed)
5 – 6 years	6.246	3.626	.005
6 – 7 years	5.545	4.418	.004
7 – 8 years	3.671	3.028	.034
8 – 9 years	9.102	3.080	.003
9 – 10 years	4.543	3.050	.019

Graphical representation of mean and SD of both normal children and children with HI is given in figure 2.

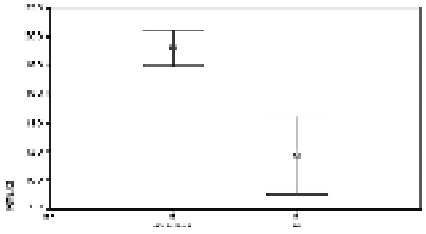


Figure 2: Mean and SD of normal children and children with HI.

This study revealed a significant difference in markedness abilities between normal children and in children with HI. As the results suggests, normal children of 5 to 10 years age did not achieve mastery of markedness abilities and they exhibited difficulties in markedness abilities in spite of good language exposure. Probably this could be attributed to lesser use of marked words in the common every day, colloquial context. The performance of children with HI was very poor when compared to normal children. This can be attributed to the overall inferior language abilities that these children have. For markedness abilities in lexical semantics, knowledge of semantics and the vocabulary is very much required. It is alarming that HI children lag behind in lexical semantics in spite of the fact that the vocabulary and semantics are the most easily and earlier chronologically acquired with respect to language development. The same therefore, needs to be focused in therapy.

CONCLUSION: The developmental trend was seen in both the normal as well as HI groups, confining the fact that markedness occurs with growth and development of language. The normal children also showed deficits indicating deficits in input and usage in that marked words are less used in common everyday colloquial context. The extremely poor performance of HI children on marked words indicates greater emphasis that is needed on enhancement of vocabulary and semantics during therapeutic intervention. Future research is needed in terms of finding the markedness abilities in different clinical populations with communication disorders, various linguistic levels viz., phonological, morphological, syntactic and pragmatic and also this markedness abilities needs to be studied in different Indian languages in both normal and clinical population.

Implications of the study: It is hoped that the present study will add to the clinical-research field of the SLP professionals in the following ways:

- Establishing the clinical relevance of Markedness theory.
- Contributing to the knowledge and understanding of linguistic behavior.
- The results of the present study can be utilized

(a) To develop diagnostic test materials for DSL with HI children.

(b) To prepare therapy materials to teach lexical items in a hierarchical manner starting from the unmarked ones to the marked ones.

(c) To compare the sequence of typical lexical development in terms of marked/unmarked semantic features, versus the loss of lexical abilities in adulthood disorders like aphasia.

This study gives an idea about the development of markedness abilities in normal children and in children with HI. These markedness abilities give an overview of development of semantics in these children. Therefore, markedness abilities can be used as an assessment procedure for semantic development in children and same hierarchy of unmarked to marked features can be used in therapeutic management of children with semantic deficits.

Acknowledgement: This is an excerpt from the project on Markedness …under ARF**.**The authors would like to thank Dr. Vijayalakshmi Basavaraj, Director, All India Institute of Speech and Hearing, Mysore. For the grant of AIISH Research Fund (ARF) for the Project and permitting us to conduct and present this research work.

REFERENCES

Archangeli, D. B. (1992). Markedness. In: Bright, William (ed.) *International encyclopedia of linguistics*. New York: Oxford University Press.

Baayen, H., Burani, C., Schreuder, R. (1997). *Effects of semantic markedness in the processing of regular nominal singulars and plurals in Italian.* In: Booij, Geert & van Marle, Jaap (eds.) Yearbook of Morphology 1996. Dordrecht: Kluwer, 13-33.

Battistella, E. L. (1996). *The logic of markedness.* New York: Oxford University Press.

Bernhard B. H. and Stemberger J. P. (1998). *Handbook of phonological development from the perspective of constraint based non linear phonology,* Academic press. New York.

Broselow E. (2004). Unmarked structures and emergent rankings in second language phonology. *International Journal of Bilingualism,* 8, (1), 51– 65

Cairns, Cairns, & Williams, F (1974). Some theoretical considerations in articulation substitution phenomena. *Language and Speech*. 14, 160-74.

Cardoso W. (1990). *The Development of sC Onset Clusters in*

Inter language: Markedness vs. Frequency Effects. Cascadilla Project Proceedings.
Croft, W. (1996). *Markedness and Universals: From Prague school to typology*. In K.R. Jankowsky. *Multiple perspectives on histerical dimensions of language*. Munster: Nodus.
Cruse, A. (2004). *Meaning in language: An introduction to semantics and pragmatics* (2nd edn.). New York: Oxford University Press.
Cruse, D. A. (1986). *Lexical Semantics*. Cambridge University Press, Cambridge.
Crystal, D. (1980). *A first Dictionary of Linguistics and Phonetics.* London: Andre Deutsch Limited.
Dressler, Wolfgang, U., Mayerthaler, W., Panagl, O., & Wurzel, W. U. (1987). Leitmotifs in Natural Morphology. *Studies in Language Companion Series.* Amsterdam: Benjamins.
Faingold, E.D. (2003). *The development of grammar in Spanish and the Romance languages.* Basingstoke, UK: Palgrave Macmillan.
Givón, T. (1991). Markedness in grammar: Distributional, communicative and cognitive correlates of syntactic structure. *Studies in Language*. 15.2: 335-370.
Givón, T. (1995). Markedness as meta-iconicity: distributional and cognitive correlates of syntactic structure.“ In: Givón, T. *Functionalism and grammar*. Amsterdam: Benjamins, 25-69.
Greenberg, J. (1966). Language universals, with special reference to feature hierarchies. *Janua Linguarum, Series Minor*, 59. The Hague: Mouton.
Haspelmath, M. (2005, 2006). Against Markedness (and what to replace it with). *Journal of Linguistics*, 41 (2005).
Hayden,M.B, Kirstein,E & Singh, B(1979). Role of distinctive features in dichotic perception of 21 English consonants. *Journal of Acoustic Society of America*, 65, 1039-1046.
Jakobson, R. (1963). „Implications of language universals for linguistics.“ In: Greenberg, Joseph (ed.) 1963. Universals of language. Cambridge, MA: MIT Press, 263-78. *Journal of Speech and Hearing Disorders*. 39, 65-74.
Jusczyk P. W, Smolensky P, Allocco T. (2002). How English-Learning Infants Respond to and faithfulness constraints, *Language Acquisition*, 10, (1),31-73.
Kean, M.L. (1992). Markedness. In: Bright, William (ed.) *International encyclopaedia of linguistics*. New York: Oxford University Press.
Newmeyer, F. (1992). Iconicity and generative grammar. *Language* 68: 756-796.
Otero R .B, Börjars K. (2006). Markedness in phonology and in syntax: the problem of grounding”, *Lingua*, 116, (5), 710-56.
Pustejovsky, J. (1995). *A theory of lexical semantics. The Generative Lexicon,* MIT Press.
Standwell, G. J. B. (1985). Reported Speech: Back shifting and the Markedness Principle, *British Journal of Language Teaching,* 23, 149- 51.
Shyamala.C., Basanti .D., Brajesh .P .(2007- 08). *A study of markedness in lexical semantics in normal and clinical population, Hearing Impairment (HI) &Mentally Retarded (MR).* Project by ARF. 07-08
Thompson,L.,& Thompson , M .T (1969). Metasthesis as a grammatical device. *International Journal of American linguistics*, 35,213- 19.

S.L.H.D:-4

HOARSENESS OF VOICE IN WOMEN –RECENT SCINARIO-

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Voice is the musical sound produced by vibration of the vocal cords in the larynx by air from the lungs. Every mature voice has unquestionably a unique character depending upon the structures of the head , neck& face of the individual just as neither two faces are the same nor are two voices.

In the adult voice delineates the personality of the speaker as much as or more than the words he speaks. The subtle variations, timber, speed inflection, stress & volume all incorporated in the melodic rhythm of a phrase contribute to the meaning intended by speaker on listener, thus emotions colour the voice giving in finite shades to the meaning. Hence voice is an indication of biological, psychological,& social characteristics of the speaker. Laver(1968) refers to these features as ‘indexical’ information of voice quality.

Voice plays the musical accompaniment of speech, rendering it tuneful, pleasing audible & coherent being essential to efficient communication by spoken word.

A bizarre or harsh & ugly voice can be serious handicap & embarrassment to the speaker if he is aware of it. It may atleast make him ill at ease in company & atmost induce him to shun social contacts &to isolate himself.

Control of voice therefore is an essential component in the individual’s ability to social situations, to make good contact & maintain equilibrium in relation to the listener whether it be one or many. When the voice deteriorates as a result of strain or actual disease the whole personality suffers with it, giving rise to feelings of inadequacy & insecurity. Aphonia means without voice. Dysphonia refers to impaired voice, ie. Voce deviating from normal.

CAUSES OF DYSPHNIA;-

a)Infections of the respiratory tract such as laryngitis & tuberculosis.

b)Misuse of the voice giving rise to vocal strain producing changes in the vocal cords.

c)Structural abnormalities which may be congenital like laryngeal web or cleft palate; acquired like benign & malignant

neoplasms & trauma to larynx.
d) Abnormalities in the resonatory system such as cleft palate (excessive nasality)& adenoids (insufficient nasality) .
e) Neuromuscular lesions such as palsy or paralysis of the vocal folds ,pharynx, tongue & soft palate.
f)Physical disease such as hypothyroidism, myasthenia gravis & the endocrinological disorders.
g)Neurotic & psychogenic disorders.
h)Effects of therapeutic drugs.

Common symptoms

Incorrect breathing, excessive tension in the larynx, an imbalance between glottis resistance & air pressure in individuals who use their voices considerably can cause a chronic laryngitis & weakness of the muscles &laryngeal joints. This condition gives rise to varying degrees of hoarseness & discomfort.

Vocal strain occurs chiefly in those occupations which make severe demands upon the voice, such as teachers, lecturers ,preachers, singers, actors &salesmen ,people who speak in noisy environments may also strain the voice working in workshops & factories.

Professional use of the voice is not the only cause of trauma, shouting at matches, parties, shouting at a dog or a deaf relative , even abnormal laughing or giggling habits can cause strain.

In this list of conditions now the wives of alcoholics & the enthusiastic young mothers of lower income group have joined, The increase in no of females with hoarseness of voice presenting history of vocal abuse HAS GIVEN RISE TO THE NEED FOR SELECTIVE INTERVENTION EFFORTS &THUS IS THE PRESENTATION.

AIM

The present study was conducted to find out THE CAUSE OF HOARSENESS OF VOICE of nonspecific laryngitis in those women attending the Audiology & Speech Therapy Section of ENT Department of Government stanley Medical college Hospital, Chennai-
600001.from the history presented by them by deliberate

METHOD & PROCEDURE-

The Government Stanley Medical College Hospital situated in the northern part of Chennai which is thickly populated by lower middle class & below poverty line people. Out of 507 patients registered in the department of ENT for Speech disorders 145 were males & 120 were females. The case history of the persons with voice disorders in the age group of 18 to 45 years both in females & males were taken for analysis on deliberate sampling method .81 males &64 females were found to have voice disorders .Among these 41 males & 49 females had hoarseness of voice with nonspecific laryngitis. The case history of the females revealed that they shout at their alcoholic husbands & their children regularly .The following table shows the no. Of patients with the voice disorders of various category

	FEMALE		MALE	
VOICEDISORDERS	NO	%	NO	%
V/H	49	73.3	41	50.6
V/FA	5	7.46		
V/AL	1	1.49	4	4.93
V/VCP	7	10.4	10	12.3
V/H/SWALLOWING	1	1.23		
V/HP			23	28.3
V/ID			3	3.7
V/NAS	1	1.49		

V/H = HOARSENESS OF VOICE DUE TO CH.LARYINGITI
V/AL = LARYGECTOMISED
V/ID = INTENSITY DISORDER
V/VCP = VOCAL CORD PARALYSIS
V/HSWAL = SWALLOWING DISORDER
V/NAS = NASLITY OF VOICE
V/FA = FUNCTIONAL APHONIA
V/HP = HIGH PITCHED VOICE

RESUT &DISCUSSION

The above data shows that females are suffering more with hoarseness of voice due to chronic laryngitis

Dr. .Rajasekar (2OO3) in his paper "hoarseness of voice- a clinical study " presented in the35th ISHA conference had reported that males are affected more .But the present data reveals that more females are coming with hoarseness of voice. The main causative factor as shouting with their alcoholic husbands & at their children.

Considering the percentage 73.3% of females having voice disorders are suffering due to their lifestyle & emotions whereas the males are affected due to organic pathology&/ due to occupational hazards.

This leads to conclude that emotional abuse can be deterious as physical. Other form of violence or abuse exist & can manifest as health symptoms as well.

CONCLUSION It may be either due to awareness or need for perfect usage of voice that more females have attended.PUBLIC AWARENESS,EMPHASIZE ON DEADDICTION PROGRAMMES &COUNSELLING FOR THE WIVES OF ALCOHOLICS ON VOCAL HYGIENE are the Steps to prevent in future, either through National Public health Leadership development network, As NLN serves as an efficient & effective means for producing core competencies.

REFERENCES

Handbook of voie training-RICHARD ALDERSON 1979.
Hoarseness of voice- a clinical study – paper presented in 35th ISHA conference by Dr.RAJASEKAR(2003)
Manual of voice & treatment paediatric through geriatric 2nd edition MYO LANDREWS 1999
Organic voice disorders-BEARL MOORE 1971.
Public health & preventive medicine- 15th edition –by ROBERT B WALLACE ,NEAL KOHATSU .
Voice &its disorders –GREENE 1972

Voice & voice therapy – DANIEL R. BOONE 1971
Voice –speech- language – LUCHSINGER &ARNOLD 1965
For female
V/H = 49 =73.13%
V/AL = 1=1.49%
V/VCP = 7=10.44%
V/HSWAL = 1=1.23%
V/NAS = 1=1.49%
V/FA=5=7.46%

For male
V/H = 41=50.61%
V/AL = 4=4.96%
V/ID = 3=3.70%
V/VCP = 10=12.34%
V/HP = 10= 12.34%

S.L.H.D:-5

EFFECT OF TEMPORAL VARIATION ON PHONEME IDENTIFICATION SKILLS IN 2 - 3 YEAR OLD LATE TALKING CHILDREN

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Introduction: The process by which humans are able to interpret the continuously varying speech signal into a sequence of discrete linguistic units and understand the intended message/sound used in a language is called speech perception. Speech perception studies on typically developing children are limited, and it is scanty in children with communication disorders. It has been reported that children with language impairments show auditory processing deficits (Tallal & Piercy, 1974, 1975; Tallal & Stark, 1981; Elliot & Hammer, 1988; Elliot, Hammer & Scholl, 1989; Sussman, 1993). One explanation for language impairment in children is that they suffer from temporal processing disorder that interferes with the ability to form well-specified mental representations of auditory stimuli (Tallal, 1990). The ***auditory temporal processing deficit hypothesis*** posits that children with ***language impairment*** have particular problems in processing auditory signals that are brief and/ or rapidly changing (Tallal, 2000).

Till date, there is no published study on phoneme perception skill in late talking (LT) children and in the age group of 2 and 3 years, except few on children with language impairement, SLI, learning disability and dyslexia (Tallal & Piercy, 1975; Stark & Tallal, 1980; Tallal & Stark, 1981; Elliot, Hammer & Scholl, 1989; Sussman, 1993; Temple, Deutsh, Poldrack, Miller, Tallal, Merzenich & Gabrieli, 2003; Swapna, 2004; Bulingame, Sussman, Gillam & Hay, 2005). Children below age 3 years with language delay (mostly expressive and sometimes receptive language) are identified as late talkers. Toddlers whose language delay is secondary to another condition such as mental retardation/general developmental delay, autism or hearing impairment are excluded as late talkers (Whitehurst & Fischel, 1994). Many toddlers diagnosed as late talkers were able to catch up to their peers when they enter preschool; such children are called as late bloomers. However about 40% of children whose communicative development is delayed by age two continue to experience immature patterns of speech and language, demonstrate additional problems, and are at risk of later academic failure (Catts, Hu, Larivee & Swank, 1994; Beitchman, Wilson, Browlie, Walters & Lancee, 1996; Leonard, 1998). Also, slow early language development reflects a predisposition for slower acquisition and lower asymptotic performance in a wide range of language related skills in to middle childhood and adolescence (Rescorla, 2002, 2005). Thus LT children are at high risk of developing higher language difficulties and reading problems in school age.

Since LT children are at risk of developing higher language deficits and reading problem, it is important to investigate their perception abilities. Identifying speech processing problem at earlier age and beginning intervention for the same may aid late talking children to develop normal language. In this context, the present study is aimed at investigating auditory processing skills of late talking children between the age of 2 and 3 years. Specifically, the effect of temporal (voice onset time) variation on phoneme identification skills in late talkers were examined and compared with those of typically developing children. It was hypothesized that there is no significant difference between groups on identification of synthetic tokens.

Method

Subjects: Two groups of Kannada speaking children were selected for the study. Group 1 consisted of thirty (boys: 21 and girls: 9) LT children. Late talkers were defined as children between the age of 2 and 3 years with age appropriate receptive language and more than 6 months delay in expressive language on administration of Assessment Checklist for Speech and Language Skills (Swapna, Jayaram, Prema & Geetha, 2006) with no mental retardation, no history of neurological and ear related problems. Group 2 included 38 typically developing (TD) children (21 boys and 17 girls) from four play schools in Mysore. Typically developing children were matched with late talking children for age and gender. Children in both groups were from middle socio-economic status. Typically developing children were formally screened for speech and language, hearing and intelligence. Children who failed in speech, language and hearing screening and who did not have appropriate developmental age were excluded from the study.

Stimuli: Two Kannada words ([bennu] and [pennu]) with

stop consonants (voiced bilabial /b/ and unvoiced bilabial /p/) as occurring in word- initial position were selected. The words were meaningful, picturable, and bisyllabic minimal pairs. These target words as uttered thrice by a 21-year-old female, native Kannada speaker were recorded onto a computer with 16 kHz sampling rate and 16 bit quantization using SSL Pro3V3 software (Voice and Speech Systems, Bangalore) and stored onto the computer memory. The words were displayed as waveform. Voice onset time, phoneme duration and total word duration were measured using waveform display. Based on VOT measures, VOT continuum was synthesized using lengthen (PSOLA) module of Praat software (Boersma & Weenink, 2007). Waveform of /b/ from onset of voicing to onset of burst was truncated from the waveform display of the word [bennu] and was reduced in steps of 0.9 (factor) till the burst and then concatenated to the remaining part of the word. When the lead VOT was '0' (no voicing), silence in steps of 10 ms was inserted between the burst and voicing of the vowel, till +40 ms. After each editing, the tokens were saved and thus a total of 15 synthetic tokens for /b - p/ VOT continuum (-77 to +40 ms) were generated. The tokens were iterated thrice, randomized and recorded onto a CD. Thus a total of 45 tokens (15*3) formed the stimulus.

Procedure: The aims of the study and the procedure of testing were explained to the parents and their written consent was taken prior to the data collection. Children were tested individually in a quiet room. Prior to the testing, training was provided. In the training session, each child was seated comfortably and was familiarized with 4 pictures used in each of the three tests for a maximum of 3 half-an-hour sessions with breaks in between when required. Four pictures were presented to the children at a time; two were the pictures of the target stimuli and the other two were distracters. Of the two distracters, one was semantically related to the target stimuli and the other was unrelated to the target stimuli. This is to reduce the chance of false positive responses. Training was provided using live voice. Child was instructed to listen to the names of pictures uttered by the investigator and point to one of the pictures placed in front of him/her. During the experiment, synthetic stimulus was played using laptop and audio-presented through two speakers placed at an angle of 45^{o} azimuth at a comfortable loudness. The child was instructed to listen carefully to the stimulus and point to the appropriate picture out of the four pictures kept before him/her. Children who had difficulty in pointing were asked to verbally imitate the tokens. The investigator noted the child's responses on a binary forced-choice scoring sheet immediately after the child's response for each stimulus.

Analyses: The responses obtained were tabulated and percent response for synthetic tokens of each child was calculated using the following formula,

$$\frac{\text{Obtained /b/ or /p/ response for each token}}{\text{Total number of iterations of token (3)}} \times 100$$

The average percent response for children in group 1, and group 2 were calculated for each synthetic token. The percent identification response for the target words were tabulated for each subject for VOT continuum and based on this, identification curves were drawn. Fifty percent crossover, lower limit of phoneme boundary (LLPB), upper limit of phoneme boundary (ULPB) and phoneme boundary width (PBW) were obtained (Doughty, 1949) from identification curves. Fifty percent crossover is the point at which 50% of the subject's response corresponds to the voiced (voiceless) category. In case of multiple crossovers, the last crossover on the right most side was considered in the study. LLPB is the point along the acoustic cue continuum where an individual identified voiced (unvoiced) stop 75% of the time and ULPB defined as the corresponding point of the identification of the unvoiced (voiced) cognate 75% of the time. In case of multiple crossovers, the VOT value corresponding to 75% identification, immediately before and after the 50% crossover was considered as LLPB/ULPB, respectively. Phoneme boundary width was determined by subtracting the lower limit from upper limit of boundary width.

Statistical analysis: Statistical Package for Social Sciences (SPSS - 16) software was used for statistical analysis. Mean and standard deviation were calculated for 50% crossover, LLPB, ULPB and phoneme boundary width for both groups of children for /b-p/ continuum. Box plots of parameters between gender, and crossover were obtained for the groups and the outliers were removed from the analysis. Since the sample sizes were not similar and standard deviation was relatively high, non-parametric tests were used for analysis. Mann-Whitney test was employed to find differences between gender within groups and between groups across the parameters.

Results

Identification was better at the ends of the continuum for both the groups. It was found that only 36.6% of LT children exhibited crossover and could identify phonemes in the continuum, whereas 84.2% of TD children were found to have crossover for /b-p/ continuum. Single crossover was observed more in TD children compared to LT children and the vice versa was seen in multiple crossovers. Ten percent of LT children exhibited single crossover, 26.6% of LT children exhibited multiple crossovers and crossover was not exhibited by 53.3% of LT children. Sixty eight percent of TD children exhibited single crossover, 15.7% of TD children exhibited multiple crossover, and 7.8% of TD children did not have crossover for /b-p/ continuum. Box plot of parameters obtained between crossover and gender indicated 3 outliers in both LT and TD group, and were excluded from the analysis. Table 1 shows the details of crossover exhibited by LT and

TD children in percentage. Also, LT group identified the end point stimuli of the /b-p/ continuum less accurately compared to TD group. Table 2 shows the mean percent identification of end point stimuli by LT and TD children for /b-p/ continuum.

Stimulus	Percent crossover (n)		Percent single crossover (n)		Percent multiple crossover (n)		Percent no crossover (n)		Percent outliers (n)	
	LT	TD	LT	TD	LT	TD	LT	TD	LT	TD
/b-p/ continuum	36.6	84.2	10	68	26.6	15.7	53.3	7.8	10	7
	(11)	(32)	(3)	(26)	(8)	(6)	(16)	(3)	(3)	(3)

Table 1: Number and percentage of LT and TD children exhibited crossovers.

Group	/b-p/ continuum	
	/b/	/p/
LT	83.3	93.4
TD	98.9	100

Table 2: Mean percent identification at end point stimuli in /b-p/ continuum.

Mean values of the parameters were compared between LT and TD children. Mean 50% crossover occurred in lead (-6.9 ms) VOT region in TD children and lag (+0.9 ms) VOT region in LT children. Mean LLPB, occurred earlier and, 50% crossover, and ULPB occurred later in LT children compared to TD children. Mean PBW was narrower in TD children compared to LT children. Also, the standard deviation of the parameters was found to be higher in LT children compared to TD children. Table 3 and 4 show the subject size (n), mean (in ms), SD, /Z/ and p values of parameters for /b-p/ continuum in LT and TD children, respectively.

Mann-Whitney test was administered to find gender difference within groups. TD group did not exhibit significant gender difference across any of the parameters. However, gender difference was significant for LLPB and 50% crossover in LT children. Therefore, mean values of parameters of boys and girls in LT and TD group were compared separately. Results of Mann-Whitney test indicated significant difference between groups for boys in 50% crossover and PBW and significant difference between groups for girls in LLPB. Table 5 shows /Z/ and p values of parameters for in LT and TD children. Figure 1 shows the average percent identification in LT and TD children. From identification function, it is evident that LT group exhibited shallow phoneme boundaries and very broad boundary width compared to TD group who exhibited sharp phoneme boundary and narrow boundary width for both /b-p/ and /g-k/ continuum. Shallow phoneme boundary and broader boundary width indicates difficulties and confusions in identifying the phonemes in the continuum.

Average crossovers											
Parameter	Boys			Girls			Total			/Z/	P value
	n	Mean	SD	n	Mean	SD	n	Mean	SD		
LLPB	18	-11.5	10.2	14	-16.4	13	32	-13.6	11.6	1.1	0.2
50% crossover	18	-6.3	10.7	14	-7.7	12.4	32	-6.9	11.3	0.3	0.7
ULPB	18	-1.7	12.1	14	-3.2	11.4	32	-2.4	11.6	0.2	0.8
PBW	18	10.2	7	14	13.1	6.8	32	11.5	7	1.4	0.1

Table 3: Subject size (n), mean (in ms), SD, /Z/ and p values of parameters for /b-p/ continuum in TD children with crossover.

Average crossover											
Parameter	Boys			Girls			Total			/Z/	P value
	n	Mean	SD	n	Mean	SD	n	Mean	SD		
LLPB	8	-16.2	14.3	3	-42	10.1	11	-23.2	17.5	2.5	0.01*
50% crossover	8	9.7	17.5	3	-22	8.3	11	0.9	21.4	2.2	0.02*
ULPB	3	7.6	10.4	3	-9.6	19.6	6	-1.0	16.9	1.1	0.26
PBW	3	31.3	11.5	3	32.3	29.3	6	31.8	19.9	0.2	0.8

Table 4: Subject size (n), mean (in ms), SD, /Z/ and p value of parameters for /b-p/ continuum in LT children with crossover. *- indicates significant difference

Parameters	Boys		Girls	
	/Z/	p value	/Z/	p value
LLPB	0.9	0.3	2.5	0.01*
50%crossover	2.6	0.008*	1.7	0.07
ULPB	1.6	0.1	0.5	0.5
PBW	2.9	0.003*	1.2	0.2

Table 5: /Z/ and p values of parameters for /b-p/ continuum in LT and TD children. *- indicates significant difference.

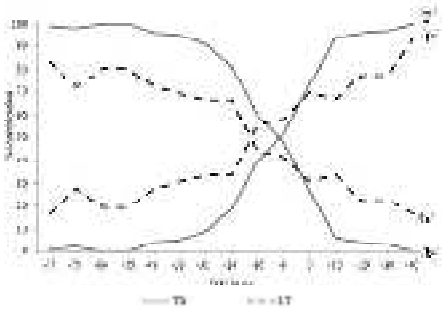


Figure 1: Average percent identification in LT and TD children for /b-p/ continuum.

Discussion: The results revealed several interesting findings. Firstly, not all 2-3 year old late talking children identified the phonemes in the continuum. Only 11 (36.6%) of 30 LT children had crossover and could identify the phonemes in /b-p/ continuum. On the other hand, 32 (84.2%) of the 38 TD children identified the phonemes in /b-p/ continuum. Multiple crossovers were more observed in LT group compared to TD group. Of the LT children who had crossovers, 72%, exhibited multiple crossovers. In TD group, only 18% of children had multiple crossovers in /b-p/ continuum. This indicates their unstable and poor phoneme identification abilities for VOT continuum in late talking children. This result is in consonance with the results of studies by Werker & Tees (1987) on children with learning disability, Thibodeau & Sussman (1979) on children with communication disorder, Sussman (1993), and Stark & Heinz (1996) on children with language impairment, using identification task.

Second, mean 50% crossover occurred at lead (-6.9 ms) VOT region for TD children and lag (+0.9 ms) in LT children. The result of TD children is in consonance with those of Abramson & Lisker (1965) in Thai language (-20 ms), Savithri (1996) in Kannada speaking children (-16.8ms) and Sathya (1996) in Telugu speaking children (-10 ms), and Catherine & Savithri (2007) in Kannada speaking children (-22 ms) who have reported 50% crossover in lead VOT region. The result is in contrast with those of Winterkorn, MacNeilage & Preston (1967), Yeni-Komishian, Preston & Cullen (1967), Zlatin & Koenigsknecht (1975), Simon & Fourcin (1978), Williams (1977a, 1977b) and Flege & Eefting (1986) who reported 50% crossover in lag VOT region in English. The difference in result may be due to the phonemic structure of the two languages. In English, stops have two way (i.e. p, b) classification where as Kannada has a four way (e.g. p, ph, b, bh) classification. The distinction between unvoiced aspirated and unvoiced unaspirated stop is phonetic in English but phonemic in Kannada (Savithri, 1996). As in Spanish (Williams, 1977b), TD children in the present study gave greater weight to prevoicing as a cue to voiced stop consonants than English listeners. However, in LT children, 50% crossover occurred at short lag VOT region (+0.9 ms) for /b-p/ continuum. This indicates differences in perception skills between LT and TD children. This result is in consonance with Swapna (2004), who reported that 50% crossover occurred at lag VOT region (+18 ms) in children with learning disability and at lead VOT region (-1.4 ms) for normal children. This indicates a delay in perceptual maturity in LT children compared to their age matched peers.

Third, phoneme boundary was within $\pm$ 20 ms for both the groups in /b-p/ continuum. This finding is in consonance with the reports of Abramson & Lisker (1965), Savithri (1996), Sathya (1996) and Catherine & Savithri (2007) who also reported phoneme boundary within $\pm$ 20 ms region. Aslin & Pisoni (1980) asserts commenting on the experiment by Pisoni (1977) on perception of non speech stimuli that a psychophysical process is probably responsible for the categorical-like discrimination within this region. Also, such narrow region of high discriminability had resulted due to general sensory constraints on mammalian auditory system to resolve small differences in temporal order and not because of phonetic categorization.

Fourth, mean LLPB occurred earlier and ULPB occurred later in LT children compared to TD children and PBW was wider in LT children compared TD children Phoneme boundary width was 31.8 ms in LT group and 11.5 ms in TD group for /b-p/ continuum. This reflects LT children's uncertainty and confusions in identifying target phonemes. Mean phoneme boundary width of TD children was narrower in the present study compared to those reported by Savithri (1996) for /b - p/ (25 ms) continuum, and Catherine & Savithri (2007) for /b - p/ continuum (36 ms). This difference in boundary width may be attributed to smaller subject size that is, 6 subjects per age group (4 - 6 year old children) in Savithri's (1996) study and 10 subjects (2 - 3 year old children) in Catherine & Savithri's (2007) study.

Fifth, there was no significant difference in the identification scores of boys and girls in TD group. This implies that phonetic processing abilities are similar for both the gender. Zlatin & Koenigsknecht (1975) also reported no significant difference between genders. In contrast, LT group showed significant gender difference in LLPB and 50% crossover for /b-p/ continuum. LLPB and 50% crossover occurred earlier in girls compared to boys in LT group. This difference may be because of maximum number of multiple crossovers exhibited by boys and unequal subject size (8 boys and 3 girls).

Sixth, significant difference was present in mean 50% crossover, ULPB and PBW in boys and LLPB in girls between the groups. LT group exhibited multiple crossovers, shallow pho

neme boundaries, wider boundary widths, high standard deviation, and less percent accuracy in identifying the end point stimuli indicating inconsistent, random phoneme identification abilities in LT children. High variability, multiple cross-overs and less accuracy in identifying end point stimulus was reported by Thibodeau & Sussman (1979) in children with communication disorder using /b-p/ continuum. Elliot & Hammer (1988) study revealed impaired discrimination ability in children with language impairment using /b-p/ continuum. In contrast to this finding, Brandt & Rosen (1980) and Coady, Kluender & Evans (2005) didn't find impairment in phoneme identification skill in children with dyslexia and SLI respectively. Methodological differences of the studies may be attributed for the variation in results across studies. The subjects group, age, size were entirely different for each of these studies.

Poor identification abilities in LT children in temporally varying stimuli may be due to inadequate central representation of the phonemes. As Sussman (1993) discussed the possible cause for difficulties present in children with language impairment for identification task, results of the current study also suggests impairment in the preliminary stage, i.e. late-talking children might have difficulty in creating phonological representation or in linking the acoustic information to phonological representation or late talking children experience a faster decay of phonological trace causing difficulty in translation into phonological code.

Conclusion

The results of this study indicate that LT children have impaired identification abilities for stimulus varying in temporal parameters. It is recommended that late- talking children should receive training to improve their auditory perceptual abilities along with speech and language intervention. Temple, Deutsh, Poldrack, Miller, Tallal, Merzenich & Gabrieli, (2003) shown that a partial remediation of language processing deficits in children with dyslexia, results in improved reading skills and ameliorates disrupted function in brain region associated with phonological processing and produced additional activation in other brain regions. Beginning training to improve perceptual skills at early age will help them to acquire normal language, reading and writing skills.

References

Abramson, A., & Lisker, L. (1965). Voice onset time in stop consonants: Acoustic analysis and synthesis. P*roceedings of the 5th International Congress of Acoustics*. Liege: Imp. G. Thone.

Aslin, R.N., & Pisoni, D. B. (1980). Some developmental process in speech perception. In G. H. Yeni-Komshian, J. F. Kavanagh & C. A. Ferguson (Eds.), Child Phonology, vol.2: Perception, Academic press: NewYork, 1980.

Beitchman, J., Wilson, B., Browlie, E., Walters, H., & Lancee, W. (1996). Longterm consistency in speech/language profiles, I: Developmental and academic outcomes. In J.B Gleacon, (6th ed). *The development of language*. pp. 353-355. Boston. Pearson Education, Inc.

Boersma, P & Weenink, D. (2007). Praat: A system for doing phonetics by computer. Institute of phonetic sciences, *University of Amsterdam*. Retrived on January 10, 2007 from http://www.praat.org/.

Brandt, J., & Rosen, J.J. (1980). Auditory Phonemic Perception in Dyslexia: Categorical Identification and discrimination of stop consonants. *Brain and Language, 9*, 324-337.

Bulingame, E., Sussman, H. M., Gillam, R. B., & Hay, J. F. (2005). An investigation of speech perception in children with specific language impairment on a continuum of formant transition duration. *Journal of Speech Language and Hearing Research, 48,* 805-816.

Catts, H., Hu, C-F., Larrivee, L., & Swank, L. (1994). Early identification of reading disabilities in children with speech language impairments. In R. Watkins, & M. Rice, (Eds.), *Specific language impairment in children*. Baltimore: Paul Brookes.

Catherine, S. P. A., & Savithri, S. R. (2007). Effect of temporal variation on phoneme identification skills in typically developing children. *Proceedings of the National Symposium on Acoustics*, pp 193-198.

Coady, J.A., Kluender, K.R., and Evans, J.L. (2005) Categorical perception of speech by children with specific language impairments. *Journal of Speech, Language, and Hearing Research*. 48, 944-959.

Doughty, J. (1949). In Zlatin, M., & Koenigsknecht, R. (1975). Development of the voicing contrast: Perception of stop consonants. *Journal of Speech and Hearing Research, 18*, 541-553.

Elliott, L., & Hammer, M. (1988). Longitudinal changes in auditory discrimination in normal children and children with language-learning problems. *Journal of Speech Language and Hearing Research, 53, 467-474.*

Elliott, L., Hammer, M., & Scholl, M. (1989). Fine-grained auditory discrimination in normal children and children with language-learning problems. *Journal of Speech Language and Hearing Research, 32, 112-119.*

Flege, J. E., & Eefting, W. (1986). Linguistic and developmental effects on the production and perception of stop consonants. *Phonetica*, 43, 155-171.

Leonard, L. (1998). *Children with Specific language impairment*. Cambridge, MA: MIT Press.

Pisoni, D. B. (1977). Identification and discrimination of the relative onset of two component tones: Implication for the perception of voicing in stops. *The Journal of the Acoustical Society of America*, 61, 1352-1361.

Rescorla, L. (2002). Language and reading outcomes to age 9 in late-talking toddlers. *Journal of Speech Language and Hearing Research, 45,* 360-371.

Rescorla, L. (2005). Age 13 language and reading outcomes in late-talking toddlers. *Journal of Speech Language and Hearing Research, 48, 459*-472.

phoSavithri, S. R. (1996). Speech perception in children: Temporal aspects. Research project funded by the Department of Science and Technology, Ministry of Science and Technology, New Delhi, India.

Sathya, K. (1996). *Development of auditory perceptual processing in children.* Unpublished doctoral thesis submitted to the University of Mysore, Mysore.

Simon, C., & Fourcin, A. (1978). Cross language study of speech pattern learning. *The Journal of the Acoustical Society of America*, 63, (3), 925-935.

Stark, R., & Tallal, P. (1980). Sensory and perceptual functioning in young children with and without delayed language development. In L. E. Bernstein and R. E. Stark (1985). Speech perception development in language impaired children: A 4-year follow-up study. *Journal of Speech and Hearing Disorder, 50, 21-30*.

Stark, R. E., & Heinz, J. M. (1996). Vowel perception in children with and without language impairment. *Journal of Speech and Hearing Research, 39*, 860-869.

Sussman, J.E. (1993). Perception of formant transition cues of place of articulation in children with language impairments. *Journal of Speech and Hearing Research*. 36, 1286-1299.

Swapna, N. (2004). Fine-grained auditory discrimination in normal children and children with learning disability. *Unpublished thesis submitted to the University of Mysore.*

Swapna, N., Jayaram, M., Prema, K. S., & Geetha, Y. V. (2006). Assessment Checklist for speech and language skills. *An ARF project undertaken at AIISH, Mysore.*

Tallal, P. (1990). Fine-grained discrimination deficits in language-learning impaired children are specific neither to auditory modality nor to speech perception. *Journal of Speech Language and Hearing Research, 33,* 616-617.

Tallal, P. (2000). Experimental studies of language learning impairments. From research to remediation. In D. V. M. Bishop, & L. B. Leonard, (Eds.). *Specific language impairment in children*. Hove, England: Psychology Press.

Tallal, P., & Piercy, M. (1974). Developmental aphasia: Rate of auditory processing and selective impairment of consonant perception. *Neuropsychologia, 12*, 83-93.

Tallal, P., & Piercy, M. (1975). Developmental aphasia: The perception of brief vowels and extended stop consonants. *Neuro psychologia, 13,* 69-74.

Tallal, P., & Stark, R. (1981). Speech acoustic-cue discrimination abilities of normally developing and language impaired children. The *Journal of the Acoustical Society of America,* 69, 568-574.

Temple, E., Deutsh, G. K., Poldrack, R. A., Miller, S. L., Tallal, P., Merzenich, M. M., & Gabrieli, J. D. E. (2003). Neural deficits in children with dyslexia ameliorated by behavioral remediation: Evidence from functional MRI. *Proceeding of National Academy of Sciences of Sciences, 100,* 2860-2865.

Thibodeau, L., & Sussman, H. (1979). Performance on the test of categorical perception of speech in normal and communicatively disordered children. *Journal of Phonetics*, 7, 375-391.

Werker, J.F., & Tees, R.C. (1987). Speech perception in severely disabled and average reading children. *Canadian Journal of Psychology, 41*, 48-61.

Whitehurst, G. J., & Fischel, J. (1994). Early developmental language delay: What if anything, should the clinician do about it? *Journal of Child Psychology and Psychiatry, 35*, 613-648.

Williams, L. (1977a). The voicing contrast in Spanish. *Journal of Phonetics,* 5, 169-184.

Williams, L. (1977b). The perception of stop consonant voicing by Spanish-English bilinguals. *Perception and Psychophysics,* 21, 289-297.

Winterkorn, J., MacNeilage, P., & Preston, M. (1967). Perception of voiced and voiceless stop consonants in three-year-old children. *Haskins Laboratories: Status Report on Speech Research*, SR-11, 41-45.

Yeni-Komshian, G., Preston, M., & Cullen, J. (1967). A brief report on the study of imitation of synthetic speech stimuli by children. *Haskins Laboratories: Status Report on Speech Research*, SR-11, 48-49.

Zlatin, M., & Koenigsknecht, R. (1975). Development of the voicing contrast: Perception of stop consonants. *Journal of Speech and Hearing Research, 18, 541-553.*

S.L.H.D:-6

SPEED OF PROCESSING IN CHILDREN WITH LEARNING DISABILITY ON LINGUISTIC AND NON-LINGUISTIC TASKS

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INTRODUCTION: There are a variety of disorders that affect the way verbal and non-verbal information is acquired, understood, organized, remembered and expressed. Learning disability is one such disorder caused by a problem in the nervous system that affects how information is received, processed or communicated. The term 'Learning Disability' describes a neurological disorder in which a person's brain is structurally or functionally different. These differences could possibly lead to a deficit in the rapidity and accuracy with which information is processed viz. the processing speed. The speed of processing has been investigated in the past by many researchers adopting reaction time tasks. They consider reaction time as a reflection of global processing speed (Cerella & Hale, 1994). Reaction time is defined as the time between the presentation of the stimulus and a motor response.

Many studies have attempted to correlate reaction time with overall reading and language ability. Some of the studies suggested that children with learning disabilities possess an underlying deficit in processing speed and do not show the expected responses on reaction time tasks. Czudner and Rourke (1970, 1972) found that the reliability of response latencies did not increase after age 10 in children with learning disabilities. They pointed out that the processing of information for young children with learning disabilities was slower or delayed and that they have basic difficulties in maintaining attention. Dykman, Walls and Suzuki (1970) suggested that children with learning disabilities processed information at a slower rate than children without learning disabilities; this slower processing rate hindered performance in academic and non-academic settings; further, the ability to arouse or maintain attention was deficient in children with learning disabilities.

Spring (1971) tested poor and normal readers on a visual perception task and found that poor readers and a longer reaction time, and speed of their responses declined significantly over the ten-minute testing session. Sroufe (1971) found that children with learning disabilities showed a general decrease in physiologic reactivity, which improved with age. Deficits observed were attributed to neurologic immaturity and reflected psychologic problems in maintaining attention. These results were consistent with those of studies using simple reaction time tasks (Sroufe, Sonies and West, 1973). Hayes, Hynd and Wisenbaker (1986) demonstrated slower and more variable reaction times in children with learning disability on certain tasks. The researchers argued that this "failure to automatize basic sub-skills" could relate to dysfunction in the central nervous system.

To summarize, the literature indicates that children with learning disability perform poorly on reaction time tasks and that they have an overall difficulty in processing information. Over the decades, these studies of reaction time have primarily focused on isolated linguistic or non linguistic tasks**.** Cerella and Hale (1994) described several possible ways to divide reaction time tasks into theoretically and empirically distinct domains. Lima, Hale and Myerson (1991) proposed a distinction between lexical and non-lexical task (which were infact nonlinguistic). The main difference between these tasks is that the linguistic tasks depend on the language knowledge while the non-linguistic tasks rely minimally on such knowledge. Such differences between linguistic and non-linguistic skill may reflect differences between particular processes. It would be interesting to examine whether the children with learning disability demonstrate similar slower performance across all different domains including linguistic and non-linguistic. Despite the growing body of literature on learning disability, there have been very limited research reports with reference to the processing speed in children with learning disability across various tasks, especially in the Indian context. Hence, a need was felt to provide further corroborative evidence to the existing research findings. Therefore this study was taken up incorporating both language and nonlanguage tasks.

OBJECTIVES OF THE STUDY

The primary aims of the study were

1. To determine whether there was a difference in overall reaction time between children with learning disability and the typically developing peers.
2. To investigate whether processing speed operates in a sufficiently similar manner across linguistic and non linguistic tasks.

METHOD

SUBJECTS: Two groups of 10 children participated in the study. Each group consisted of 4 boys and 6 girls who were monolingual native speakers of Kannada ranging in age from 8 to 12 years. The clinical group consisted of children who were diagnosed as having learning disability (LD) by a multidisciplinary team of qualified specialists including speech-language pathologist and clinical psychologist. The children were profiled using a standardized diagnostic tool viz. Early reading skills (Rae & Potter, 1981) adapted on Indian children by Loomba (1995). They were required to function two grades or more below their expected grade. The control group consisted of children who exhibited no learning problems and were functioning well at academics. Those children with no history of language, hearing, neurological, developmental, sensory, intellectual or emotional and orofacial abnormalities were included in the study. They were screened for voice, articulation, fluency and language. All the children with learning disability had attended speech therapy for an average duration of six months. All the children were studying in English medium schools, were right handed and were from middle and upper class families.

MATERIAL: The tasks were divided into-

I Linguistic tasks: The two subtasks under this domain considered were viz.

1. Beginning consonants task: The stimuli were taken from the standardized test for diagnosing learning disability i.e. Early Reading Skills test (Rae & Potter, 1981) from a subsection of the test Phoneme-Grapheme Correspondence Test.
2. Rhyme task: The stimuli was taken from The Fused Rhymed Words Test (Wexler & Halwes, 1983) which consists of 15 different single-syllable word pairs in which each member of every pair differs from the other only in the initial consonant (e.g., coat, goat).

II Non-linguistic tasks: The two subtasks under this domain considered were viz.

1. Picture Matching: The stimuli were considered from a language test viz., Bankson Language Screening Test (BLST). A main section called visual perception was considered from which the following sub-sections were taken i.e. visual matching, visual discrimination, and visual sequencing.
2. Visual Search: The stimuli were extracted from a sub-sec

tion of Early Reading Skills test (ERS), i.e. Visual Discrimination level-1.

There were ten stimuli each in task sub-types. It was ensured that all the stimuli included in these tasks were well within the children's comprehension level. The description of the type of tasks used and the instructions given have been provided in table 1.

completion of the response (key press).

The mean reaction time and the accuracy of the tasks were analyzed for both the groups for each of the linguistic and nonlinguistic tasks. The data was analyzed and statistically treated using the SPSS software (version 10) to determine if there was any significant difference in the reaction time and accuracy of typically developing children and children with

Table 1: Description of reaction time (RT) tasks

Task Type Linguistic-	**Description of tasks**	**Instruction**	**Sample Stimuli**
a)Beginning Consonants Task	Two words were displayed one below the other at the same time and the child had to judge whether the second stimulus began with the same beginning conson ant as the first stimulus.	Strike 'Yes' key if stimuli started with the same alphabet, 'No' key if not	"Rattle" and "Rumble"
b)Rhyme Task	Two words were displayed one below the other. The words either were rhyming or not rhyming and child had to acknowle dge his/her judgment through key press.	Strike 'Yes' key if stimuli rhymed, 'No' key if not.	"Sit" and "Bit" presented simultaneously one below the other
Non-linguistic- (cognitive task) a)Picture Matching	This required the child to judge whether two pictures with minimal differences, presented simultaneously on screen one beside the other matched completely or not.	Strike 'Yes' key if pictures matched and 'No' key if not.	Set of two pictures (line draw ings) one on right hand side and the other on the left hand side of the screen
b)Visual search	Four pictures were presented on the bottom screen and one picture was presented on the top screen simultaneou sly. The child was required to judge whether the picture stimulus on top of screen was present or absent among the four pictures on the bottom screen.	Strike 'Yes' key if the picture stimulus on top screen was present among the four picture stimuli on bottom part of the screen.	Set of four (line drawings) appear on bottom part of screen and one picture stimulus on top simultaneously

PROCEDURE: All tasks were presented on a laptop computer using the DMDX software, and children responded by striking a key on the keyboard. A set of practice trials as many times as necessary was administered to ensure that the child understood the task which was followed by the actual ten stimuli. For all the tasks, the child was expected to give a key press response, and the child pressed one key (marked "yes" in green colour) for a yes or positive response and a different key (marked "no" in red colour) for a negative response. The children were instructed always to respond as quickly as possible without affecting the accuracy. The environment was conducive for the children to maintain their focus and attention. The tasks were divided into two sessions; which required a total of twenty minutes to complete. Both sessions contained two subtasks, each of linguistic and non-linguistic type. All the children performed the tasks in the same order. For all tasks, the children were instructed to rest both their hands just above the keys to be used, which was marked by words "yes" and "no" in specific colours and respond appropriately. The reaction time was measured (milliseconds) as the duration between the presentation of the stimuli and the

learning disability. Descriptive statistics was used to obtain mean and standard deviation. This was later compared within and across various tasks for both groups.

RESULTS AND DISCUSSION

I Reaction time

The mean reaction time and standard deviation for the two groups of children in both the linguistic and non-linguistic tasks including Beginning Consonants Task (BC) & Rhyme Task (RT) in the linguistic domain and Visual Search (VS) & Picture Matching (PM) in the non-linguistic domain was calculated and these values have been depicted in table 2. It can be seen from the table that the overall mean reaction time of children with LD was greater (2518 msec) when compared to the reaction time of the typically developing children (1380 msec) for both linguistic and non linguistic tasks taken as a whole. A similar trend was seen when the mean reaction times for all the individual subtasks were compared between the two groups of children. Further, it can be seen that the average reaction time is slightly greater for the nonlinguistic tasks in both groups of children. Also the reaction time was more for VS task for both groups of children and less for the RT

task for the typically developing group and BC task for the children with learning disability.

Table 2: The mean and standard deviation of reaction time in both groups of children for both linguistic and non-linguistic domains

Tasks	Sub-Tasks	TD*		LD*	
		Mean	SD	Mean	SD
Linguistic Tasks	Beginning consonants	1372.73	570.79	2360.00	894.67
	Rhyming words	1265.20	570.26	2420.61	808.44
	Total	1318.97	570.52	2390.31	851.55
Non Linguistic Tasks	Picture Matching	1302.94	301.98	2466.38	761.56
	Visual search	1580.26	587.03	2825.90	636.07
	Total	1441.60	444.50	2646.14	698.86
	Overall	1380.29	507.51	2518.23	775.20

*TD- Typically developing children, *LD-Children with learning disability

Mixed ANOVA was administered to study the main interaction effects of task and group. The results revealed no significant effect of task [$F(1,18)=0.438$, $p>0.05$], significant effect of group [$F(1,18)=28.528$, $p<0.01$], and no significant interaction between task and group [$F(1,18)=0.228$, $p>0.05$].

The main interaction effects of linguistic task (BC and RT) and group was analyzed using Mixed ANOVA. The results revealed no effect of task [$F(1,18)=0.015$, $p>0.05$], significant effect of group [$F(1,18)=16.646$, $p<0.01$], and no significant interaction between task and group [$F(1,18)=0.195$, $p>0.05$]. The same test was carried out with respect to the non-linguistic task (PM and VS). The results revealed no effect of task [$F(1,18)=5.363$, $p>0.05$], significant effect of group [$F(1,18)=27.842$, $p<0.01$], and no significant interaction between task and group [$F(1,18)=0.089$, $p>0.05$].

The mean reaction time values obtained were subjected to independent t-test to examine the significant difference between the groups in each task and the individual subtasks. The results revealed that there was a significant difference between both the groups in each of the task ($p<0.01$). The pairs viz. linguistic and non-linguistic task, BC-RT and PM-VS were tested for significance using paired t-test. There was no significant difference between these pairs at 5% level of significance.

These findings revealed that the reaction times of children with LD are significantly longer than the typically developing children. These results are in good agreement with the findings of Dykman, Walls and Suzuki (1970), Czudner and Rourke (1970, 1972), Sroufe (1971), Spring (1971), and Hayes, Hynd and Wisenbaker (1986) who suggested that children with LD processed information at a slower rate than children without LD. The slow reaction time in children with LD could be probably because of a general neuromaturational delay or neurologic immaturity (Scroufe, Sonies, & West, 1973) and because of a difficulty in maintaining or sustaining attention (Czudner & Rourke, 1970, 1972; Dykman, Walls & Suzuki, 1970; Sroufe, 1971). In addition the results also revealed that although the reaction time for nonlinguistic tasks was slightly greater, there was no significant difference in reaction times with respect to the linguistic and nonlinguistic tasks for both the groups. This could have resulted because of the type and number of tasks considered in the various domains. Similar results have been obtained by Miller, Leonard, Kail, Zhang, Tomblin and Francis (2006) in children with specific language impairment.

II. Accuracy:

An attempt was also made to determine differences in terms of the accuracy of responses in both the groups for linguistic and non linguistic tasks. This was calculated by counting the number of correct responses in each of the task. The mean and standard deviation was calculated and has been depicted in table 3. It can be seen from the table that the accuracy was lesser for the children with LD. In addition, the accuracy was better for the nonlinguistic task than the linguistic task.

Table 3: Accuracy of responses across groups

Tasks	Sub-Tasks	TD*		LD*	
		Mean	SD	Mean	SD
Linguistic Tasks	Beginning consonants	8.9	1.1	8.1	0.7
	Rhyming words	8.4	1.3	7.5	1.5
	Total	8.7	1.2	7.8	1.1
Non Linguistic Tasks	Picture Matching	6.0	1.5	6.2	1.6
	Visual search	6.4	0.8	5.8	1.7
	Total	6.2	1.2	6.0	1.7
	Overall	7.5	1.2	6.5	1.4

*TD- Typically developing children, *LD- children with learning disability

Mixed ANOVA was administered to study the main interaction effects of task and group. It revealed significant effect of task [$F(1,18)=78.061$, $p<0.01$], no significant effect of group [$F(1,18)=1.164$, $p>0.05$], and no significant interaction between task and group [$F(1,18)=1.826$, $p>0.05$]. The main interaction effects of linguistic task (BC and RT) and group was analyzed using Mixed ANOVA. The results revealed no effect of task [$F(1,18)=1.984$, $p>0.05$], significant effect of group [$F(1,18)=5.150$, $p<0.05$], and no significant interaction between task and group [$F(1,18)=0.016$, $p>0.05$]. The same test was carried out with respect to the non-linguistic task (PM and VS). The results revealed no effect of task [$F(1,18)=0.000$, $p>0.05$], no significant effect of group [$F(1,18)=0.130$, $p<0.05$], and no significant interaction between task and group

[F(1,18)=1.091, p>0.05].

The mean and the standard deviation were subjected to independent t-test to examine the difference between groups in each task. The results showed no significant difference between both the groups in each of the task (p>0.05) except the linguistic task where it showed a significant difference (p<0.05). The pairs viz. linguistic and non-linguistic task, BC-RT and PM-VS were tested for significance using paired t-test. There was no significant difference between the pairs BC-RT and PM-VS in both the groups whereas a significant difference was observed for linguistic and non-linguistic tasks in both the groups at 5% level of significance (p<0.01).

Thus the results suggested that the children with LD were significantly less accurate than the typically developing children especially on the linguistic tasks. The difficulty with the linguistic tasks could be probably attributed to their neuromaturational delay which could have possibly led to certain deficits in the linguistic skill. This shows that the language knowledge plays a significant role in the performance of these children. Hence, the linguistic tasks must be given greater importance during the intervention program.

However, the mean accuracy of children with learning disability was slightly better as compared to typically developing children in one of the sub-tasks (picture matching, a non-linguistic task). This could have resulted because of the fact that it a nonlinguistic task which rely mimimally on language knowledge. Moreover these children could have been exposed to this type of a matching task during the therapy sessions. There could also have been a possibility of guessing (which is a factor that is beyond the control of the investigators since they are covert in nature) or some other idiosyncratic factors associated with this response.

CONCLUSIONS

The important findings drawn from the present study are that the children with learning disability have longer reaction times in comparison with the typically developing children which indicate that their speed of processing is slow. This slower speed of processing was seen both in the linguistic and non-linguistic tasks. Moreover within both the groups there was no significant difference across the linguistic and nonlinguistic tasks. It was also seen that children with LD were significantly less accurate than the typically developing children especially on the linguistic tasks. These findings have implications with respect to intervention programs of children with learning disability. It is recommended that reaction time assessment be a part of the diagnostic protocol. Emphasis should also be placed on such reaction time tasks being incorporated in the therapy schedule so as to facilitate an increase in their overall processing speed. Along with devoting significant attention to details of language, clinicians might also provide children with activities that promote the mental manipulation of language and nonlanguage material that the children have previously acquired. Thus the treatment should be more broad based incorporating the linguistic and nonlinguistic tasks. Future investigations must try to determine why and under what circumstances children with learning disability are slow processors of information.

REFERENCES

Cerella, J., & Hale, S. (1994). The rise and fall in information-processing rates over the life span. *Acta Psychologica,* 86, 109-197.

Czudner, G., & Rourke, B. P. (1970). Simple reaction time in brain damage and normal children under regular and irregular preparatory interval conditions. *Perceptual and motor skills,* 31, 767-773.

Czudner, G., & Rourke, B.P.(1972). Age differences in visual reaction time of "brain damage" and normal children under regular and irregular preparatory interval conditions. *Journal of Experimental Child Psychology*, 13, 516-526.

Dykman, R.A., Walls, R., & Suzuki, T. (1970). Children with learning disabilities: Conditioning, differentiation, and the effect of distraction. *American Journal of Orthopsychiatry*, 40, 766-781.

Hayes, F. B., Hynd, G, W., & Wisenbaker, J. (1986). Learning disabled and normal college students' performance on reaction time and speeded classification tasks. *Journal of Educational Psychology,* 78, 39-43.

Kohnert, K., & Windsor, J. (2004). The search for common background: Part II. Nonlinguistic performance by linguistically diverse learners. *Journal of Speech, language and Hearing Research,* 47, 891-903.

Lima, S.D., Hale, S., & Myerson, J. (1991). How general is general slowing? Evidence from the lexicon domain. *Psychology of Ageing*, 6, 416-425.

Loomba, M. (1995). Descriptive analysis of the sequential progression of English reading skills among Indian children. An unpublished master's dissertation submitted to University of Mysore, Mysore, India.

Miller, C.A., Leonard, L.B., Kail, R.V., Zhang, X., Tomblin, J.B., & Francis, D.J. (2006). Response tiem in 14-year-olds with language impairment. *Journal of Speech, language and Hearing Research,* 49, 712-728.

Rae, G., & Potter, T.C. (1981) Early Reading Skills. *Informal Reading Diagnosis – A Practical Guide for the Classroom Teacher*, Prentice Hall, New Jersey.

Spring, C. (1971). Perceptual speed in poor readers. *Journal of Educational Psychology,* 62, 492-500.

Sroufe, L.A. (1971). Age changes in cardiac deceleration within a fixed fore period reaction-time task: An index of attention. *Developmental Psychology*, 5 (2), 338-343.

Sroufe, L.A., Sonies, B.C., & West, W.D. (1973). Anticipatory heart rate deceleration and reaction time in children with and without referral for learning disabilities. *Child Development*, 44, 267-173.

Wexler, B., & Halwes, T. (1983). Increasing the power of dichotic methods: the fused rhymed words test. Neuropsychologia, 21, 59-66.

S.L.H.D:-7

LANGUAGE SAMPLING FOR CORPUS LINGUISTICS: PICTURE STIMULI VS. SPONTANEOUS ELICITATION

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Abstract: Corpus Linguistics is field of linguistics and the term corpus is derived from Latin word 'corpus' that means body. In linguistics, it refers to a collection of data either in text or verbatim transcription of speech. Corpus linguistics can be used as a resource for linguistic description or as a means of verifying hypotheses about a given language.

A speech corpus is being developed with the purpose of using the data for fundamental research to study acoustic-phonetic, lexical, semantic, syntactic manifestations in a given language. It is also used to capture the variability that arises due to variations among speakers, gender, speaking environments, recording, transmission channels etc. Adult spoken language has been archived at the Central Institute of Indian Languages (CIIL), which has resulted in extensive creation of dictionaries in various languages. Use of computer text corpora in research is well established and is being used for teaching purposes. This includes the use of corpus data to inform and create teaching materials; it also includes the direct exploration of corpora by students in the study of linguistics, foreign languages, and language samples of persons with communication disorders.

Sampling language for study of corpus linguistics particularly in the population of children is challenging. Presently the most common method of sampling language from children is to administer a test and score the responses. The aim of the present study was to compare spontaneous language sampling with language samples elicited through pictures. For spontaneous language sampling, the child was given a topic and asked to speak about the topic. The sample was recorded on a digital recorder, transcribed and coded for analysis. For eliciting samples with the help of picture stimuli, pictures from the Computerized Linguistic Protocol for Screening (CLIPS: Anitha and Prema, 2002) were employed. Eight-year-old children who are native speakers of Kannada language were selected as subjects for the study. The data was analysed using Systematic Analysis of Language Transcripts (SALT). Analysis was done to examine the language data with reference to spontaneous vs. elicited responses. The study summarizes the results with reference to the method that can be employed to obtain language corpus from children.

India is a plural country with ubiquitous multilingual and multicultural people. According to the 1991 census, there are 114 languages and 216 mother tongues, 18 scheduled languages. These languages are spoken and used constantly by people for communicating with one another and are being studied and acquired by children in real time. People use these languages for their needs. Documentation of these languages becomes imperative for diachronic study of the language and hence studies in corpus linguistics play a very important role in documenting these languages to facilitate future studies in a language.

Corpus is a term that is derived from Latin that means a body and in the case of language; it means a spoken or written records of a language. A corpus can be classified into corpora for general and specific purpose. Many people have studied and worked in the field of corpus linguistics and are documenting language and its use. These documentations can be of written form and cite their source as excerpts from texts, magazines, newspapers, and many other reading materials that are printed. For example, a vast repository of written corpus is being created at the Central Institute of Indian Languages, Mysore. On the other hand, it can be in the form of a spoken language corpus that cites its source in real time usage of language.

A brief look at the child language corpora

Literature review on child language corpora suggests that considerable amount of work has been done in the area of child language that has led to the creation of wonderful repositories of child language. Research in child language has resulted in two major corpuses called CHILDES and CLAN in child language. The Child Language Data Exchange System (CHILDES) is a corpus established in 1984 by Brian MacWhinney and Catherine Snow to serve as a central repository for first language acquisition data. Its earliest transcripts date from the 1960's, and it now has contents (transcripts, audio, and video) in over 20 languages from 130 different corpora, all of which are publicly available worldwide. Recently, CHILDES has been made into a component of the larger corpus TalkBank 1 which also includes language data from aphasics, second language acquisition, conversation analysis, and classroom language learning.

[1] (TalkBank is a multilingual corpus established in 2002 and currently directed and maintained by Brian MacWhinney. The goal of TalkBank is to foster fundamental research in the study of human and animal communication. It contains sample databases from within several subfields of communication, including first language acquisition, second language acquisition, conversation analysis, classroom discourse, and aphasic language. It uses these databases to advance the development of standards and tools for creating, sharing, searching, and commenting upon primary linguistic materials via

networked computers),

However, corpus linguistics in India is an upcoming area that is of interest to language scientists who have worked on adult as well a child language. While speech corpus is being developed by establishing Minority Language Engineering (EMiLE), the Central Institute of Indian Languages (CIIL) has language database in five Indian languages (Bengali, Gujarati, Hindi, Urdu, and Punjabi) that is established using the recorded telephonic conversations. The Centre for Developing Advanced Computing (C-DAC), Noida is developing speech corpora for Hindi, Marathi and Punjabi languages. It is being used for development of speech synthesis systems. C-DAC centres in Kolkata and Trivandrum are developing speech corpus for Bengali, Assamese, Manipuri, Malayalam, Tamil and Telugu languages respectively for the purposes of developing speaker identification. Central Electronic Engineering Research Institute (CEERI) and Tata Institute of Fundamental Research (TIFR) jointly developed database of 207 words spoken by 50 speakers (two utterances) in Hindi for use in development of voice operated Railway Reservation Enquiry Systems. Central Forensic Science Laboratory (CFSL) at Chandigarh has developed Speaker Identification Database (SPID) for English and Hindi. It is developing a multilingual speakers' database for the identification in forensic applications. Institute of Computer Science (ICS), Hyderabad developed speech database for Telugu and Hindi for development of Interactive Voice Response Systems. Speech database is also being created at Devi Ahilya University Indore, for studying the effect of noise enhancement techniques for speech recognition and comparing differences in spoken Hindi in India.

While there appears to be a good beginning made for establishing speech and language corpora of typical adults, very few documented reports are available on corpora of children with communication disorders. There are several tests developed in India to measure language components at the phonological, syntax, semantic and pragmatic levels (Linguistic Profiling (LPT), Karanth, 1980; Vijayalakshmi, 1981; Prakshan 1999).and also training kits are developed for language intervention (Early Language Training Kit- Karanth, Manjula, Geetha and Prema, 1999). The data obtained on these tests are with reference to the objective of the respective research/ test but not with the purpose of establishing a holistic database of spoken language corpus in children. The present study focuses on the methodology of collection of spoken language data of children. This is a much-debated field as to the preferences and the techniques of eliciting data from children. The study focuses on comparison of language samples elicited through picture stimuli and spontaneous speech, the two most common methods of eliciting language data from children.

Studies on methods of language sampling

A variety of methods have been employed to collect languages samples, including encouraging the child to play with toys in free play interactions, to describe pictures, or to retell stories. Alternative means of assessing children's linguistic knowledge have involved more highly structured methods, particularly formal tests and elicited imitation tasks. Gallagher and Mulac (1975), Dailey and Boxx (1979),Connell and Myles-Zitzer (1982), Lahey, Launer and Schiff-Myers (1983), examined the linguistic behaviours sampled during elicited imitation and those produced during less structured spontaneous speech. The findings of the above studies revealed that more highly structured elicitations do not consistently predict children's spontaneous performances. Further, it was stated that while the spontaneous language sample provides a means of assessing syntactic, semantic and discourse regulation skills of children, a highly structured context, such as elicited imitation constraints the child's linguistic production, and precludes the evaluation of the child's conversational skills. Studies by Miller (1981), Bloom (1974), Morehead (1975), Prutting, Gallagher and Mulac (1975) Hood and Lightbown (1978), concluded that a highly structured observations of children's language not occurring within the context of natural discourse are void of a primary communication intent. Fujiki and Brinton (1983), on structured interactions suggested that a more highly structured interaction reduces variations in child's language use. Alternatively, it increases the reliability of the expressive language tests. Therefore, the elicitations are likely to underestimate the child's actual linguistic knowledge and provide little information regarding the child's discourse skills. In addition, children's language use has been observed to vary with different speaking partners and in different environments (Olswang and Carpenter, 1978, Scott and Taylor, 1978, Wellen and Broen, 1982) As a result of this variability the collection of spontaneous language samples generally has been with in free play interactions that permit low-structured unobtrusive observation and more closely preserve the naturalness of verbal interaction.

Longhurst and Grubb' 1974, Crystal et al. 1976, conducted a comparative study of language samples collected in four situations. The results found that elicitation settings with less structure, such as FP, elicited more complex language than did more structured setting such as CV. Several authors [Fujiki and Will brand 1982, Dolloghan et al 1990 Evans and Craig 1992] have criticised FP as being a time consuming method for the elicitation of an adequate sample and iterate that FP does not give the child an opportunity for them to use all their acquired syntactic structures. Atkin and Cartwright 1982 investigation into the effectiveness of three language elicitation procedures on Head Start children and their results showed that there was a significant difference between the proportions of complex syntactic structures elicited by FP compared with the other two methods.

Connell and Myles-Zitzer (1982) An Analysis of Elicited Imitation as a Language Evaluation Procedure. Journal of Speech and Hearing Disorders Vol.47 390-396 examined two aspects of elicited imitation procedures, the relationship between imi

tation and spontaneous performance and the effect of non-linguistic context using seven typical preschool children. They reported that the elicited imitation performance did not accurately predict spontaneous speech performance and that the addition of nonlinguistic context cues did not significantly affect the accuracy of imitation. Lahey, Launer and Schiff-Myers (1983). Prediction of production: Elicited imitation and spontaneous speech productions of language disordered children. Applied Psycholinguistics, 4, pp 317-343.- designed two forms of an imitation task to elicit eleven language behaviours from 32 language impaired children (mean age 7;4, mean MLU 2.9). The major finding was that predictions of spontaneous production varied among the eleven language behaviours. Additionally, the presence of contextual support had little effect.

Studies on Complex language elicitation was carried out by Wren.C.T 1985, who collected language samples from children with syntax problems and found that SG elicited less complex language than CV but more complex than FP.

Comparison of elicited imitation and spontaneous language sampling was undertaken by Fujiki and Brinton (1987). A Comparison with Spontaneous Language Production Language, Speech, and Hearing Services in Schools Vol.18 301-311-. Thirteen language-disordered subjects, ranging in age from 5:6 to 6:6, participated in the study. A Two half-hour spontaneous language sample was elicited from each child. In addition, each subject was given an examiner-constructed elicited imitation test.. The results of the two procedures were compared with regard to structure mastery the results of which were again highly variable between subjects.

Evans and Craig 1992 conducted a language sampling collection and analysis: Interview compared to freeplay assessment context on children with language impairment and the results indicated that CV elicited more complex language than FP.

Wagner, Nettelbladt, Sahlen and Hiholm 2000 conducted a study on conversation versus narration in pre-school children with language impairment and concluded that Wren: narration (a combination of SG and story retelling] elicited more complex utterances than did CV, which consisted of a combination of discussion on topics of interest to the child's life and interview-style question asking.

Southwood and Russell (2004) Comparison of Conversation, Freeplay, and Story Generation as Methods of Language Sample Elicitation Journal of Speech, Language, and Hearing Research Vol.47 366-376. are of the opinion that the spontaneous language sample forms an important part of the language evaluation protocol (Evans and Craig, 1992; Evans and Miller, 1999) because of the limitations of standardized language tests and their unavailability in certain languages, such as Afrikaans. Their study examined three methods of language elicitation, namely conversation (CV), free play (FP), and story generation (SG) on the five measures (number of utterances, variety of syntactic structures, mean length of the utterance (MLU), number of syntactic errors, and proportion of complex syntactic utterances) elicited from ten 5-year-old, Afrikaans-speaking boys. The study concluded that FP elicited significantly more utterances than did SG but elicited a smaller proportion of complex syntactic structures than did CV and SG. Furthermore, SG elicited longer utterances than did CV or FP.

Studies in corpus linguistics are dependent on varied and vast quantity of language data. Endeavours in creating a spoken language corpus must reflect the organic and creative nature of language in use recorded in. real time. Therefore, the need for the present study is to assess the creative and vast elicitations that can be utilised for making a spoken language corpus. A brief look at the work done by experts in the field of language elicitation reveals that structured elicitations do not consistently predict children's spontaneous performances though they increase the reliability of the expressive language tests. Structured elicitations reduce variations in child's language use, for example elicited imitation constraints the child's linguistic production, and precludes the evaluation of the child's conversational skills and provide little information regarding the child's discourse skills. The studies enumerate that spontaneous language sample contained more varied utterances than structured elicitations and provides a means of assessing syntactic, semantic and discourse regulation skills of children.

For the purpose of studies in corpus linguistics, a comparison of children's spoken language within two sampling conditions - spontaneous speech elicitation where the children were asked to describe a visit to the zoo, talk about their daily activity and their favourite cartoons., and elicitation through picture stimuli where the children's response to CLIPS (Computerized Linguistic Protocol for Screening (CLIPS, Anitha & Prema, 2002) have been considered. The samples from both conditions were transcribed and analysed with the help of SALT (Systematic Analysis of Language Transcripts, (SALT, Miller & Chapman, 1985).

Method

Language sampling in children is a challenging endeavour. The most common method of sampling language from children is to administer a test and score the responses. The aim of the present study was to compare spontaneous language sample with samples elicited through pictures. For this purpose, two participants aged 8 years, whose mother tongue is Kannada, with no known communication disorders, were considered for the study. The spoken language samples were recorded on a digital recorder at the participant's home in their mother's presence. During spontaneous elicitation, the children were asked to describe a visit to the zoo, talk about their daily activity and their favourite cartoons. For elicitation task, pictures were chosen from the Computerized Linguistic Protocol for Screening (CLIPS, Anitha and Prema, 2002).

Procedure

The language samples from the participants were collected in home situation, in the presence of their mother. During the first session, a spontaneous language sample was elicited. The time required for spontaneous elicitation was 15 minutes. The second session involved the administration of CLIPS the total time was 60 minutes. During spontaneous elicitation, the participant was asked to describe a trip to the zoo, their daily activity. In the mother- child interaction, the mother narrated the story of 'huli bantu huli' (tiger comes, tiger) to the child and asked questions based on the story. During Picture elicitation CLIPS was administered. The data elicited were recorded on a digital recorder and transcribed using broad phonetic transcription.

Results and discussion

The transcribed data was tagged and fed to SALT software. The analysis of results of participant A and participant B with the help of SALT is summarized in Table 1 and Table 2.

Table 1: Language sample of Participant A:

Type of linguistic entity	Spontaneous sample	Picture stimuli
Total Utterance	153	27
No. of complete words	739	479
MLU in words	17.74	4.83
MLU in morphemes	21.74	4.92
TTR	0.56	0.49
No. of different root words	417	233
Total main body words	739	479

MLU - Mean Length Unit; TTR-Type Taken Ratio

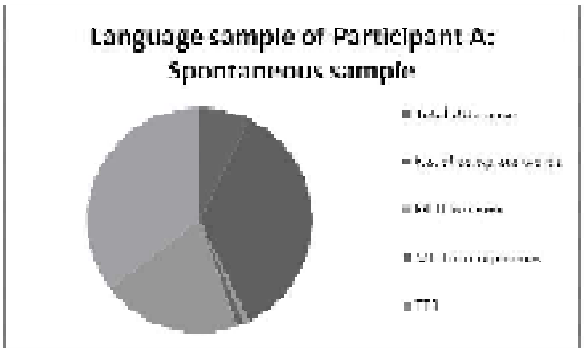
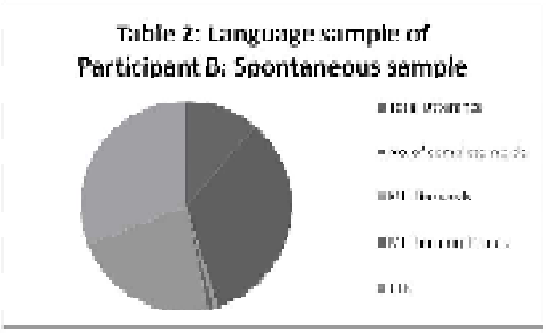


Table 2: Language sample of Participant B:

Type of linguistic entity	Spontaneous sample	Picture stimuli
Total Utterance	87	11
No. of complete words	256	61
MLU in words	5.55	2.71
MLU in morphemes	5.82	2.74
TTR	0.72	0.85
No. of different root words	169	52
Total main body words	236	61



Results and Discussion: From the results it can be gleaned that the Total number of utterances, Number of complete words, MLU in words, MLU in morphemes. TTR, Number of different root words and the total main body of words is higher in both the participant for spontaneous sample than picture stimuli.

The number of different root words is greater in spontaneous elicitation (417 for participant A and 169 for participant B) as suggested by Studies conducted by (Miller 1981, Fujiki & Brinton 1983)

The type token ratio of the child is higher for Spontaneous elicitation (0.56 for participant A and 0.85 for participant B) than that of CLIPS (0.49 for participant A and 0.72 for participant B) as supported by the studied conducted by (Bloom 1974, Morehead 1975, Prutting Gallagher & Mulac 1975, Hood & Lightbown, 1978,)

The effectiveness of two methods of language sample elicitation was compared with regard to their number of utterances, and the Type Token Ratio uttered by the children. It was found that elicitation in terms of spontaneous methods is higher (0.56 for participant A and 0.85 for participant B) than the picture elicitation (0.49 for participant A and 0.72 for participant B) for both the participants.

Spontaneous method of elicitation generated significantly more utterances than did picture elicitation. These results concord with the studies of Evans and Craig 1992, and supported by the studied conducted by (Bloom 1974, Morehead 1975, Prutting Gallagher & Mulac 1975, Hood & Lightbown, 1978,) who found that conversation elicited more language than freeplay. The results of the present study also concords with the results from Evan and Craig. It is evident from the data that Total utterances of the child is higher for Spontaneous elicitation(153 for participant A and 87 for participant B) than that in picture elicited response(27 for participant A and 11 for participant B)

Spontaneous samples elicited longer utterances (17.74 in MLU for participant A and 5.55 in MLU for participant B) than did picture elicitation (4.83 in MLU for participant A and 2.71 in MLU for participant B) thus refute the results of Dollgahan et al 1990 and Wagner et. al 2000 who found that picture elicitation elicited longer utterances than spontaneous methods of elicitation. The reason may be attributed to the fact that children were more vocal in narrating their expe

riences to the researcher and the child was not under any pressure to speak.

There was no significant difference between the proportion of complex syntactic structures elicited by spontaneous methods as well as picture elicitation. These results concord with the study carried out by Atkins and Cartwright 1982 and Longhurst and Grubb 1974 who found that elicitation settings with less structure, such as Free play, elicited more complex language that did more structures settings such as picture elicitation.

The findings of the study regarding the number of complex syntactic structures concurs with those of Evans and Craig 1992. who found that Conversation elicited more complex language than Free play, despite the fact that the participants in their study were language impaired, which may have influenced their results, as children who are language impaired tend to be less responsive in the presence of adults {Rosinski, McCledon & Newhoff, 1987] which may have reduced the quality of their expressive language .

Peterson and McCabe 1983 mentioned that the topic of discussing can influence the length of a elicitation like picture elicitation (though the Peterson et al study was on story generation). A possible explanation for the difference in results may be that as a method of controlling the variables the same pictures were shown to both the participants. The pictures shown were nouns and verbs from CLIPS and perhaps the nature of the pictures restricted the use of words that a child may use for describing a picture. This is evident from the present study as the over all performance was low for the participants in picture elicitation than compared to spontaneous elicitation.

Conclusion

The present study looks at language elicitation through two methods namely picture stimuli and spontaneous elicitation for the purposes of making spoken language corpora. The participants were 8 years old Kannada speakers who were typically children without any language impairment. In the spontaneous method of elicitation, the participants were asked to speak about their visit to the zoo, describe their day, and talk about their favourite cartoon. In picture elicitation CLIPS was administered. The results indicate that The total utterance, Number of complete words, Mean Length of Utterance in Words, Mean length of Utterance in Morphemes, Type Token Ratio, Number of Different Root Words, Total Main Body words were significantly higher for spontaneous elicitation than picture elicitation.

The Underlining factor of any corpus studies is the requirement of vast amounts of language samples for general or specific uses. However, a study in the field of child language corpora is in its nascency in India. Studies carried out in the area of picture stimuli and spontaneous speech elicitations have been in the form of tests to assess the language deficit a subject. Endeavours in child language corpora recommend the usage of Spontaneous elicitation methods for eliciting data that is varied and in large quantity. For example the Brian Mc Whinney, the creator of CHILDES recommends the use of spontaneous methods of elicitation as it is not restricting in nature and the child has ample ways to express himself. During spontaneous speech, the child may overlap and repeat however, recordings of spontaneous speech of long duration and in different context will yield a substantial and varied language data.

References

§ Adams, C., & Lloyd, J. (2005). Elicited and spontaneous communicative functions and stability of conversational measures with children who have pragmatic language impairments. *International Journal of Language & Communication Disorders, 40* (3) , 333 – 347

§ Agrawal S.S, Samudravijaya K and Arora K, (2006). Recent Advances of Speech Database Development Activity for Indian Languages, *Proc. ISCSLP 2006, Singapore*, pp. 771-776,

§ Anderson, R.C., and P. Freebody. (1983). Reading comprehension and the assessment and acquisition of word knowledge. Pp. 231-256 in *Advances in Reading/Language Research*, B. Hutson, ed. Greenwich, CT: JAI Press.

§ Anglin, J. M. (1993). Vocabulary development: A morphological analysis. *Monographs of the Society for Research in Child Development*, 58(10, Serial No. 238), 1-165.

§ Aston. G., Silvia. S., & Stewart. D. (1996). Corpora and Language Learners. *John Benjamin Publishing Company.* Isbn. 9027222886

§ Atkins. C.P & Cartwright.L.R.(1982). An investigation of the effectiveness of three language elicitation procedures on Head Start children. *Language, Speech and Hearing Services in School, 13*, 33-36

§ Bacchini. S. , Kuiken.F ., &Schoonen. R. (1995) Generalizability of spontaneous speech data: the effect of occasion and place on the speech production of children. *First Language, 15,* No. 44, 131-150

§ Baroni, M., Kilgarriff, A., Pomikálek, J., & Rychlý, P. (2006). WebBootCat: a web tool for instant corpora. *Proceedings of EURALEX,* Trento, Italy

§ Baroni, M. (2007). Distributions in text. In A. Lüdeling and M. Kytö (eds.), *Corpus linguistics: An international handbook*. Berlin: Mouton de Gruyter.

§ Biber, D. (1993). Representativeness in corpus design. *Literary and Linguistic Computing,* 8 (4): 243-258.

§ Biber, D. (1995). On the role of computational, statistical and interpretive techniques in multi-dimensional analysis of register variation. *Text,* 15 (3): 314—370

§ Biber, D., Conrad. S. R.,& Reppen. (1998). *Corpus Linguistics: Investigating Language Structure and Use* Cambridge: Cambridge University Press

§ Biemiller, A., & Slonim, N. (2001). Estimating root word vocabulary growth in normative and advantaged populations: Evidence for a common sequence of vocabulary acquisition. *Journal of Educational Psychology,* 93, 498–520. doi:10.1037/

0022-0663.93.3.498
§ Bishop D.V.M., Chan.J., Adams. C., Hartley. J .,& Weir. F (2000), Conversational responsiveness in specific language impairment: Evidence of disproportionate pragmatic difficulties in a subset of children worked with Development and Psychopathology *Cambridge University Press*
§ Bloom, L. (1974). Talking Understanding, and thinking: Developmental relationship between receptive and expressive language. In R.L. Schiefelbusch and L.Lyod (Eds.), *Language perspectives- acquisition, retardation, intervention* (pp285-312). Baltimore : University Park Press.
§ Camarata. S.M. , Nelson. K.E.,& Camarata .M.N. (1994) Comparison of conversational-recasting and imitative procedures for training grammatical structures in children with specific language impairment .*Speech Hearing Research. 37*(6):1414-23
§ Craig H.K.,& Evans J. L (1989) .Turn Exchange Characteristics of SLI Children's Simultaneous and Non simultaneous Speech .*Journal of Speech and Hearing Disorders .54* 334-347.
§ Craig.H.K., & Washington.J.A.(2000). An assessment battery for identifying language impairments in African American Children. *Journal of Speech, Language, and Hearing Research, 43*, 366-379
§ Craig E.R., & Chapman.R.S. (1987) Story Recall and Inferencing Skills in Language/Learning-Disabled and Nondisabled Children . *Journal of Speech and Hearing Disorders .52.* 50-55.
§ Connell J. P.,& Myles-Zitzer C . (1982). An Analysis of Elicited Imitation as a Language Evaluation Procedure. *Journal of Speech and Hearing Disorders* Vol.47 390-396
§ Crystal, D. 1995. *The Cambridge Encyclopedia of the English Language.* Cambridge: Cambridge University Press
§ Dash. N. S. (2005). *Corpus Linguistics and Language Technology.* Mittal publications. Isbn 818324033x
§ Davies A. (1975). *Problems of Language and Learning*. Heinemann Publications. Isbn 0435101900
§ Dickinson. D .K. & Neuman. S.B. (2006). *Handbook of early Literacy research.2*. Gilford press. Isbn.1-59385-184-7. Acc no. 14784
§ Dolloghan, C; Campbell, T & Tomlin, R. (1990). Video narration as a language sampling context. *Journal of Speech and Hearing Disorders,* 55, 582-590
§ Dunn. M., Flax. J., Sliwinski. M., & Aram. D (1996). The Use of Spontaneous Language Measures as Criteria for Identifying Children With Specific Language Impairment An Attempt to Reconcile Clinical and Research Incongruence .*Journal of Speech and Hearing Research .39,* 643-654
§ Eisenberg. S (1997). Investigating Children's Language: A Comparison of conversational Sampling and Elicited Production. *Journal of Psycholinguistic Research. 26,* 5
§ Evans. J.L., & Craig. H.K (1992). Language sampling collection and analysis: interview compared to free play assessment contexts. *Journal of Speech and Hearing Research, 35,* 343-353
§ Fenson, L., Dale, P., Reznick, J., Thal, D., Bates, E., Hartung, J., Pethic, S., & Reilly, J. (1993). *The MacArthur communicative development inventories: User's guide and technical manual*. San Diego, CA: Singular Publishing.
§ Fishman. J.A. (1999). *Handbook of Language and Ethnic Identity.* Oxford University Press. Isbn.0-19-512428-6. Accno.12189
§ Fujiki. M .,& Brinton .B. (1983). Sampling Reliability in Elicited Imitation .*Journal of Speech and Hearing Disorders ,48* ,85-89
§ Fujiki. M.,& Brinton. B (1987). A Comparison with Spontaneous Language Production. *Language, Speech, and Hearing Services in Schoolsl,18* ,301-311
§ Gill, F. (1993). A corpus-driven approach to grammar. In Baker. M, Francis .G, and Tognini E.-Bonelli, eds., *Text and Technology: In honour of John Sinclair*. Amsterdam: John Benjamins
§ Greenslade K.J., Plante E.,& Vance R. (2009).The Diagnostic Accuracy and Construct Validity of the Structured Photographic Expressive Language Test—Preschool: Second Edition .*Language, Speech, and Hearing Services in Schools ,40,* 150-160.
§ Hood, L & Lightbown, P. (1978) What children do when asked to say what I say: Does elicited imitation measure linguistic knowledge? *Allied Health and Behavioural Science*, 1, 195-220
§ Hoffman. L.M (2009) .The Utility of School-Age Narrative Microstructure Indices: INMIS and the Proportion of Restricted Utterances. *Language, Speech, and Hearing Services in Schools ,40* ,365-375.
§ Kramer. C. A., James. S., & L.Saxman .J. H (1979). A Comparison of Language Samples Elicited at Home and in the Clinic .*Journal of Speech and Hearing Disorders ,44,* 321-330 .
§ Kilgarriff, A., Atkins, S., & Rundell, M. BNC Design model past its sell-by. *Proceedings of the Corpus Linguistics Conference,* Birmingham, UK
§ Klecan-Aker J.S., & Hedrick D.L (1985). A Study of the Syntactic Language Skills of Normal School-Age Children .*Language, Speech, and Hearing Services in School.16* ,187-198
§ Lahey. M., Launer P.B., & Schiff-Myers.M (1983). Prediction of production: Elicited imitation and spontaneous speech productions of language disordered children. *Applied Psycholinguistics, 4 ,* 317-343.
§ Longhurst, T..M. & Grubb.S. (1974). A comparison of language samples collected in four situations. *Language, Speech and Hearing Services in Schools*, 5, 71-78
§ Mallikarjun B. (2001). " Languages of India according to the 1991 census". *Language in India*
§ McEnery, T. and Wilson, A. (2001). *Corpus Linguistics.* (2nd Ed.) Edinburgh: Edinburgh University Press
§ McEnery, T., Xiao, R.,& Tono, Y. (2006). *Corpus-based lan*

guage studies : an advanced resource book London: Routledge.
§ Morehead, D. (1975). The sstudy of linguistically deficient children. In S.Singh (Ed), *Measurement in hearing speech and language*. Baltimore: University Park Press
§ Morrison J.A., & Shriberg. L.D (1992). Articulation Testing Versus Conversational Speech Sampling. *Journal of Speech and Hearing Research,35,* 259-273 .
§ Nelson. L.K .,& Weber-Olsen. M (1980). The Elicited Language Inventory and the Influence of Contextual Cues .*Journal of Speech and Hearing Disorders,45,* 549-563 .
§ Norbury C. F., Nash M., Baird G; Bishop D.V.M. (2004) . Using a parental checklist to identify diagnostic groups in children with communication impairment: a validation of the Children's Communication Checklist—2 .*International Journal of Language & Communication Disorders, 39(*3), 345 – 364 .
§ Paradis.J (2005) .Grammatical Morphology in Children Learning English as a Second Language: Implications of Similarities with Specific Language Impairment. *Language, Speech & Hearing Services in Schools, 36(*3),172-188.
§ Peña E. D., Malek .M., Ruiz-Felter. R., Resendiz. M., Fiestas C., & Sabel. T. (2006) Dynamic Assessment of School-Age Children's Narrative Ability: An Experimental Investigation of Classification Accuracy .*Journal of Speech, Language, and Hearing Research,49* ,1037-1057 .
§ Pence. K.L (2007). *Assessment in Emergent Literacy*. Plural Publishing. Isbn.978 1 59756 097 9. Acc no. 15485
§ Peterson.C ., & McCabe.A. (1983). *Developmental psycholinguistics: Three ways of looking at child's narrative*. Newyork: Plenum Press
§ Prutting, C; Gallagher, T; & Mulac, A. (1975) Imitation: A closer look. *Journal of Speech and Hearing Disorders*, 41, 412-422
§ Rosinski-McCledon, M.K., & Newhoff. M (1987) .Conversational responsiveness and assertiveness in language impaired children. *Language, Speech and Hearing Services in Schools, 18*, 53-62
§ Sampson. G .,& McCarthy. D, eds. (2004). *Corpus Linguistics: Readings in a Widening Discipline.* London: Continuum
§ Schultz .T ., & Kirchhoff. K. (2006). *Multilingual Speech Processing*. Elsevier Inc. Isbn. 978-0-12-088501-5. Accno. 14847
§ Southwood. F., & Russell A.F, (2004). Comparison of Conversation, Freeplay, and Story Generation as Methods of Language Sample Elicitation. *Journal of Speech, Language, and Hearing Research,47* ,366-376 .
§ Thirumalai. M.S. (1977). *Language acquisition thought and disorder*. Central Institute of Indian Languages. Acc no. 4320
§ Thirumalai .M. S.(1977). *Learning theories and Linguistics*. Central Institute of Indian Languages. Acc no. 4289
§ Thirumalai .M. S. (1979). *Language in Science*. Geetha Book House. Acc no 6444
§ Wagner. C.R., Nettelbladt. U., Sahlen.B., & Hilholm. C. (2000). Conversation versus narration in pre-school children with language impairment. *International Journal of Language and Communication Disorders, 35,* 83-93
§ Wren. C.T.(1985) collecting language samples from children with syntax problems. *Language, Speech and Hearing services in Schools, 16*, 83-102
§ Ziatas. K., Durkin. K.,& Pratt. C (2003). Differences in assertive speech acts produced by children with autism, Asperger syndrome, specific language impairment, and normal development. *Development and Psychopathology, 15* , 73-94 .
Web references
www.disabilityindia.org/djartjan06A.cfm
"www.encyclopedia.com
www.essex.ac.uk

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A Brief about CLIPS :

The screening test was developed by selecting pictures from the project 'production of linguistic training material in major Indian languages' founded by UNCIEF.

The early language training manual (Karanth, Manjula, Geetha, Prema, 1999) was developed as indigenous training material at affordable prices for those identified with delayed acquisition. The instruction manual developed and designed is to meet need and serve as core teaching material in 10 Indian languages spoken across India

The material for language training consists of 664 picture cards designed to teach/ elicit a variety of language forms, meaning and use. The picture consists of simple line drawing in the Indian context\. The pictures were filed tested by field investigators in 10 languages in the age range of 3-12 , adults (literate and illiterate) and children with delayed speech and language. This was done for assessing the suitability of the picture to the Indian population. Based on the field-testing few pictures were eliminated and some were modified. The pictures were taken because

pictures were filed tested in various Indian languages

Ambiguous pictures were removed during field test

Pictures were black and white line drawing and easily replicable and culture free so that children of different places can be assessed

Selection of pictures for CLIPS

The field-tested data of UNCIEF project was examined to choose pictures for developing the protocol. The pictures which elicited 75% to 100% responses from the subjects during earlier field tests were selected and the pictures which were ambiguous and descriptive enough were selected. The selected pictures were equally distributed among different categories semantics and syntax were scanned individually and stored in a cd rom which was loaded on a lap top computer for presentation during the screening

Test Items

The test items compromises of a set of 4 pictures, single picture as well as set of 3 or 4 pictures depending on target

parameter containing black and white line drawing in each of the categories. The categories are arranged according to increasing difficulty order as given by Karanth & Suchitra 1993. the various categories are lexical categories, antonym, polar questions, syntagmatic relationships, paradigmatic relationships, semantic similarity, semantic anomaly, semantic contiguity, plurals, affirmative –negative forms, interrogatives, person, number gender, transitive intransitives, causatives, conditional clauses, conjunctions, comparatives, quotatives, case markers, tenses, participle constructions.

Design

The order presentation of comprehension and expression task in particular category was varied in such a way that every alternate subject in the age group was tested for comprehension and expression therefore out of 6 subjects in age group three subjects had comprehension tasks to be performed 1st and 3rd had expression task to be performed first. The counter balance design was adopted to see whether the performance of children differs when presented with comprehension or expression.

Data

The subject was instructed according to the specific instruction. Comprehension expression separately for different categories to respond appropriately e.g lexical task. what is this? No subject was given any clues or promoted for response elicitation. The responses elicited after showing the pictures one after the other. The subjects response are recorded on a scoring sheet. The subject Reponses were scored as (yes) when a target response e.g (Nurse for picture of nurse or equivalent response. Eg. Sister for picture of nurse) the incorrect data was recorded verbatim in the data entry format.

S.L.H.D:-8

VOCAL CHANGES IN PREMENOPAUSAL, POSTMENOPAUSAL AND SURGICALLY INDUCED MENOPAUSAL PROFESSIONAL VOICE USERS

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INTRODUCTION: Sex hormones have a great influence on voice quality, so it has been suggested that the human larynx can be considered as 'sex hormonal target organ' (Abitbol et al., 1989). In both male and female genders, the voice evolves from childhood to senescence under the varied levels of estrogens, progesterone, and androgens. Both male and female voice changes in early and later reproductive stages of life (i.e. puberty and andropause/ menopause). However, because the female reproductive endocrine system is much more complicated, the female voice is more significantly and cyclically affected by sex hormonal variations than the male voice.

Estrogen target cells have been identified in the epithelium of the vocal folds (Fergusson, Hudson and McCarty, 1987). These estrogen receptor sites on the membranes of the epithelial cells are proteins that bind with specific hormones in the fluid component of the cell. It is suggested that a decrease in estrogen levels causes water retention, edema and venous dilatation of vocal fold tissue, which result in increased vocal fold mass. There are indications that these variation are reflected in the voice and that finally the menopause triggers more permanent vocal changes.

At the menopause, cyclical menstruation ceases as a result of stopped secretion of progesterone and decreased secretion of estrogen. Post menopausally, androgens (male hormones) are secreted by the ovaries and the adrenal cortex. The lack of estrogens and relative excess of androgens results in the vocal fold becoming edematous (gradual atrophy of mucosa), so that the voice becomes noticeably deeper and hoarse. The reduction in the activity of glandular cells around the vocal folds causes dryness, which in turn may result in vocal fatigue and dysphonia.

Surgically induced menopause (hysterectomy) is the removal of the uterus and sometimes-other parts of the reproductive system as well. The removal of the uterus brings with it the end to menstruation and fertility. Voice undergoes changes due to lack of estrogen in surgically induced menopausal women (Firat, 2009).

Abitbol & Abitbol (1998) reported findings of decreased intensity, vocal fatigue and narrow register in professional voice performers. If the woman has to use her voice a great deal at work, the laryngeal condition may be aggravated by vocal strain.

Most women arrive at menopause after a gradual decline in estrogen, making it a progressive and somewhat steady process. Women who arrive at menopause by surgical means, however, are suddenly thrust into a menopausal state by more abrupt means. Some women welcome the immediate change, while others are irritated by it.

When such risk factors are present in professional voice user such as teachers, they may cause vocal limitations and unpredictability and cause performance difficulties. Hence, there is a need to study the voice changes in professional voice user affected by such conditions.

The main objective of this experiment is to document changes in voice because of variation in sexual hormones. This in turn would form the base for a multidisciplinary approach to understand in a comprehensive and integrated manner, menopausal and surgically induced menopausal female voice characteristics.

METHOD

Participants

The participants in the study were six females who were professional voice users. They were all teachers by profession. They had a minimum of 8 years experience in teaching middle

and high school classes. The participants were divided into 3 groups. The first group consisted of 2 teachers in the age ranges of 35 - 45 years who are in the pre – menopausal period (who had normal menstrual cycles). The second group included 2 teachers (above 45 years) who were in the menopausal stage. The third group comprised of 2 teachers (above 45 years) who had undergone surgically induced menopause (Hysterectomy). Three trained speech language pathologists were considered as judges for perceptual analysis of voice samples.

Procedure: The purpose of the present study is to comprehensively analyze vocal function of women in premenopausal, post menopause and surgically induced menopause, by using a battery of voice assessment protocol including acoustic and perceptual procedures.

Task: All the subjects were instructed to carry out the following tasks

1) Sustained vowels /a/ and /i/ for 3-5 seconds duration each at comfortable pitch and loudness
2) Sentence production
3) Spontaneous speech – they were asked to talk about their profession

Acoustic analysis: The audio samples were directly recorded using the wave surfer software and saved as audio wave files. These audio wave files were line fed into the module of CSL-4500. The following parameters were extracted using the Multi-Dimensional Voice Profile" (MDVP) software. Each isolated vowel was fed to the MDVP with a sampling rate of 32 kHz. Subsequently eight acoustic measures were extracted from each vowel production, as follows:

I. Fundamental frequency information measures
1) Average fundamental frequency (F0)
2) Average pitch period (T0)
3) Highest fundamental frequency (Fhi)
4) Lowest fundamental frequency (Flo)
5) Standard deviation of fundamental frequency (STD)

II. Short and long term frequency perturbation measures
1) Absolute jitter (Jita)
2) Jitter percent (Jitt)
3) Relative average perturbation (RAP)
4) Pitch perturbation quotient (PPQ)
5) Smoothed Pitch perturbation quotient (sPPQ)
6) Fundamental frequency variation (vF0)

III. Short and long term amplitude perturbation measures
1) Shimmer in dB (ShdB)
2) Shimmer % (Shim)
3) Amplitude perturbation quotient (Apq)
4) Smooth Amplitude perturbation quotient (sApq)
5) Peak amplitude variation (vAm)

IV. Voice break related measure
1) Degree of voice breaks (DVB)
2) Number of voice breaks (NVB)

V. Sub harmonic related measures
1) Degree of sub harmonic segments (DSH)
2) Number of sub harmonic segments (NSH)

VI Voice irregularity related measures
1) Degree of voice less (DUV)
2) Number of unvoiced segments (NUV)

VII. Noise related measures
1) Noise to harmonic ratio (NHR)
2) Voice turbulence index (VTI)
3) Soft phonation index (SPI)

VIII. tremor related measures
1) F0 tremor intensity index (FTRI)
2) Amplitude tremor intensity index (ATRI)
3) F0 tremor frequency (Fftr)
4) Amplitude tremor frequency (Fatr)

Perceptual Analysis: The audio wave files of the phonation samples were used for perceptual analysis. The samples were presented individually to the listeners using headphones. Consensus Auditory- Perceptual Evaluation of Voice (CAPE-V, Kempster et al., 2002) was used for the analysis. The test has options for rating the following features of voice as mild, moderate and severely deviant using a 100 mm visual analogue scale.

- ❖ Roughness,
- ❖ Breathiness,
- ❖ Strain,
- ❖ Pitch,
- ❖ Loudness and
- ❖ Overall severity

Analysis: The extracted acoustic features were compared across the three groups. The results are discussed based on the mean values obtained for subjects in each group as the sample size was small.

RESULT AND DISCUSSION

Acoustic

I. Fundamental frequency information measures

Condition	Vowel	F0	T0	Fhi	Flo	STD
Pre-menopause	/a/	202	6.6	251.5	131.3	21.9
	/i/	218.6	4.6	252.5	191.2	5
Post-menopause	/a/	182.3	3.8	235.3	196	6.4
	/i/	209	4.8	209	96	30.4
Hysterectomy	/a/	171	6	202.2	158.5	4.3
	/i/	200.1	4.9	258.5	92	30.5

Table 1: Mean of Fundamental frequency information measures

The above table shows the comparison across the three groups of participants in frequency related measures. In the pre-menopausal group, it can be observed that the fundamental frequency of all the vowels was higher as compared to the post-menopausal and the hysterectomy group. This shows that there is a reduction in the fundamental frequency brought about by the hormonal changes during post-menopause and hysterectomy. The other measures of frequency namely the highest and the lowest frequency of phonation also show variability across groups. The highest fundamental frequency (Fhi) is higher for pre-menopause followed by post-menopause and lastly the hysterectomy group. This supports the role of hormones in the pitch changing mechanism. Owing to hormonal changes during post-menopause and hysterectomy, one can see a lowering of the pitch during phonation tasks. The frequency range is highest in pre-menopausal group as compared to the other two groups which show reduced phonation ranges. This is again attributable to the change in the pitch-changing mechanism brought about by hormonal changes. These hormonal changes restrict the highest and the lowest limits of phonation thereby resulting in reduced frequency range. The higher standard deviation seen in pre-menopausal group is suggestive of the higher variability in phonation as against the remaining two groups.

Short and long term amplitude perturbation measures exhibited almost similar pattern across 3 groups. Post menopause group showed maximum values followed by hysterectomy and pre-menopause group except for peak amplitude variation (vAm) which showed maximum values for pre-menopause.

In postmenopausal women laryngeal changes like edema, muscular and mucosal dystrophy and atrophy have been reported. This could have led to higher amplitude perturbation. (Evelien et al., 2009). In case of surgically induced menopause also there is sudden lack of estrogen and relative excess of androgen which can lead to same changes such as edema and atrophy.

IV. Voice break related measure

Condition	Vowel	DVB	NVB
Pre-menopause	/a/	.4	.5
	/i/	.3	1
Post-menopause	/a/	10	3.5
	/i/	22.4	6
Hysterectomy	/a/	.6	.5
	/i/	.8	2.1

Table 4: Mean of voice break related measure

II. Short and long term frequency perturbation measures

Condition	Vowel	Jita	Jitt	RAP	PPQ	sPPQ	vF0
Pre-menopause	/a/	175.7	2.5	1.5	1.6	3	15
	/i/	97.1	2.1	1.3	1.2	1.3	2.3
Post-menopause	/a/	54.6	1.8	.9	1.1	.8	2.9
	/i/	96.5	2	1.9	1.3	3.6	14.5
Hysterectomy	/a/	110.4	2.3	1.1	1	1.3	2.5
	/i/	98.3	2.3	1.4	1.1	1.5	2.8

Table 2: Mean of short and long term frequency perturbation measures

The above table reveals the changes seen across the three groups in short and long term frequency perturbation measures. Frequency perturbation measures namely absolute jitter (Jita) and jitter percent (Jitt) are highest for pre-menopause followed by hysterectomy and least for post-menopause groups. The other measures of frequency perturbation also show similar patterns with the highest perturbation measure being recorded for the pre-menopause group followed by the hysterectomy group and least for the post-menopause group. There is not much of difference in the pattern across vowels.

Voice break related measures were found maximum in post menopause followed by hysterectomy and pre-menopause group. This can also be attributed to laryngeal changes in post menopause and hysterectomy.

III. Short and long term amplitude perturbation measures

Condition	Vowel	shdB	Shim	APQ	SAPQ	vAm
Pre-menopause	/a/	.6	7.7	5.6	1.9	45.2
	/i/	.6	7.9	5.5	9.2	74.9
Post-menopause	/a/	.7	9.6	6.3	13.7	88.7
	/i/	.6	7.1	6.04	11.3	33.3
Hysterectomy	/a/	.7	7	6.9	9.1	19.1
	/i/	.7	7.5	5.9	7.1	18.3

Table 3: Mean of Short and long term amplitude perturbation measures

V. Sub harmonic related measures

Condition	Vowel	DSH	NSH
Pre-menopause	/a/	1.8	2
	/i/	1.7	5
Post-menopause	/a/	8.6	7
	/i/	8	8
Hysterectomy	/a/	8.1	8
	/i/	7.6	6

Table 5: Mean of sub harmonic related measures

VI. Voice irregularity related measures

Condition	Vowel	DUV	NUV
Pre-menopause	/a/	6.3	4
	/i/	1.5	2
Post-menopause	/a/	4.8	5
	/i/	2.8	7.5
Hysterectomy	/a/	6.8	8
	/i/	4.5	11

Table 6: Mean of voice irregularity related measures

In the sub harmonic related measures and in the voice irregularity related measures it can be found that the scores are higher but more or less similar for hysterectomy and post menopause clients while the scores were less for pre-menopause clients. This is expected because in hysterectomy and post-menopause conditions there is a change in the hormonal levels which may have lead to vibratory irregularities.

VII. Noise related measures

Condition	Vowel	NHR	VTI	SPI
Pre-menopause	/a/	.2	.1	8
	/i/	.2	.1	2.6
Post-menopause	/a/	.2	.1	8.8
	/i/	.2	.1	3.8
Hysterectomy	/a/	.2	.03	35
	/i/	.2	.05	28.1

Table 7: Mean of Noise related measures

In this study it was noticed that the NHR and VTI values across conditions were almost similar. Noise to harmonic ratio (NHR) is one of the sensitive index of vocal function. NHR quantifies the relative amount of additive noise in the voice signal. Additive noise arises from turbulent airflow generated at the glottis during phonation. Inadequate closure of the vocal folds allows excessive airflow through the glottis, giving rise to turbulence. The result will be friction noise which is reflected as a higher noise level in the spectrum.

Soft Phonation Index (SPI) is an acoustic analysis parameter contained in the Multidimensional Voice Program (MDVP) which was designed to be an indicator of vocal fold adduction and glottal closure during phonation. The sudden stoppage of estrogen and increased androgen production in hysterectomy conditions results in the edema of the vocal fold which resulted in much more breathy voice leading to higher SPI. Similar results were found in this study; SPI is affected more in hysterectomy followed by post menopause and pre-menopause.

VIII. Tremor related measures

Condition	Vowel	fTRI	ATRI	Fftr	Fatr
Pre-menopause	/a/	5.4	10.9	5.4	2.2
	/i/	.2	12.7	2.9	2.3
Post-menopause	/a/	.4	16.7	2.4	-
	/i/	.6	12.8	2.3	5
Hysterectomy	/a/	0.4	-	3.8	3.6
	/i/	.4	10.2	3.9	4.1

Table 8: Means of tremor related measures

It is evident from literature that there is noticeable change that occurs in the female voice after menopause as a result of increased systemic androgen. The ovary secretes minimal or no estrogen, but continues to secrete androgen, which causes unsteadiness of the voice, rapid changes of voice quality resulting from the instability in vocal fold vibration, thus varying the tremor related measures such as fTRI, aTRI, Fftr, Fatr. In our study it is seen that, there is an overall increase in these measures in pre menopause conditions when comparing with post menopause and the hysterectomy conditions. Increased jitter, other perturbations and noise measures usually indicate lack of precise control in vocal fold vibrations and presence of a posterior glottis chink commonly noticed in normal females especially in younger age groups.

However the decreased mean values for perturbation, noise related measures values in post-menopause maybe attributed to the complete vocal fold close during vibrations as the vocal folds are edematous a condition due to lack of female hormones in post-menopause.

Perceptual

TYPES	ROUGHNESS	BREATHINESS	STRAIN	PITCH	LOUDNESS	RESONANCE	OVERALL SEVERITY
PRE 1	25 (mild)	20 (mild)	-	-	-	Normal	20 (mild)
PRE 2	-	-	-	-	-	Normal	-
Post 1	40 (moderate)	50 (moderate)	60 (mod -sev)	20 (mild)	-	Normal	55 (moderate)
Post 2	60 (mod- sev)	65 (mod - sev)	60 (mod - sev)	20 (mild)	–	Normal	65 (mod – sev

HIST1	75 (mod - sev)	85 (severe)	75 (severe)	15 (mild)	-	Normal	80 (severe)
HIST2	60 (mod - sev)	65 (mod sev)	60 (mod -sev)	25 (mild)	20 (mild)	Normal	70 (mod - sev)

Table 9: Perceptual ratings

According to the perceptual voice evaluation using CAPE - V, it is seen that the severity was more for subjects who had surgically induced menopause, followed by post menopause and least affected in pre menopause conditions.

In the present study, with respect to perceptual evaluation, it was found that, pitch was lower in both hysterectomy and post menopause conditions. This is because at menopause there will be a reduction in the secretion of female sex hormones. This lack of oestrogen and relative excess of androgens result in the vocal folds becoming oedematous which made the voice to become notably deeper and hoarse. In hysterectomy also this kind of sudden changes led to lowered pitch.

It was evident from the perceptual analysis that in both hysterectomy and post menopause conditions the vocal quality was found to be hoarse. This we can see from the results that the both roughness and breathiness have contributed more or less equally to this hoarse vocal quality. As our subjects were teachers who are classified under professional voice users, the findings of vocal strain being higher in the post menopause and hysterectomy conditions can be attributed to the fact that the laryngeal changes during these conditions may be aggravated by the increased use of voice.

Conclusion:

The present study attempted to examine the vocal changes across the 3 conditions namely, pre-menopause, post-menopause and hysterectomy. Acoustic and perceptual analysis of the voice samples revealed changes across the three conditions. Post menopausal condition was severely affected followed by hysterectomy and premenopause. The voice change following postmenopause and hysterectomy is attributed to the hormonal changes affecting laryngeal systems. This is a preliminary attempt towards gaining insight into the vocal fold function following menopause as a consequence of normal ageing and surgically induced menopause. Further investigation is required through longitudinal studies with a larger number of individuals.

REFERENCES

Abitbol, J., & Abitbol, B. (1998). The voice and menopause: The twilight of the divas. Contraception, Fertilite, Sexualite, 26, 649–655.

Abitbol, J., de Brux, J., Millot, G., Masson, M. F., Momoun, O. L., Pau, H., & Abitbol, B. (1989).Does a hormonal vocal cord cycle exist in women? Study of vocal premenstrual syndrome in voice performers by videostroboscopy–glotography and cytology on 38 women. *Journal of Voice*, 2, 157–162.

Ferguson, B.J., Hudson, W.R., McCarty, K.S.(1987) Sex steroid receptor distribution in the human larynx and laryngeal carcinoma. *Archives of Otolaryngology Head Neck Surgery*. 113:1311-1315

Firat, Y., EnginUstun, Y, Kizilay,A. , Ustun, Y., Akarcay, M, Selimoglu, E, Kafkasli, A (2009). Effect of Intranasal Estrogen on Vocal Quality. *Journal of Voice*, 23 (6), 716-720

Kempster, G., Gerratt, B., Verdolini, K., Kraemer, J.& Hillman, R.(2002). ASHA Special Interest Division 3, Voice and Voice Disorders

S.L.H.D:-9

COGNITIVE CUEING AND VOCAL VARIABILITY

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Introduction: An emotion is a mental and physiological state associated with a wide variety of feelings, thoughts, and behavior. Emotions are subjective experiences, often associated with mood, temperament, personality, and disposition. Emotions colour the language, and can make meaning more complex. To classify the emotive state by a speaker on basis of the prosody and voice quality, there is the necessity to classify acoustic features in the speech as connected to certain emotions. This also implies the assumption that voice alone really carries full information about emotive state by the speaker. Generally materials from three categories are used in investigating emotional speech: spontaneous speech, acted speech and elicited speech. Spontaneous speech contains the most direct and authentic emotions, but the difficulties in collecting this kind of speech are also extensive. In the ideal condition, speakers should be recorded without knowing about it, so that they behave completely naturally. The acted speech is merely conforming to stereotypes of how people believe that emotions should be expressed in speech, not how emotions actually are expressed. This indicates that acted speech is more stereotypical, and that the expression of emotions is more extreme than in spontaneous speech. In elicited speech the idea is that certain emotions are induced. The procedure can be that subjects watch a film, which should evoke specific emotions, and then they have to retell the film to the experimenter. Here the idea is that the speech shall be coloured by the emotion induced. It is also possible to put a subject into a situation meant to evoke a specific emotion,

and then record her/his speech. The induction method has the positive feature that it gives control over the stimulus; on the other hand, different subjects may react differently on the same stimulus. The validity of such elicited, or induced, speech depends to a large extent on how successful the induction process was (Stibbard, 2001).

A key aspect of cognitive cueing is an individual's level of cognitive development. In order for cognitive cueing to be effective, an individual must be able to form mental representations of objects and realize that objects exist even when they are not in sight (Piaget, 1952). Developmental specialists believe the ability to form mental representations develops from 2.0 to 8.11 years of age (Piaget, 1952; White, 1965).

A mental image is an experience that, on most occasions, significantly resembles the experience of perceiving some object, event, or scene, but that occurs when the relevant object, event, or scene is not actually present to the senses (McKellar, 1957; Richardson, 1969; Finke, 1989; Thomas, 2003). While aspects of cognitive therapy have been incorporated into the area of voice, there are a limited number of research studies exploring its use in voice and voice training. Reich et al. (1989) utilized aspects of cognitive training to elicit five stimulus-tone conditions of (a) discrete steps, (b) slow steps, (c) fast steps, (d) glissando, and (e) fast glissando when studying F0 range in children ages 8.0 to 11.11 years with healthy voice quality. Each task required the participants to think about their voice and produce a fast, slow, smooth, or divided voice production. Results indicated that all the stimulus conditions evoked significantly higher maximum frequencies than the discrete steps condition, which generated the smallest frequency ranges when compared to the other conditions.

Cognitive cueing is an approach to voice treatment that stimulates voice patterns as a way of changing speakers' voices. Cognitive cues have been utilized when measuring voice productions (Andrews, Shrivastav, & Yamaguchi, 2000; Bohnenkamp, Andrews, Shrivastav, & Summers, 2002). The acoustic correlates of emotions traditionally investigated are pitch (fundamental frequency, both average and range), duration, intensity and voice quality (Murray & Arnott, 1993).

Andrews, Shrivastav, & Yamaguchi (2000), found no variation in the spectral parameters (MSF0) was found in the normal adults while there was an increase in duration in the 'cue' trial. When cognitive cues were used as an elicitation method, the subjects varied their frequency range and altered the rate of speech. Bohnenkamp et al. (2003) studied the usefulness of cognitive cues in an attempt to alter rate of speech. The study found cognitive cues to have a significant effect on increasing vocal variation and to be a promising task elicitation method (Andrews et al., 2000; Bohnenkamp et al., 2002). The purpose of the present study is to explore how much of variability will be present in some parameters of voice when cognitive cues are given.

Aim of the Study: To find out the extent of variability present in voice when cognitive cues are presented.

Method

Subjects

Twenty participants (10 males and 10 females) in the age group of 20 to 25 years were taken for this study. Participants were noted to be fluent and competent in English language use. Participants were excluded if they had a velopharyngeal disorder, or were perceived by a speech language pathologist to have a voice disorder, abnormal oral-peripheral structures, or hearing loss, neurological or psychological problems.

Materials : Four primary emotions were considered in this study; happy, sadness, fear and anger. Along with these sentences, sentences that evoke neutral emotions were also considered. For each emotion, two sentences were constructed and for each sentence, cognitive cues were provided. These cues were targeted to create specific mental images.

Procedure: The participants were seated comfortably in a quiet room and were asked to read the sentences which were recorded on Computerized Speech Lab and analyzed utilizing the software Multidimensional Voice Profile (MDVP) of Computerized Speech Lab, Model 4500. Each participant was asked to read each sentence three times. In first trial, the participants were instructed to read all the sentences aloud. This is the no cue condition. In the second and third trials, the subjects were asked to read the sentences after listening to the cognitive cues provided by the examiner. This is the cognitive cued condition. Only the first and the third trials were considered for further analysis. The sentences and cues used are mentioned in the Appendix.

Analysis: The samples from each of the participants were separately acoustically analyzed using the MDVP software. The F0 measures included mean speaking fundamental frequency (MSF0), standard deviation of fundamental frequency (SDSF0), variability of fundamental frequency (vF0) and sentence duration.

Mean speaking fundamental frequency (MSF0) – It is the average pitch that is used during speaking and is expressed in Hertz (Hz).

Standard Deviation of Speaking Fundamental frequency (SD SF0) – The standard deviation reflects the frequency variability for a reasonably large time segment or passage.

Variation of Fundamental frequency (vF0) - It is the relative standard deviation of fundamental frequency which reflects the variation of F0 within the analyzed voice sample. It is expressed in terms of %.

Sentence Duration – It is the period of time during which the sentence is spoken, expressed in seconds.

Statistical analysis

All the extracted parameters of the two trials mean speaking fundamental frequency (MSF0), standard deviation of speaking fundamental frequency (SDSF0), variation of fundamental frequency (vF0) and sentence duration were subjected to

statistical analysis. Descriptive measures and repeated measure ANOVA were obtained to check for significance, if any, across the trials and gender.

Results: The results are tabulated in tables 1 to 4. The tables show the mean speaking fundamental frequency, standard deviation in fundamental frequency and variation in fundamental frequency and duration across the two trials, emotions and gender respectively. When the 'no cue' versus the 'cue' condition were compared, it was seen that the subjects increased the MSF0 significantly during the cued trials (P= 0.000) for most emotions. On comparing the MSF0 between gender across emotions, there was significant difference across gender (P = 0.03). There was more difference for females compared to males in the 'no cue' and 'cue' condition. For happy emotion, females and males increased their SF0 from 'no cue' to 'cue' condition while for neutral emotion, though there was a difference in females in the 'cue' trial , there was no difference for males. In afraid and angry emotion, there was a significant difference in females across the trials while males did not have a much difference in SF0 in these emotions. There was no significant change in SF0 in sad emotion for both males and females. With respect to the SDSF0, the subjects exhibited greater variability in the cued trial (P= 0.15) and difference was seen across gender (P= 0.32). There was more change for both males and females in the happy 'cue' trial. Males also showed a significant increase in SDSF0 in anger emotion but significant change was not present in the other emotions. Females showed an incease in SDSF0 in neutral and angry emotion, but this significant change is not present in afraid and sad emotions. In terms of sentence duration, there was a significant difference across the trials as well as gender. There was a significant increase in duration for sad and afraid emotion for both males and females. For neutral and angry emotion, there was no signiciant change in duration across gender. But in happy emotion, there was a significant increase in duration in males compared to females.

TABLE 1: Mean speaking fundamental frequency (MSF0 Hz) across emotions, gender and trials

EMOTION No Cue	GENDER	MEAN Fo	S.D.	EMOTION Cue	GENDER	MEAN Fo	S.D.
Neutral	Female	231.0	8.9	Neutral	female	254.1	40.3
	Male	131.3	13.7		male	131.4	16.0
Happy	Female	218.5	13.1	Happy	female	275.7	56.7
	Male	124.5	15.0		male	151.3	15.5
Afraid	Female	224.0	14.2	Afraid	female	249. 0	41.4
	Male	125.0	12.3		male	134.9	27.2
Angry	Female	231.1	14.2	Angry	female	265.0	37.6
	Male	130.1	18.4		male	152.3	22.4
Sad	Female	215.3	19.0	Sad	female	220.4	26.6
	Male	128.5	17.0		male	128.0	13.3
Total	female	223.9	15.0	Total	female	252.8	44.1
	Male	127.9	15.0		male	139.5	21.4

Table 2: Mean standard deviation of speaking fundamental frequency (SDSF0) across emotions, trials and gender

EMOTION No Cue	GENDER	Mean	S. D.	EMOTION Cue	GENDER	Mean	S. D.
neutral	female	34.2	14.0	neutral	female	45.5	18.8
	male	21.5	9.8		male	14.9	5.6
happy	female	37.6	10.5	happy	female	54.4	28.0
	male	16.3	5.8		male	26.4	11.8
afraid	female	35.8	17.0	afraid	female	37.1	16.5
	male	20.3	9.0		male	20.6	9.3
angry	female	39.6	9.6	angry	female	46.0	11.8
	male	19.4	9.3		male	28.5	9.3
sad	female	33.1	7.8	sad	female	26.1	6.6
	male	18.2	5.4		male	17.6	7.9
Total	female	36.1	11.9	Total	female	41.8	19.6
	male	19.1	8.0		male	21.6	10.1

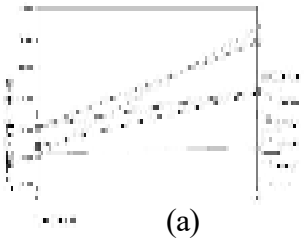
Table 3: Mean Variation in fundamental frequency (vF0 %) across emotions, trials and gender

EMOTION No cue	GENDER	Mean	S. D	EMOTION No cue	GENDER	Mean	S. D
neutral	female	14.1	5.2	Neutral	female	16.8	5.4
	male	15.5	5.2		male	11.4	3.8
happy	female	16.7	4.7	Happy	female	17.5	6.1
	male	12.1	3.3		male	16.2	6.1
afraid	female	13.4	1.8	Afraid	female	13.7	6.9
	male	14.8	5.0		male	12.7	2.9
angry	female	16.7	3.7	Angry	female	16.6	2.7
	male	13.6	3.7		male	17.9	5.4
sad	female	15.0	3.8	Sad	female	12.9	4.0
	male	13.8	4.3		male	12.8	5.1
Total	female	15.2	4.1	Total	female	15.5	5.4
	male	13.9	4.4		male	14.2	5.2

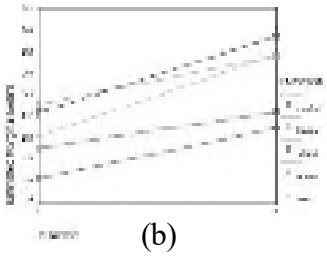
Table 4- Mean sentence duration (seconds) for the two trials across emotions, gender and trials.

EMOTION No cue **	GENDER***	Mean*	S. D.	EMOTION No cue **	GENDER***	Mean*	S. D.
neutral	Female	1.7	.6	Neutral	female	2.0	.8
	Male	1.4	.5		male	2.2	.7
happy	Female	2.4	.3	Happy	female	2.5	.3
	Male	2.2	.1		male	3.0	.4
afraid	Female	2.3	.3	Afraid	female	2.8	.3
	Male	2.2	.4		male	3.1	.7
angry	Female	2.0	.5	Angry	female	2.2	.3
	Male	1.9	.5		male	2.2	.7
sad	Female	2.0	.4	Sad	female	2.8	.5
	Male	2.0	.3		male	2.7	.9
Total	Female	2.1	.5	Total	female	2.5	.6
	Male	2.0	.5		male	2.6	.8

Graph (a) shows the change in mean fundamental frequency for different emotions across the 'no cue' and 'cue' trial condition. Graph (b) shows the change in sentence duration for different emotions across the trials.



(a)



(b)

Discussion: All subjects varied their voice more during the cued rendition across the five emotions ; neutral, happy, afraid, angry and sad. The graphs a and b show the difference in MSF0 and duration for trials with respect to the emotions. It is seen that there is a statistical difference between the two trials and emotions. For *neutral emotion*, the MSF0 and mean sentence duration is lesser than for the other emotions. This is seen as less variation for the neutral emotion in the 'no cue' and 'cue' condition. For *happy emotion*, Öster & Risberg (1986) reported that happiness gives an increase in pitch. In the present study, there was a steep increase in MSF0 from the 'no cue' to 'cue' condition. Davitz (1964) reported an increase in speech rate for the happy emotion. Same finding was observed in the 'no cue' and 'cue' condition. Fairbanks and Provonost (1939) reported that *anger* generally is characterized by high pitch which is also evident in the graph (a). Stibbard (2001) reported of short duration for this emotion but the present study does not conform to this finding. There was no significant difference in the mean sentence duration between the 'no cue' and the 'cue' trial. The MDF0 for *fear*, in the present study, was lower than that observed for anger with slower speech rate. Williams and Steven (1972) analyzed acted speech in specially written play and reported low SF0, but with occasional SF0 peaks and low speech rate which confirms the findings of the present study. *Sadness* had the least variation in MSF0 from the 'no cue' condition to the 'cued' condition. Reduced sentence duration was also

served in the cued trial when compared to the no cue trial.

In the current study, there was a significant difference in SDSF0 from 'no cue' trial to the 'cue' trial' across most emotions. This proves that the subjects had more variation in the SF0 of voice for the 'cued' trial compared to the 'no cue' trial. But no statistical difference was seen across gender. But a significant difference was seen in MSF0 and sentence duration across gender, with females having statistically more difference than males. While some studies prove that women are more emotionally expressive (Miller, 1976) and men conceal or control their emotional displays (Buck, Miller, & Caul, 1974), many other studies have reported there are no significant difference in vocal variability when imagery is used across gender (Beech and Leslie, 1978; Di Vesta , Ingersoll & Sunshine, 1971; Forisha, 1981; Guy and McCarter, 1978; Hiscock & Cohen, 1973, Van Dyne & Stava, 1981). There was no statistical difference in vF0 across trials and gender but a significant difference was seen across emotion. Happy emotion had more change than the other emotions. This reason can be due to the individual differences in which the cognitive cues were perceived and to an extent, there is also an influence of the life experiences and the personality of the individual. The variability in voice was scattered in the study and when they are averaged, there was no significant difference across the trials.

The subjects in the study demonstrated significantly greater values for frequencies and duration when imagery associated with the cognitive cue was utilized as the task elicitation method compared the just reading trials. These parameters are bound to increase because when an individual reads the sentences with emotions, there will be a change in the spectral and temporal features of the sentences than when no emotions are attached to it. These effects warrant further study.

It is interesting to speculate about the implications of the study. The mental images elicited in the present study were visual. One may, however, hypothesize that cognitive patterns have some functional relationship to laryngeal movement patterns. The findings of this study indicate some directions in future research concerning the nature of cognitive cueing and how laryngeal motor patterns may be influenced by different types of imagery. Thus exploration of mental practices or imaging of laryngeal maneuvers may be a promising line of research.

References

Andrews, M., Shrivastav, R., & Yamaguchi, H. (2000). The role of cognitive cueing in eliciting vocal variability. *Journal of Voice*, 14(4), 494-501.

Bohnenkamp, T., Andrews, M., Shrivastav, R., & Summers, A. (2002). Changes in children's voices: the effect of cognitive cues. *Journal of Voice*, 16 (4), 430-443.

Katharine S. (2006). The effect of cognitive cues on voice productions for children ages 5.0 through 7.11 years. Miami University, Oxford.

Reich, A., Mason, J., Frederickson, R., & Schlauch, R. (1989). Factors influencing fundamental frequency range estimates in children. *The Journal of Speech and Hearing Disorders*, 54, 429-438.

Zraick, R., Nelson, J., Montague, J., & Monoson, P. (2000). The effect of task on determination of maximum phonational frequency range. *Journal of Voice*, 14, 154-160.

Appendix

Instructions ('No cue' trial): Read the sentences on the sheets.

1. This is a pen.
2. The tests are in the cupboard.
3. I got the highest IA in class.
4. The director announced a holiday today.
5. I was stuck in the lift for an hour.
6. I haven't prepared for my exams.
7. He spilt tea on my dress.
8. You made me late again.
9. He cannot walk anymore.
10. The results are out and I failed.

Instructions ('Cue' trial): Imagine these situations I am about to tell you and read the sentences after I tell you each instance.

1. Imagine you see a pen in your room. What will you feel?
2. Imagine you are taking a case in OPD and you do not know which test to administer. You seek help from the staff to find out which test to administer. You search for the test and when you find it you realize that you do not know much about the test. You administer the test in half an hour as you have a class after your postings. The next day, you're posted in therapy and your friend comes looking for you to find out where that test is kept as she /he had to readminister the test since you had left out some parts of the test. How would you tell her/he where the test is kept?
3. Imagine you bunked class because of no reason at al. Your friends remind you that the teacher will be covering an important topic. You take it for granted that you have the whole night to read what was taught. But you forget to read that lesson that day. The next day, you come to class just to find that your teacher is giving you a surprise test. You are nervous. You begin to answer the test bearing the guilt that if you had listened to your friends, probably you could have answered better. The time goes by and you answer according to your previous knowledge and logic. The next day, when your teacher comes to class, she calls out your name just to say you topped the class. This means you got the

highest IA for the most difficult paper. Keeping this situation in mind, read the third sentence.

4. Imagine you were busy throughout the week with the celebrations in your hostel/home. At the back of your mind you know that there is a test held the day after this celebration. You keep it aside thinking you can read for it after the celebration. The celebrations get over at 11 pm and by the time you settle down, it is 1 am. You think of sitting for studying but you doze off to wake up the next day by the intercom ringing in your corridor. You wake up with a startle and begin to get nervous. The phone keeps ringing and you answer the phone. On the other line, the watchman asks your name and class and conveys that the Director is giving all the students a day of for the wonderful show held the previous week. How would you feel?

5. Imagine you wake up late for your postings. You realize you have a case under the supervision of a staff you are very afraid of. You were once caught in an instance where you got scolded for being late by 5 minutes. You reach the clinic to find you're late by 10 minutes this time. You think of the option of going back to hostel, but you do not have enough attendance to bunk. You go ahead to the clinic to experience the first situation in room number 75. To your luck no one is there. You mark your attendance and proceed for your next situation. Your therapy room is on the first floor. The stairway is jammed by people who are painting the walls and by making children climbing the stairs with their parents. So you decide to take the lift. You enter the lift and press the switch and the lift closes to take you to your destination. All of a sudden, the lights turn off. There is utter darkness and silence. What would you do? The intercom and your mobile are not of any help. You begin to bang the door. No one hears you. 5 minute goes by; 15 minutes goes by; another 20 minutes go by; it's getting stuffy and warm and your finding it hard to breath and you are scared of the darkness. This goes on for an hour. How would you feel?

6. Imagine you are having a study leave for only 6 days and the first paper you will write is difficult for you. You begin to study for that paper. Four days before your exams you get a phone call saying your father is admitted in the ICU. You get nervous and leave for home. You reach your hometown and directly push off to the hospital where your father is. You reach there and you see your mom terribly upset and decide to comfort her. The next day, your father recovers from his illness, would u know you prefer to stay by your father's side and still take the responsibility of the hospital dealings? You realize that you have to get back to hostel as you have your exam the next day and when you reach, you are nervous because you do not know what you're to write for the exams. How would you feel?

7. Imagine today is your birthday. You had a blast with your friends the previous night. And you are looking forward to meeting your classmates the next day. You go for postings wearing an expensive dress your father had got you. It is your favorite shade and you are looking so adorable in it. Your friends give you gifts and make you feel very special. You decide to treat them in the canteen. As you enter, your other friends sing you the birthday song. You treat them. You then get a phone call from your best friend back in your home town and to your surprise, they give you the news that they will be in front of your institute gate in an hour. How would you feel? You tell this news to your friends sitting closest to you. That moment, a friend you are not very fond off, comes to wish you and grabs a seat next to you. While he/she talks to you, he/she accidently spills tea on your favorite dress. Instead of asking you for forgiveness, he/she gives a very care free attitude. How would you feel?

8. Imagine you picked up a quarrel with you friend as he/she spoilt you dress. You decide to go to hostel and change your dress. But when you are back to the clinic, you realize your case sent a complaint about you to the clinical coordinator. You are called for and you get scolded. You feel so terrible and begin to think this day should not have existed. You go to your chamber and on the way you meet your friend who caused the calamity. How would you feel?

9. Imagine you are posted in OPD. You wait for a case file to land on the table. As you wait, you see a very familiar face among the patients who are waiting. You get a case file and get this patient you feel *u know.* The boy is on a wheel chair and cam along with his mother. You behind to take the case history and over the course of the interview, you realize he was your best friend in school. Time and distance brought separation between you both. You are excited you met him and his mother after several years. You used to be at his home on the weekends to play. On the other hand, you r filled with remorse as he is on a wheel chair. You get to know your friend met with an accident and was diagnosed as having 'global aphasia'. You remember how talented he was. How would you feel?

10. Imagine you are having trouble studying motor speech disorders paper. You study very hard. You write your exam with the expectation you will pass. The days go by and finally the day of the results arrives. You and your classmates run to the notice board to see the results. To your utter disappointment you failed. All your other friends passed. You are left out. You had worked so hard. How would you feel?

S.L.H.D:-10

COMPARISON OF ATTITUDES OF MOTHERS AND FATHERS OF CHILDREN WITH MENTAL RETARDATION AND HEARING IMPAIRMENT WITH THAT OF TYPICALLY DEVELOPING CHILDREN

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INTRODUCTION: Children need a loving and secure environment for their optimum growth and development. Their physical needs must be met, but at the same time their emotional and psychosocial needs also have to be fulfilled. They need love, care, attention and guidance in order to develop as stable, well-adjusted and sociable human beings. It is very important for children to have stable and loving relationships with their caregivers; especially so with their mothers. As a typically developing child grows, he/she learn by watching and imitating the mother, simultaneously responding positively to the instructions, guidance and reinforcements offered by her. All of these occur very naturally and instinctively between a typically developing child and his/her mother. Studies have shown that infants who are abandoned and separated from their mothers become unhappy and depressed, sometimes to the point of panic. After long periods of separation and isolation, they show symptoms of either apathy and withdrawal or restlessness, hyperactivity, inability to concentrate and craving for affection. A study addressing social deprivation in orphanage children in Iran by Hunt (1983) reported that children wore glum expressions, failed to play with toys and showed no interest in either things or people. These children were wary and withdrawn initiating no interaction with adults and seldom with other children. Most of them (2 out of 25) at an age of 3 years used their voice mostly for crying and yelling and showed retardation in the development of language, social, emotional and intellectual skills. In another study by Hunt (1991), significant differences were observed between group of children who were deprived of interactive contact group of children receiving early stimulation and social enrichment. The latter group of children were alert and interested, interacted with toys or people of their own choice and tended to approach with interest almost any adult who came within view. The language development and intelligence quotient (IQ) of the latter group was superior than the former group. The difference in performance of the group was attributed to the intervention programme offered to the second group, in which caregivers were made aware of the needs of children and instructed to respond to their needs as soon as these were expressed, to show them love and to play with them. In addition, they were instructed to imitate the cooing and babbling sounds of the babies. The personal contact was made possible by reducing the children-caregiver ratio from 35:3 to 10:3. The caregivers gradually developed a strong emotional attachment to their children which again strengthened their sensitivity to the children's needs and initiatives (Hunt, 1991).

The highlight of any enriched stimulation programs offered to children is to focus on the need of children for appropriate psychosocial as well as physical care. To be able to give this, a caregiver does not require extensive academic training. In fact, it is something very simple and natural that seems to be part of our biological and cultural heritage and can therefore be easily facilitated or reactivated in sensitive human caregivers. All adults have the capacity to love and care for and guide children under their care. But it is also true that some caregivers do this more than others and the reasons can be any one or combination of the following:

- poverty,
- stress of daily living,
- ill health,
- depression or other emotional problems etc

In some parents / caregivers, it can simply be a lack of awareness and understanding of the need for such care for their offspring. Studies have highlighted the significant role of mothers play and interaction in the child's upbringing (Light, 1988; Light 1989, Light, 1997; Light, Binger, Agate & Ramsay, 1999; Light, Collier & Parnes, 1985a, 1985b, 1985c). In comparison, few studies have examined the role of fathers on the child's upbringing. Clarke (1997) examined the influence of fathers and mothers in terms of play behaviour of the child, conducted under unstructured observation and daily records maintained by the mothers of the children. It was noted that the play varied across fathers and mothers in terms of the concept, physical distance and parallel talk.

There is dearth of studies in investigation the differential role of mothers and fathers in interaction with their child and also the differences in attitudes if any between mothers and fathers across different domains. This is especially true with respect to children with various developmental disabilities such as hearing impairment, mental retardation, cerebral palsy etc. The demand placed on the parents of disabled children is much more than those on the parents of typically developing children. Parents of the disabled not only have to involve themselves actively in reactivating the disabled skills of children, but also continue to provide all the care and encouragement that is required for the child inspite of all the impediments. In achieving this target, parents have to also develop the tact and skill of keeping their own psychophysical, emotional and psychosocial needs in balance. This coordinative

balance is not easy to achieve and it is not equally well performed by fathers and mothers.

Need for the study:

Although it is commonly felt and expressed by the rehabilitators that there are evident differences in the care and upbringing skills of fathers when compared to that of mothers, especially in instances when there are children with developmental disability born in the family, it is not subjected to investigation as is evident from the dearth of reported literature on this theme in Indian society. Investigation into the attitudinal differences if any between mothers and fathers would equip the rehabilitators with better understanding of the roles played by each parent in the management of the disabled child. Understanding the intricate relationship between mother-child and father-child will expose the kind of participation displayed by each parent in their child's upbringing.

In this backdrop, the study attempted to compare the attitudes of parents of typically developing children and parents of children with communication disorders in various skills related to nurturing of child. Children with communication disabilities need extra care in terms of many supportive therapies such as speech and language stimulation, physiotherapy, occupational therapies and so on. Hence, the attitudes of the parents become very important in determining the progress of the child. In general, mothers of children with communication disabilities are seen to play a greater role in schooling and speech-language stimulation. However, no clear documentation is available as of now. For example, the influence of literacy, employment of mothers, socioeconomic status of fathers and mothers of children with developmental disabilities as compared to that of typically developing children is less known. Understanding the attitudes and division of roles of the parents will enable us to promote intervention guidelines that will empower the mothers of children with communication disabilities. It will also help us gain insight into means of improving the participation of both parents across all important domains so that the caregiver-child interaction is present for both parents.

Among all potential variables in a Indian context, factors such as socio-economic status, educational qualifications and occupational status of the mothers of children seem to be potential in affecting the parental attitudes, this study attempts to compare and analyze these variables in groups of parents of typically developing children with those of children with developmental disorders of hearing impairment and mental retardation. In other words, the present study purports to document the attitudinal differences of mothers and fathers of typically developing children with those of mothers and fathers of children with hearing impairment and mental retardation.

Aims of the study:

To compare and analyze the attitudes of mothers and fathers of the following groups with respect to socio economic status, occupational status of the mothers, educational qualification of the parents of following:

Typically developing children

Children with hearing impairment

Children with mental retardation

METHOD

Participants

The participants of the study were divided into two groups. *Group 1 (Control Group):* included 100 mothers and 100 fathers of typically developing children aged between 2 – 10 years.

Group 2 (Experimental Group): This included two subgroups:

Group A: included 60 mothers and 60 fathers of children with hearing impairment

Group B: included 40 mothers and 40 fathers of children with mental retardation

The participants of the experimental groups were randomly selected from among parents of children attending the Preschool and speech-language therapy at All India Institute of Speech and Hearing, Mysore and Schools in Mysore. It was ensured that the group included participants belonging to different socio-economic strata, different educational backgrounds and working and non working mothers. Informed consent was obtained from the selected participants. To facilitate cross-group comparisons, this groups of participants were subdivided as follows:

A. Based on the net annual income of both the parents, the participants were divided into two socio-economic strata namely

- Lower socio-economic status
- Higher socio-economic status

B. Based on the educational qualification of the parents, they were divided into seven groups namely

- Illiterate – not completed primary level of education.
- Lower secondary level
- Higher secondary level
- Pre-university level
- Under-graduate level
- Post-graduate level
- Doctoral level

C. Mothers belonging to both the control and experimental groups were further divided into 2 groups based on employment status:

- Working group
- Non-working group

The exclusion criteria for selection of the participants of the study were as follows:

- None of the participants were widows or widowers
- Both the parents lived together and were involved in child upbringing
- None of the children were adopted children

Material and Procedure:

A questionnaire survey procedure was used to understand the emerging attitudes of mothers and fathers in the control and experimental groups with respect to various domains and skills involved in a day to day living situation reflecting good nurturing skills of the parents in bringing up their children. A close ended questionnaire was prepared by the investigators of the study. The items in the questionnaire were prepared to include two domains:

1) General skills: questions were framed to elicit responses in the following domains:

- Social
- Daily living
- Play
- Caring
- Small talk
- Schooling

2) Communication and related skills: questions were framed to elicit responses in the following domains:

- Improving Speech
- Improving Language
- Homework/ home-training
- Improving Creative skills
- Others.

The questionnaire is enclosed as Appendix A. The participants were instructed to "tick" their responses as "yes" or "no" for each of the question in the questionnaire.

Analysis:

A score of '1' was assigned to questions which elicited 'yes' response favoring a positive attitude and '0' was assigned to questions which elicited 'no' response favoring non favoring attitude. The responses were compared and analysed separately for mothers and fathers across different domains. Responses were compared across socio-economic strata, educational status and working status of the mothers across all the groups. The raw scores were computed as percentage scores to facilitate graphic representation and comparison across the groups.

RESULTS AND DISCUSSION

The results are presented and discussed under the following heads:

1) Comparison of overall parental attitudes of typically developing (TD) children with that of Hearing Impairment (HI) and Mental Retardation (MR).

2) Comparison of parental attitudes of working and non working mothers of TD children with that of Hearing Impairment (HI) and Mental Retardation (MR).

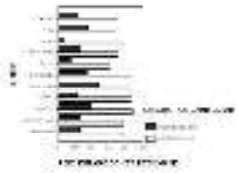
3) Comparison of attitudes of parents of TD children with that of Hearing Impairment (HI) and Mental Retardation (MR), based on socio economic status.

4) Comparison of attitudes of parents of TD children with that of Hearing Impairment (HI) and Mental Retardation (MR), based on education status.

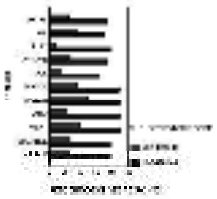
1) Comparison of overall parental attitudes of typically developing (TD) children with that of Hearing Impairment (HI) and Mental Retardation (MR).



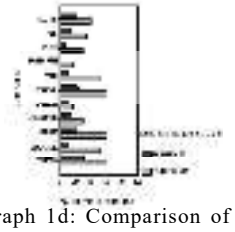
Graph 1a: Comparison of attitudes of mothers and fathers of typically developing children



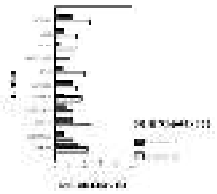
Graph 1b: Comparison of attitudes of mothers of typically developing children and children with HI



Graph 1c: Comparison of attitudes of mothers of typically developing children and children with MR



Graph 1d: Comparison of attitudes of fathers of typically developing children and children with MR



Graph 1e: Comparison of attitudes of fathers of typically developing children and children with HI

Graphs 1a to 1e shows a comparison of attitudes of mothers and fathers of TD children, mothers of TD versus HI chidren, mothers of TD versus MR children, fathers of TD versus HI children and faters of TD versus MR children. Graph 1a shows a comparison of attitudes of mothers and fathers of typically developing children across all the domains covered in the questionnaire. The responses revealed that in typically developing children, both the parents share their roles more often with respect to nurturing their child, as is evident across all domains under the general category namely social, activities of daily living, taking care, play and talk showed high dual-parent participation indicating equal contribution and lack of clear-cut division across roles in these domains. However, the participation of mothers has superceded that of the fathers suggesting that although both parents play a significant role in furthering the communication related skills, mothers seem to take more onus of their children compared to the father. A similar trend is seen with respect to the attitudes of fathers with respect to mothers of HI and MR as compared with that of TD children. Graph 1b shows the comparison of attitudes of mothers of typically developing children with that of mothers of children with hearing impairment. Mothers of children with hearing impairment showed a greater partici

pation in both the general and communication related domains as compared to mothers of typically developing children. Graph 1c shows the comparison of attitudes of mothers of typically developing children with mothers of children with mental retardation. In comparison to that of mothers, from Graph 1d and 1e, it is evident that the fathers were less active in the selected domains of the study. The gap is quite significant between that of fathers and mothers of TD versus the disordered groups of HI and MR.

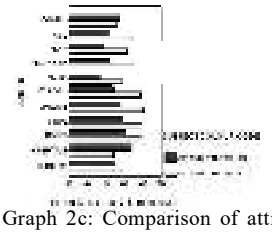
2) Comparison of parental attitudes of working and non working mothers of TD children with that of Hearing Impairment (HI) and Mental Retardation (MR).



Graph 2a: Comparison of working and non-working mothers of typically developing children



Graph 2b: Comparison of attitudes of working mothers of typically developing children and children with MR



Graph 2c: Comparison of attitudes of working mothers of typically developing children and children with HI



Graph 2d: Comparison of attitudes of non-working mothers of typically developing children and children with MR



Graph 2e: Comparison of attitudes of non-working mothers of typically developing children and children with HI

Graphs 2a to 2e shows the comparison of attitudes across working and non-working mothers of typically developing children as compared to that of HI and MR groups. There is a difference in the role played by the two groups with the non-working mothers showing higher percentage of "yes" responses. This indicates that across the two sub-groups of mothers of typically developing children, the non-working group played a higher individual role in the upbringing of the child whereas although the working group showed significant contributions, they seemed to be helped by the fathers of the children leading to shared responsibilities. Also, the working mothers of typically developing children belonged to the higher educational groups and hence may have displayed better understanding in terms of sharing their responsibilities. This graph thus reveals that the working status of the mothers does have an effect on their attitudes. Graph 2b and 2d shows a comparison of attitudes across working mothers of typically developing children and mothers of children with mental retardation and Graph 2c and 2e shows a comparison of attitudes across working and non working mothers of typically developing children and mothers of children with hearing impairment. Non working mothers seem to be more involved with the children compared to the working mothers. Further inspection of the graphs reveals that the responses reveal a higher "yes" response on part of working mothers of children with hearing impairment and mental retardation as against working mothers of typically developing children. Thus irrespective of the additional workload brought about by work, mothers of children with hearing impairment and mental retardation play a major role in the child's upbringing across domains.

Comparison of Graph 2c and 2e reveal that the working mothers of typically developing children showed a higher positive response when it came to encouraging creative skills. This could be attributed to the child's hearing status. On the other hand, mothers of children with hearing impairment concentrate on core areas such as schooling whereas mothers of typically developing children motivate their children to explore other areas of interest simultaneously.

Graph 2b and 2d shows the comparison of attitudes across working mothers of typically developing children and mothers of children with mental retardation. This trend is similar to that of the hearing impaired group wherein a higher percentage of "yes" responses were observed across all domains except for the social domain. This could again be possibly due to the child's impairment with the mothers attempt to safeguard their children from physical injuries while socializing. Working mothers of children with mental retardation differed from mothers of children with hearing impairment in that they provided greater impetus for creative skill development. This can be attributed to the fact that the focus of the mothers could have been to empower their children with mental retardation to fare better in pre vocational skills which depend mostly on the creative abilities. This could have lead the mothers to encourage them to learn other skills with the intention of enhancing some means of livelihood. The role of mothers of children with mental retardation is significantly higher than those of typically developing children in domains related to speech, language and communication.

Graph 2d shows the attitude of non-working mothers of typically developing children and those of children with mental retardation. It reveals a higher "yes" responses from mothers of children with mental retardation across all domains except for the "schooling" domain where the non-working mothers of typically developing children showed a marginal increase in their "yes" responses. This can be attributed to the child's functional level of performance. Non-working mothers of children with mental retardation showed an exceptionally high participation in encouraging creative skills and also taking the child for physiotherapy session and so on. In communication and related domains, the non-working

mothers of children with mental retardation played a significantly higher role as against non-working mothers of typically developing children. This could be attributed to better shared responsibility among parents of typically developing children when compared to parents of children with mental retardation.

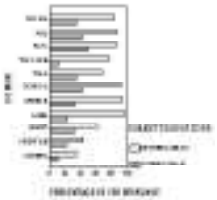
Overall, the responses of mothers of children with hearing impairment and mental retardation, irrespective of whether they belong to working or non working groups is significantly higher than those of normally developing children in domains related to speech, language and communication.

3) Comparison of attitudes of parents of TD children with that of Hearing Impairment (HI) and Mental Retardation (MR), based on socio economic status.

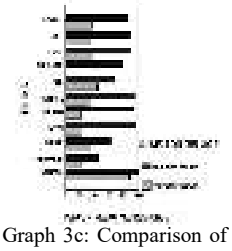
The participants were divided into two subgroups based on the annual income of the family as Lower socioeconomic status (SEL) and Higher socio economic status (SEH). Graphs 3a to 3c show the responses of parents of TD, HI and MR respectively for SEL group. Graphs 4a to 4c show the responses of parents of TD, HI and MR respectively for SEH group.



Graph 3a: Comparison of attitudes of mothers and fathers (SEL) of typically developing children



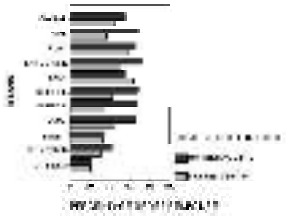
Graph 3b: Comparison of attitudes of mothers and fathers (SEL) of children with hearing impairment



Graph 3c: Comparison of attitudes of mothers and fathers (SEL) of children with MR

Graph 3a shows the comparison of attitudes of mothers and fathers of typically developing children belonging to lower socio-economic strata. Both the parents play a similar role across general and communication domains. Majority of the participants reported that both of them play a role in the child's development with respect to all aspects. Thus, parents exhibited greater understanding and better coordination with respect to their participation in the child's nurturing process. Graph 3b shows the comparison of attitudes of mothers and fathers of children with hearing impairment and belonging to lower socio-economic strata. A very high number of "yes" responses were recorded from the mothers as compared to fathers. The mothers play significant roles with very less contribution from the fathers especially in the communication and schooling domain. Graph 3c shows the comparison of attitudes of mothers and fathers of children with mental retardation and belonging to lower socio-economic strata. The participation of mothers was much higher than fathers across all domains. Though there is sharing to a small extent in the general domain, mothers played the major role in communication and related domains.

Graph 4a to 4c shows the attitudes of mothers and fathers of typically developing children, mental retardation and hearing impairment respectively, belonging to higher socio-economic strata. Interestingly, similar trend as seen for SEL groups is observed in parents of these groups (SHE). This implies that the socioeconomic status has not contributed to the degree of participation of the parents. Both SEL and SHE group of parents have shown similar attitudes across the selected domains of observation. Although not significant a slight increase in the participation of fathers belonging to SEL is observed when compared to tht of SEH fathers.



Graph 4a: Comparison of attitudes of mothers and fathers (SEH) of typically developing children

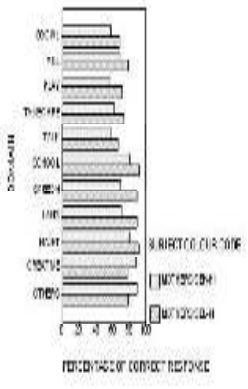


Graph 4b: Comparison of attitudes of mothers and fathers of (SEH) of children with MR

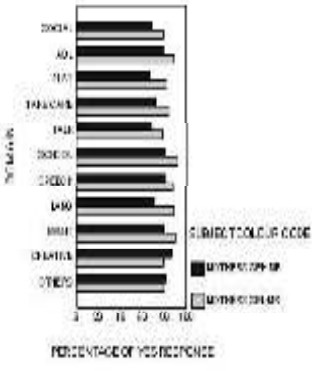


Graph 4c: Comparison of attitudes of mothers and fathers of (SEH) of children with HI

Graph 5a and 5b show a comparison of mothers of SEH and SEL for HI and MR groups. It is seen from the graphs that the mothers of children with hearing impairment and mental retardation, belonging to lower socio-economic strata displayed greater participation across all domains as compared to mothers of children with hearing impairment and belonging to higher socio-economic strata. Though the difference is not of very high magnitude, it can be attributed to the fact that parents from higher socio-economic strata show better sharing of roles as against those from lower socio-economic strata.

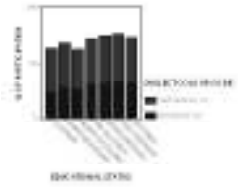


Graph 5a: Comparison of attitudes of mothers of children with HI from SEH and SEL

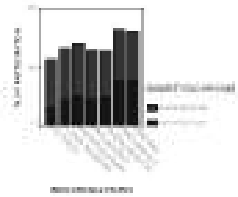


Graph 5b: Comparison of attitudes of mothers of children with MR from SEL and SEH

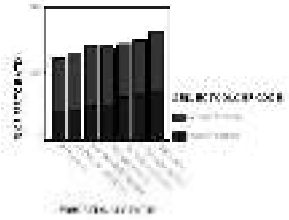
4) Comparison of attitudes of parents of TD children with that of Hearing Impairment (HI) and Mental Retardation (MR), based on education status



Graph 6a: Comparison of attitudes of mothers and fathers of typically developing children based on educational status



Graph 6b: Comparison of attitudes of mothers and fathers of children with MR based on educational status



Graph 6c: Comparison of attitudes of mothers and fathers of children with HI based on educational status

Graph 6a to 6c reveals the participation of parents of typically developing children, mental retardation and hearing impairment respectively based on the educational status of the parents. Although not significant the higher the education level, more was positive attitude of the parents. But it is notable that even the illiterates participated equally well as that of the highly educated (> doctoral degree). This effect is more so in the groups of MR and HI as compared to that of TD. The responses also revealed that irrespective of the educational status mothers played a dominant role in the child's upbringing. Further, the different levels of educational status did not seem to lead to affect mothers' participation. A rising pattern in the participation was observed among fathers with an increase in the educational status.

Conclusion: The study attempted to analyze differences if any in the parental attitudes across three groups of subjects namely parents of typically developing children, children with mental retardation and children with hearing impairment.

Comparison of the overall parental attitudes of typically developing children revealed that mothers of children from all three groups showed greater participation as compared to fathers. When compared across the three groups of children, non-working mothers seemed to play a major role as compared to working mothers. However, working mothers of children with hearing impairment and mental retardation showed significant participation as compared to their non-working counterparts. Comparisons of parental attitudes based on socio-economic status revealed higher participation of mothers belonging to the lower socio-economic status as compared to mothers belonging to higher socio-economic status. On the other hand, fathers belonging to higher socio-economic status showed higher participation as compared to fathers from lower socio-economic status. Based on educational status it was observed that irrespective of the educational status mothers continued to play a major role in the child's upbringing with the fathers showing a marginal increase in participation with increase in educational level.

On the whole, it can be said that irrespective of the employment status, educational status and socio-economic status, mothers play a higher significant role as compared to fathers. Since the maternal participation is more than that of the paternal participation as reflected in various domains addressed in this study, it may be of significance to consider empowerment of mothers in the Indian society on issues related to general upbringing of the child as well as disability issues. A model of intervention programme that takes into account the maternal role in general and rehabilitative issues of their offsprings with developmental disorders such as hearing impairment and mental retardation is to be developed as mothers seem to be the most active agents in promoting the skills of their ward irrespective of whether it is a general or specific skill that requires to be strengthened in their children. The need of the hour maybe is to include mothers as more active agents in promoting rehabilitative issues of the disabled population.

References:

Light,J. (1988). Interaction involving individuals using augmentative and alternative communication: State of the art and future research directions. *Augmentative and Alternative Communication*, 10, 151-160.

Light, J. (1989). Toward a definition of communicative competence for indoviduals using augmentative and alternative communication systems. *Augmentative and Alternative Communication,* 4, 66-82.

Light, J. (1997). *"Let's go star fishing"*: Reflections on the contexts of language learning for children who use aided AAC. *Augmentative and Alternative Communication,* 13, 157-171.

Light, J. , Binger, C., Agate, T. & Ramsay, K. (1999). Teaching partner-focussed questions to individuals who use augmentative and alternative communication to enhance their communicative competence . Journal of Speech and Hearing Research, 42, 241-255.

Light, J., Collier, B., Parnes, P. (1985a). Communicative interaction between young non-speaking physically disabled children and primary caregivers: Part I – Discourse patterns. *Augmentative and Alternative Communication,* 1, 74-83.

Light,J. , Collier, B., Parnes, P. (1985b). Communicative interaction between young non-speaking physically disabled children and primary caregivers: Part II- Communicative Functions. *Augmentative and Alternative Communication,* 9, 10-25.

Light,J. , Collier, B., Parnes, P. (1985c). Communicative interaction between young non-speaking physically disabled children and primary caregivers: Part III- Modes of Communication. *Augmentative and Alternative Communication,*1, 125-133.

Hunt (1983): Improving Mother/child Interaction to Promote Better Psychosocial Development in Children. Retrieved October 2009 from www.who.org

Hunt (1991): Improving Mother/child Interaction to Promote Better Psychosocial Development in Children. Retrieved October 2009 from www.who.org

S.L.H.D:-11

THE NUANCES OF GENDER IN DISCOURSE

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INTRODUCTION: Communication theory, Message Model, Conduit Model or 'the speech chain' explains "Communication" as the transfer of information from one brain/person to another and usually involves a two-way process. It is commonly defined as "the imparting or interchange of thoughts, opinions, or information by speech, writing, or signs" which underlines three conceptualizations as- the use of sign system, transfer of information and the use of 'language'. This 'language' is a system for encoding and decoding information. While language (code) is "cognitive", communication is more of a "social" aspect.

This "language" is better manifested through various speech acts- like conversation, discourse, story telling etc. One of the first discourse genres to be analysed as having a recurring set of structural/functional slots was 'oral discourse'. Such 'discourse' activity yields data on various aspects as- the thought or the individualistic schema representation; the linguistic codes (morphology, semantics, syntax, pragmatics, phonology) involved in his/her descriptive context; and the sociological and ritualistic dependencies on his perception. These cognitive and linguistic processes interact to produce a sequence of utterances that relate to each other in expressing a logical and coherent narrative.

Coates and Johnson (2001) rightly hinted at the fact that the study of language provides a uniquely "social" perspective on the study of gender differences. The study of language in the construction and maintenance of gender divisions emerged as an active research topic during the past three decades. Social sciences and social psychology has since then laid the importance of studying the relation between language and gender. Studying language will seem more interesting when investigators examine the ways the gender is negotiated and defined in social contexts. Gender differences in language use are likely to reflect a complex combination of social goals, situational demands, and socialization. Findings suggest that men, in contrast to women, tend to use language more for the instrumental purpose of conveying information; women are more likely to use verbal interaction for social purposes with verbal communication serving as an end in itself (Brownlow, Rosamon and Parker, 2003). Despite the overall message goals that account for the sentence construction, the difference in semantic goals in men and women also contribute to the variations.

Even more, people use words in a variety of ways that vary as a function of context. This poses as a great hindrance in making decisions on the analysis of language as it relates to men and women. Explorations of gender differences in language have ranged from the overall structure of men's and women's narratives (Herring, 1993), down to the level of specific phrases (Holmes, 1995; Thomas and Murachver, 2001) and words (Danner, Snowdon, and Friesen, 2001; Mehl and Pennebaker, 2003). The point to ponder is that which dimensions of language should be examined to capture differences in how men and women approach the world and what parameters would put down a distinct view of the difference. Thus, comparisons between genders that have presented confounding problems, could be reinstated, reviewed and studied discretely while keeping the task constant.

NEED FOR THE STUDY: Linguistic dynamics change with language development and researchers have found that females showed significantly greater activation in language areas of the brain than males. There is considerable debate regarding the magnitude of observed gender differences as well as the types of conditions under which gender differences are most likely to occur. Computerized text analysis provides us with the statistical power and coding consistency that are essential to answer to questions that have captured the imagination of investigators as to when, where, why, and how do men and women talk differently?

Thus, there is a need to look into the linguistic variations between males and females on a discourse task with objective documentation of the characteristics, using a computerized assessment tool/software.

OBJECTIVES OF THE STUDY:

The objectives of the study are -

- ✓ To list out the gender specific characteristics on a discourse task.
- ✓ To find out the feasibility of using a computer based software program (SALT -Systematic Analysis of Language Transcripts, Miller and Iglesias, 2006), in documenting the linguistic parameters.
- ✓ To find gender differences, if any, on the language measures using narration task.

METHOD:

Participants:

A group of 14 (8 males and 6 females) typically-developing school-going children from 8th to 10th grade were considered for the study. It was made sure that the children had no speech and language disorders.

Procedure: Children were seated comfortably, in a quiet environment and a picture narration task was administered to them. The picture is a compilation of activities happening in school (children playing, teacher teaching, students answering etc). A one minute narration of the picture elicited from each of them was collected as the sample for analysis. The speech narration was audio-recorded using Olympus digital recorder. The recordings of the narratives were transcribed in detail by trained transcribers using broad IPA and subsequently fed to the SALT software to get the desired linguistic parameters.

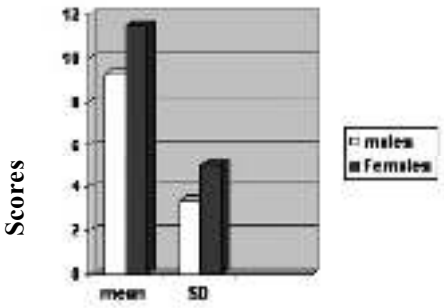
Tools: A computer software, SALT (Systematic Analysis of Language Transcripts), Version 9.0, developed in Language Analysis Lab, University of Wisconsin-Madison (Miller and Iglesias, 2006) was used for the following study. SALT, the Systematic Analysis of Language Transcripts, is a computer program designed to help, analyze and interpret language samples from one or more speakers during a communicative interaction or during any narration activity.

Analysis: The audio recorded sample was analyzed for features of phonological complexity, fluency, complexity of grammatical structures, and narrative coherence. Gender differences in talkativeness, affiliative speech, and assertive speech were also accounted for from the sample. The gender variations were documented across linguistic, psychological, cognitive and social features.

RESULTS AND DISCUSSION: The results were analysed with reference to the objectives proposed for the study.
Comparison of narrative samples of males and females was carried out to find out the difference, if any, on the various linguistic parameters. The software used is a viable, highly efficient alternative to linguistic analysis.
The narrative language sample was analysed on the following dimensions as:
(A) Linguistic dimensions (word count, mean length of utterance, negations, articles, and numbers)
(B) Psychological processes (positive and negative emotions),
(C) Cognitive processes (causation, hedges, insight, discrepancy, extensions), and
(D) Social processes (communication, friends, family; use of pronouns, time and space differences)

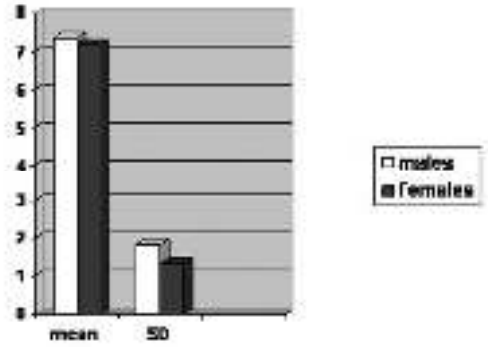
(A) <u>LINGUISTIC DIMENSIONS:</u> The broad transcription of the discourse of each subject was fed to the SALT software to derive the above mentioned linguistic parameters. The analysis was based on two measures of lexical diversity - number of different words (NDW) and type-token ratio (TTR) and one measure of grammatical complexity (mean length of utterance in words and morphemes (MLU). Word count, words per sentence, total no. of utterances, and rate of speech were the other units that were even the objective under this domain.

Figure 1



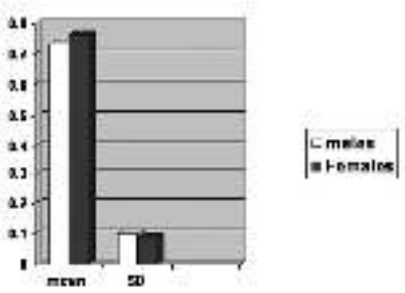
Total number of utterances

Figure 2



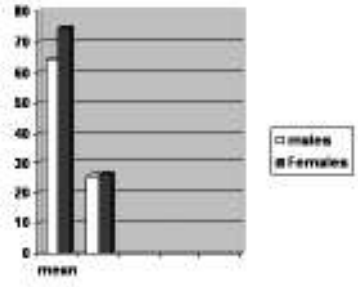
Mean length of utterance at morpheme level

Figure 3



Type-token ratio

Figure4



Rate of speech

Although no significant difference was observed in any of the parameters on statistical measures, group scores did indicate a difference in performance in parameters as total number of utterances (Figure 1), type-token ratio (Figure 3) and rate of speech (Figure 4) where females performed better than the males, whereas males provided better results on mean

length of utterance at morpheme level (Figure 2).

The representative sample here is a small group and to document language behaviors in such a population, statistical measures prove ineffective (owing to higher standard deviation and small sample size).

Females use more number of different words in their description than the males although statistically the values were not significant, possibly to the very reason that the sample collected from each of them was limited to a 1- min discourse owing this to the idea of maintaining uniformity across the data collection in an experimental study as this.

(A) OTHER PROCESSES (Psychological, Cognitive and Social Processes):

In describing the picture of a school scene, females used more insight into the picture, made use of hedges (eg: 'If I see this picture…'), and speech acts such as asking questions and giving permission (eg: 'Why can't all schools take up …'). While females identified themselves as a character in the picture, males envisage of it from a general student's view point and are keen to note the number of characters in the picture (eg: 'Four or five of them are doing exercises') (e.g., Herring, 1993).

While males described the concrete features of the picture, females appeared to imply, interpret the picture by perceiving the implicit (abstract) features by giving an elaborate description. (eg: **Male #1:** Here, so many children are sitting. They are listening. He is reading. Sir is teaching. He is playing football and kicking it wonderfully. Ball is going up. Sir was making students to do exercises. They were doing. Even I feel like doing it but I am not able to do.

Female #1: In this picture, after seeing all this we should do the work properly. If we play correctly, we can maintain good health. We should do exercise. After doing exercise, if we play in the evening our body will be fit in the evening. Even when teachers asks question in class we should answer correctly.)

Use of Pronouns: The use of first-person plural as I, You and me (eg: 'I think…') was used frequently in the description by females; in contrast to which the males used more of the third person as He/She, Their, Them (eg:' A student like me would perceive as…/ I being a student…').

Negations (eg: 'It seems the girl cannot answer') were a feature of the male whereas references to objects (eg: 'She had it in mind that she has to perform well in class') were featured in a female's speech.

Null effects were found for a variety of relatively narrow categories including anger, gender, time, and space. Men and women did not merely focus on different word categories (e.g., anxiety vs. anger, or emotion words vs. cognitive words), but actually used different superordinate language dimensions. From, the above results we can infer that, *female language emphasized on psychological processes, social processes, and verbs while male language emphasized cognitive concerns*. Thus, the results are in support to the idea that men and women both employ language for different reasons and express differently.

In conversations, for example, men used many more negations, negative emotion words, present-tense verbs in their references to numbers, whereas women predominated in and references.

Example of a male's language (the transliteration of the discourse in Kannada language is given below)

Male #2: Here one teacher is teaching. He is asking one child to read it. In that they were playing football. In other words, master is teaching exercises and children were doing. Other students are seeing what he is reading. Teacher is asking questions on that. One, two, three, four, five, six, seven children are playing football. Four or five of them are doing exercises. All of them were lifting shoulders correctly.

Example of a female's language

Female #2: If I see this picture, I will feel studies are important and with that not only studies, playing is also important. If we have to be healthy, exercises are important. These three should be there. It is not enough only studying, exercises are also important. Alongwith studies, for physical fitness exercises are also important and we should follow this. In some schools, teachers are there only for study purposes. Like that, in every school people should come forward for sports also and exercises too.

Women's greater use of pronouns and intensive adverbs is even supported in previous work (Mehl and Pennebaker, 2003). Men's language included substantially greater use of numbers, articles, long words, and swearing (e.g., Gleser, 1959; Mehl and Pennebaker, 2003; Mulac and Lundell, 1986). Women's use greater affect words (Danner et al., 2001) and more polite forms (Holmes, 1995). Study by Newman, Groom, Handelman and Pennbaker (2008) provides strong evidence that women seem to have more of a "rapport" style, discussing social topics and expressing internal thoughts and feelings, whereas men "report" more often, describing the quantity and location of objects. Keeping in mind the earlier work on emotional references, women use more affect words, but this was not restricted to positive emotions, as one earlier study suggested. Women were more likely than men to refer both to positive feelings and to negative emotions—specifically, sadness and anxiety – finding supported by Thomas and Murachver, 2001.

The *image-schemas*, defined as pre-conceptual representations of human bodily experience, differ for each child, although all of them belong to a particular group of the population which more or less resembles the broad category of students of a particular grade. The perception, imagery, language, concreteness and abstractness are the variety of mental processes that are reflected in their linguistic output (in a picture description task).

The fact that no significant findings were observed between males and females linguistic dimensions could be attributed

to the reason that statistical measures do not pull similarities together and individual differences are not highlighted. However, if there is a corpus of language data under analysis, probably in such a case SALT along with the statistical measures would prove suitable in the differentiation.

Recent research has suggested that language use also varies according to an individual's age (Pennebaker and Stone, 2003), and that gender differences vary across children of different ages (Mulac et al., 1990). The complexity of the children's discourse is greater because they are more able to plan joint events and anticipate the responses and arguments of the other where the pragmatic development plays an important role in the manifestation (Ervin-Tripp, 2001). Hence, we stick to the fact of using a particular age group and determining the variations in them.

CONCLUSIONS: There is dearth of literature on gender and language to date, yet it is such an obvious distinction that might be drawn but ultimately a neglected area for research. Interpreting the gender differences is clearly a nuanced matter. Our understanding of other human beings is dependent on language. A central role in the maintenance of gender stereotypes owes to the average differences in communication style among the different genders and these may perpetuate the perception of a "kernel of truth" that underlies those stereotypes.

A qualitative investigation of the gender differences reported here put forth an avenue for future research. Such a groping into the matter would allow for a more complete explanation of the ways in which social roles and relationships between speakers contribute to differences in language use. However, the analysis in this study identifies the *how's* of communication differences between genders merely, without addressing the issue of *why* these differences exist. Rather, our goal was to provide a clear map of the differences in men's and women's language, and to offer a starting point for future research.

Burman in his study "Sex Differences in Neural Processing of Language among Children" found that girls reported of significantly greater activation in language areas of the brain than boys. The information in the various tasks(auditory and visual) got through to girls' language areas of the brain — areas associated with abstract thinking through language and their performance accuracy correlated with the degree of activation in some of these language areas. However, this was not at all the case for boys. (Wendy Leopold, 2008). Even the pattern of results associated with the metaanalysis of gender effects in language behavior support the socialization and the social-constructionist explanations. Furthermore, our data support and clarify, rather than contradict, previous research, suggesting language-based gender differences on firmer empirical ground.

These data also have direct implications for determining special education program intervention strategies and in monitoring student progress. The language sample norms obtained from these research projects can be stored in the SALT Reference Databases. An individual's language output may also be compared to a reference database of language measures. Another proposed form for linguistic analysis is the Linguistic Inquiry and Word Count (LIWC proposed by Pennebaker, Francis and Booth, 2001) which allows to perform an extensive analysis on each individual text in an archive (Newman et al, 2008). LIWC analyzes text samples on a word-by-word basis and compares each to a dictionary of over 2,000 words divided into 74 linguistic categories.

However, the size and diversity of the dataset suggest that a more extensive sample in terms of *a very large and diverse data corpus* combined with a computerized text analysis program would have provided more causal attributions in terms of psychological, social and/or genetic effects. There is reason to suppose that the differences between male and female speech are lessening, but that subtle differences are likely to exist and continue owing to the inherent differences in the structural and functional make-up of cortex in the two genders.

REFERENCES:

Brownlow, S., Rosamon, J. A., & Parker, J. A. (2003). Gender-linked linguistic behavior in television interviews. *Sex Roles, 49,* 121–132.

Danner, D. D., Snowdon, D. A., & Friesen,W. V. (2001). Positive emotions in early life and longevity: Findings from the nun study. *Journal of Personality & Social Psychology, 80,* 804–813.

Ervin-Tripp, S. (2001). The Place of Gender in Developmental Pragmatics: Cultural Factors. Research on Language and Social Interaction, 34(1), 131-147.

Retrieved October, 11, 2009 http://ihd.berkeley.edu/

Grey C. Towards an overview of work on gender and language variation. Retrieved October, 11, 2009 from http://faculty.ed.umuc.edu

Herring, S. C. (1993). Gender and democracy in computer-mediated communication. *Electronic Journal of Communication*, *3*(2). Retrieved September 3, 2003, from http://www.cios.org/getfile/ HERRING_V3N293

Holmes, J. (1995). *Women, men and politeness.* Harlow: Longman.

Leaper, C., & Ayres, M. M. (2007). A Meta-Analytic review of gender variations in Adult's language Use: Talkativeness, Affiliative speech and Assertive speech. *Personality and Social Psychological Review, 11, 328-363*.

Retrieved October, 11, 2009from http://psr.sagepub.com/

Lund, N. J. & Duchan, J. F. (1993). *Assessing Children's Language in Naturalistic Contexts*. New Jersey; Prentice Hall.

Mc Enery, T., Xiao, R., & Tono, Y. (2006). *Corpus-Based Language Studies- An advanced resource book*. New Cork: Taylor and Francis Group.

Mulac, A., Studley, L. B., & Blau, S. (1990). The gender-linked effect in primary and secondary students' impromptu essays. *Sex Roles, 23,* 439–469.

Nelson, K. (1998). *Language in Cognitive Development*. New York: Cambridge University Press

Newman, M. L., Groom, C. J., Handelman, L. D. & Pennbaker, J. W. (2008). Gender Differences in Language Use: An analysis of 14,000 text samples. *Discourse Processes, 45, 211-236.*

Retrieved October, 10, 2009 from http://homepage.psy.utexas.edu/

Leopold, W. (2008). Gender differences in language appear biological. Retrieved October, 8, 2009 from http://www.eurekalert.org/

S.L.H.D:-12

EFFECT OF GENDER ON SPEECH RHYTHM IN KANNADA SPEAKING CHILDREN

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ABSTRACT: Rhythm, a prosodic feature, refers to an event repeated regularly over a period of time. Languages of the world have been organized under stress-timed, syllable-timed and mora-timed. The present study investigated the differences in the type of speech rhythm if any, between typically developing male and female Kannada speaking children. Ten children (5 males and 5 females) in the age group of 8-9 years were selected and screened for oral mechanism and function, speech, language and hearing. A five-minute speech sample of each child was elicited using pictures depicting simple stories which was audio-recorded. The speech samples were transferred on to Adobe Audition software and the Vocalic (V) and Intervocalic (IV) durations were measured. The duration difference between successive vocalic and intervocalic segments was calculated and averaged to get the normalized Pairwise Variability Index (nPVI) and raw Pairwise Variability Index (rPVI), respectively. The results indicated high nPVI and low rPVI values for both the genders and therefore the rhythmic pattern remains unclassified and cannot be placed in any of the rhythmic classes.

Keywords: Speech rhythm, Vocalic duration, Intervocalic duration, Pairwise Variability Index

Introduction: Rhythm, a prosodic feature, refers to an event repeated regularly over a period of time. Rhythm depends on the language and the types of syllables used in a language. Languages differ in characteristic rhythm and with respect to adult speakers, have been organized under stress-timed, syllable-timed and mora-timed, based on the Rhythm Class Hypothesis. The Rhythm Class Hypothesis states that each language belongs to one of the prototypical rhythm classes known as stress-timed, syllable-timed or mora-timed.

When a language has simple syllabic structure, for e.g. VC or CCV, the durational difference between the simplest and most complicated syllable is not wide. This durational difference may be less than 330ms. Under these circumstances, the rhythm of the language is said to be a fast **syllable-timed rhythm**. If the syllabic structure is still simpler, for e.g. VC or CV, then the durational difference between syllables is negligible and it is called a **mora-timed language**. When a language has complex syllabic structure, for e.g. V and CCCVCC, the difference between syllables can be very wide. In such a condition one has to use a slow **stress-timed rhythm**.

The development of concept on rhythm measurement was started with the concept of isochrony – i.e. each syllable has equal duration or the occurrence of regular stress beats. The first attempt to test Rhythm Class Hypothesis was made by Abercrombie (1967) by using the ***average syllable duration***, but was not found to be effective in classifying rhythm types. Roach (1982) used a different measure – ***inter-stress interval*** (ISI). However, ISI also does not seem to classify languages on the basis of rhythm. Ramus, Nespor & Mehler (1999) measured and found that a combination of ***vocalic durations*** (% V) and ***SD of consonant intervals*** (?C) provided the best acoustic correlate of rhythm classes.

The **Pair-wise Variability Index (PVI)** was developed by Low (1998) for rhythmic analysis, which is a quantitative measure of acoustic correlates of speech rhythm and it calculates the patterning of successive vocalic and intervocalic (or consonantal) intervals, showing how one linguistic unit differs from its neighbor. The normalized Pairwise Variability Index (nPVI) and raw Pairwise Variability Index (rPVI) was developed by Low, Grabe & Nolan (2000). nPVI is used for rhythmic analysis of vocalic durations and rPVI is used for rhythmic analysis of intervocalic durations. The classification of languages according to nPVI and rPVI is based on the following pattern.

	Intervocalic interval (IV)	Vocalic interval (V)
Stress-timed	High	High
Syllable-timed	High	Low
Mora-timed	Low	Low

Table 1: Classification of rhythm patterns based on the Vocalic and Intervocalic intervals.

In the Indian context, the data collected so far is mostly on adults and much needs to be done on speech rhythm in children. Savithri, Jayaram, Kedarnath & Goswami (2006) investigated rhythm in Kannada speaking adults and results showed that Kannada is a mora-timed language (low rPVI and nPVI). The rPVI values for the reading sample ranged between 35.90 and 52.10 with a mean of 46.18 and nPVI values ranged between 41.80 and 54.36, with a mean of 46.95.

A study by Savithri, Johnsirani & Ruchi (2008) investigated the rhythm in normal and hearing-impaired children in the age range of 5-10 years. The mean rPVI and nPVI values for normal children were 15.70 and 62.49, whereas that for the hearing-impaired children was 20.54 and 67.14 respectively.

Another recent study by Savithri, Sreedevi & Kavya (2009) investigated the type of speech rhythm in normally developing 8 – 9 year old Kannada speaking children. The rPVI values for these children ranged between 44.97 to 78.17 with a mean of 65.90 and the nPVI values ranged between 80.10 to 122.75 with a mean of 96.06.

The results of both the above mentioned studies indicated high nPVI and low rPVI values and therefore the rhythmic pattern remains **unclassified** and cannot be placed in any of the rhythmic classes (stress-timed, syllable-timed, mora-timed). The results also showed that syllabic structure used by the children was simpler and in the acquisition stage of rhythmic patterns. There is a need to develop normative data for the development of rhythmic pattern in children and hence a project was undertaken for the same. The present paper is a part of the project and investigates the differences in the type of speech rhythm if any, between typically developing male and female 8-9 year old Kannada speaking children.

Method:

***Material*:** Pictures depicting simple stories developed by Rajendra Swamy (1992) was used to elicit speech.

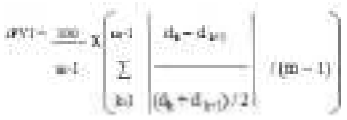
***Subjects*:** Ten children (5 males and 5 females) in the age group of 8-9 years participated in the study. All the subjects were screened to rule out any deficits in oral mechanism and function, speech, language and hearing.

***Procedure*:** A five-minute speech sample of each child was elicited using pictures depicting simple stories and this was audio-recorded using Olympus digital voice recorder at a sampling frequency of 16 kHz. The subjects were tested individually and were instructed to see the pictures carefully and narrate stories using them. Prompting was used at times when the child did not respond.

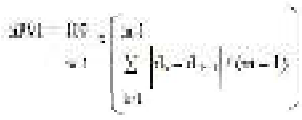
***Analyses*:** The speech samples were transferred on to Adobe Audition software and displayed as a waveform along with fundamental frequency (F_0) and amplitude displays. The pauses were then eliminated by using the software. This was done in order to get an appropriate measure of the vocalic and non-vocalic segments. The Vocalic (V) and Intervocalic (IV) durations were measured using the cursor.

Vocalic measure refers to the duration of vowel/semivowel/diphthong that will be measured as the time duration from the onset of voicing to the offset of voicing for that vowel/semivowel/diphthong. Intervocalic measure refers to the duration between two vocalic segments. It was measured as the time duration between the offset of the first vocalic segment to the onset of the second vocalic segment. Figure 1 below, shows the illustration of vocalic and intervocalic measures in the sentence [ondu:ralli ondu ka:ge ittu].

The duration difference between successive vocalic and intervocalic segments was calculated and averaged to get the nPVI and rPVI, respectively. Pairwise Variability Index developed by Grabe and Low was used as a measure of rhythm. The rPVI and nPVI were measured using the following formulae:



where, m is the number of intervals and d_k is the duration of the k^{th} interval



where, m is the number of intervals and d_k is the duration of the k^{th} interval.

Microsoft Office Excel program was used to calculate the difference between successive vocalic and intervocalic segments and was averaged to get the nPVI and rPVI respectively. The rhythm pattern of the children was classified as belonging to one of the three groups based on the values of nPVI and rPVI.

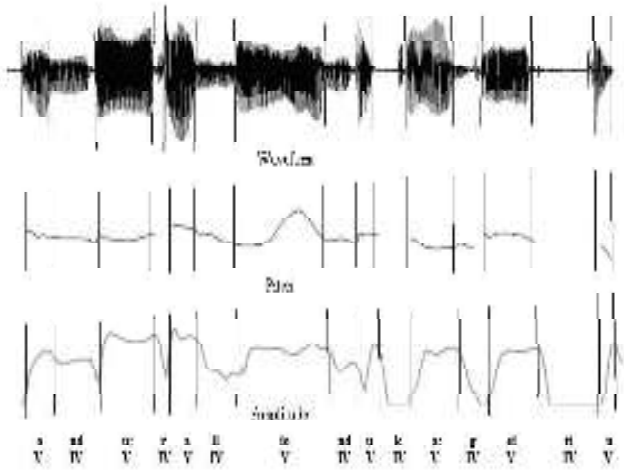


Figure 1: Illustration of measurement of vocalic (V) and intervocalic (IV) intervals in the sentence [ondu:ralli ondu ka:ge ittu]

Results and Discussion

The mean rPVI and mean nPVI values were calculated for both male and female children. Statistical analysis was carried out using Mann Whitney-U test, to obtain the significant differences between the genders. The rPVI values for the male children ranged between 48.0 to 66.57 with a mean of 59.74 and the nPVI values ranged between 82.51 to 112.8 with a mean of 98.23. The rPVI values for the female children ranged between 50.62 to 71.17 with a mean of 59.72 and the nPVI values ranged between 66.79 to 105.35 with a mean of 85.31. The nPVI values were found to be higher than the rPVI values in both the groups, which are depicted in the Tables 2 and 3 below. Mann Whitney-U test indicated no significant difference between the genders for rPVI [$|Z| = 0.1$, $p > 0.05$] and nPVI [$|Z| = 1.4$, $p > 0.05$].

Sub. No.	Story 1		Story 2		Story 3		Story 4		Avg.	
	rPVI (IVI)	nPVI (VI)	rPVI (IVI)	nPVI (VI)	rPVI (IVI)	nPVI (VI)	rPVI (IVI)	nPVI (VI)	rPVI (IVI)	nPVI (VI)
1.	63.89	92.18	67.78	82.85	58.53	93.45	58.31	96.38	62.13	91.22
2.	44.97	93.31	55.49	100.8	46.24	97.03	45.31	94.46	48.0	96.4
3.	69.11	91.98	63.53	100.4	72.22	144.3	61.43	114.7	66.57	112.8
4.	78.17	122.75	55.42	107.8	59.02	99.10	60.23	103.32	63.21	108.24
5.	50.43	61.75	58.20	79.10	63.29	96.53	63.22	92.64	58.79	82.51
Avg.	61.31	92.39	60.08	94.19	59.86	106.08	57.7	100.3	59.74	98.23

Table 2: The rPVI and nPVI values of the five **male** subjects across four stories.

Sub. No.	Story 1		Story 2		Story 3		Story 4		Avg.	
	rPVI (IVI)	nPVI (VI)	rPVI (IVI)	nPVI (VI)	rPVI (IVI)	nPVI (VI)	rPVI (IVI)	nPVI (VI)	rPVI (IVI)	nPVI (VI)
1.	55.52	109.89	60.86	84.51	79.46	91.10	68.81	90.13	66.16	93.91
2.	54.93	61.02	46.98	75.52	49.43	64.80	51.13	65.82	50.62	66.79
3.	73.76	84.61	71.40	96.0	68.03	75.43	71.50	81.27	71.17	84.33
4.	45.15	87.42	58.43	110.18	52.44	118.65	60.97	105.16	54.25	105.35
5.	52.67	71.65	55.31	81.52	59.44	80.06	58.25	71.37	56.42	76.15
Avg.	56.41	82.91	58.60	89.55	61.76	86.01	62.13	82.75	59.72	85.31

Table 3: The rPVI and nPVI values of the five **female** subjects across four stories.

The results revealed several points of interest. Firstly, the results indicated that the rhythmic pattern found in both male and female children remained '**unclassified**' since the nPVI values were found to be higher than the rPVI values in both the groups and therefore, it cannot be placed in any of the rhythmic classes (stress-timed, syllable-timed, mora-timed). This implies that the usage of vowels in the speech of the children is still in the acquisition stage of language. The greater values for nPVI may be attributed to the prolongation of vowels during narration of stories by the children.

Secondly, the results of the present study revealed that the mean rPVI and mean nPVI values were 59.74 and 98.23 respectively, for the male children and 59.72 and 85.31 respectively, for the female children. The nPVI values are higher than the rPVI values in both the groups. Although there is no statistically significant difference between genders for rPVI and nPVI, there is a clear reduction in the nPVI values for females which is depicted in Figure 2 below. The possible explanation could be that the rhythm acquires an adult-like pattern earlier in female children compared to their male counterparts, with increasing age

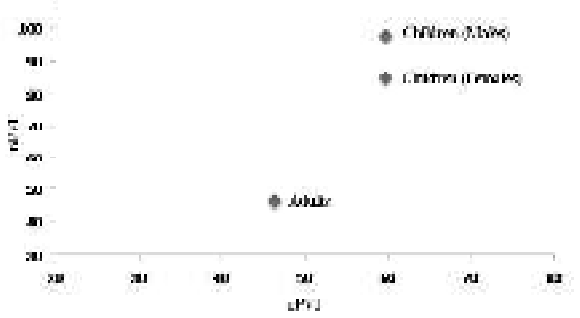


Figure 2: Mean of nPVI and rPVI values for Children(Males and Females) vs. Adults

Third, speech rhythm study in adults indicated Kannada to be a mora-timed language, which is not in consonance with the findings of the present study, wherein results showed that the rhythmic pattern in children remained 'unclassified'. This difference between the PVI values of adults and children has also been depicted in Figure 2. This difference could be attributed to the fact that since children are still in the acquisition stage of language, they are using a syllabic pattern i.e. a vocalic pattern different from adults and the usage of vowels in their speech was greater. Also the narration task in children is unpredictable unlike the reading task by adults and hence would have an influence on the differences in PVI values.

Hence, by studying the development of speech rhythm in children from 3 years till the age of 12 years, it will be possible to provide information on how the rhythm acquires adult-like form with increasing age. This will also add information about the effect of age, gender and language exposure on speech rhythm, which will be helpful in providing effective diagnostic and rehabilitative aid to the clinical population.

Conclusions: The present study attempted to investigate differences in the type of speech rhythm between typically developing male and female Kannada speaking children by measuring the vocalic and intervocalic intervals. The results of the present study indicated that the rhythmic pattern found in both male and female children are similar although female children may show a tendency to acquire the adult-like pattern earlier. This study reveals that the syllabic structure used by children is different from the adults and there is a need to develop normative data to find the age at which they acquire adult-like rhythm pattern.

Acknowledgements: The authors wish to thank DST for providing grants towards the project. We would like to thank Dr.

Vijayalakshmi Basavaraj for permitting us to carry out this study and to present it in the conference. Our heartfelt thanks to all the participants of the study.

References

Abercrombie, D. (1967). *Elements of General Phonetics*. Chicago: Aldine Pub. Co.

Low, E. L. (1998). *Prosodic Prominence in Singapore English*. Unpublished Ph.D. Thesis, University of Cambridge.

Low, E. L., Grabe, E. & Nolan, F. (2000). Quantitative Characterizations of Speech Rhythm – 'Syllable timing' in Singapore English. *Language and Speech*, *43*, 377 – 401.

Rajendra Swamy (1992). Some aspects of fluency in children: 6-7 years. Jayaram M. & Savithri, S. R. (Eds.), Dissertation abstract: Research at AIISH, Vol. 3, pp. 6-7.

Ramus, F., Nespor, M. & Mehler, J. (1999). Correlates of Linguistic Rhythm in the Speech Signal. *Cognition*, *72*, 1 – 28.

Roach, P. (1982). On the distinction between 'Stress-timed' and 'Syllable-timed' languages. In D. Crystal (Ed.), *Linguistic Controversies* (pp. 73-79). London: Arnold.

Savithri, S. R., Jayaram, M., Kedarnath, D. & Goswami, S. (2006). Rate of Speech/Reading in Dravidian Languages. *Journal of Acoustical Society of India*, *33*, 352 – 355.

Savithri, S. R., Johnsirani, R. & Ruchi, A. (2008). Speech Rhythm in Hearing-Impaired Children. AIISH Research Fund Project.

Savithri, S. R., Sreedevi, N. & Kavya, V. (2009). Speech Rhythm in Kannada Speaking Children. Paper accepted for National Symposium on Acoustics - 2009.

S.L.H.D:-13

GENDER DIFFERENCE IN COPING AMONG PARENTS OF CHILDREN WITH AUTISM

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Abstract: The research on the coping strategies of parents is scanty. Previous research has shown that gender difference exists in the coping strategies used. Pleck's GRS(Gender Role Strain) theory explains that males react differently from females in certain situations and the consequences of the behavior would also differ. In particular, in the parents of children with autism following the diagnosis of their child, the coping strategies and the psychological consequences of these strategies will be influenced by gender and might be in line with GRS model. Autism is a communication disorder in which children have difficulty in the use of language and in the formation of relationship with others. This condition, especially the diagnosis generally causes a disruption in the mental state of the parents, which they will have to cope up with. This aspect of coping of the parents of this particular population in specific has not been explored and the present study would throw light on the same, especially so in the Indian context with its unique socio-cultural background. 17 parents participated in the present study, consisting of 5 males and 12 females. The coping strategies were assessed by Carver's Brief COPE inventory (Carver, Scheier & Weintraub, 1987). It consists of 28 questions each of which has a minimum score of 1 and a maximum score of 4. The results of the study are discussed in light of findings from the western literature. This has implications in improving our counseling and guidance strategies in day-to-day clinical practice.

Introduction: Approaches to working with parents of autistic children have changed significantly during the past twenty years. Marcus, Kunce and Schopler (1997) noted a parallel between this change and the recognition of autism as a developmental disorder rather than as an emotional disturbance. As part of this change, the parents have become more directly involved in the treatment of their child. Parents are no longer viewed as the cause of their child's problem but rather recognized as partners in the treatment of their child. Similar perspective from the parents' side still remains a question. Parents need functional coping strategies to succeed in this new role. Coping strategies are looked upon as being cognitive structures of the emotional system influencing the individual's structure of emotions. Without functional and flexible coping strategies parents risk burn out effects. The strategies parents would choose would be wide and varied, some might have a negative attitude, some would have a positive attitude and others would have an attitude of denial or escapism. These attitudes would be differently present in different parents and would be helping them to cope up with the life situations at varying levels. The level of difference would vary depending on very many factors like the environment at home, the support available, the counseling obtained and many more. The parents would be trying to involve in various activities in order to distract themselves, escape from the situation, actively cope with the situation and similar activities may bring about betterment in the life of the parents as well as the children. The better parents are able to cope with daily life situations, the more probable it is that they successfully can contribute to the care of their children. Further, good coping skills may facilitate parents to have enough strength. The level of coping in turn is widely influenced by very many factors like the emotional level of the person, the environment at home, work place, educational environment of the child, support from family, counseling and education of the parents. Generally the mother is the primary care taker of the child and the father's role, though very important, is generally highlighted to a lesser extent. This is especially

due to reasoning to the fact of providing financial support to the family; whereby the father has a role and he will have to cope up in a different perspective when compared to the mother. The new psychology of men has advanced our understanding of gender, using the Gender Role Strain Paradigm as an overarching theoretical framework (Pleck, 1981, 1995). The Gender Role Strain Paradigm emphasizes the centrality of gender ideology as a cultural script that organizes and informs everything from the socialization of small children to the emotions, cognition, and behavior of adults. In his work describing gender-role strain, Pleck (1981) identified different types of strain that occur from trying to live gender-role expectations. Considering Pleck's theory a gender difference could be expected as both men and women generally confirm to gender norm and thus they feel good and they don't become deviant.

Thus it could be hypothesized that there exists difference in the outlook and strategies used by mothers and fathers of children. There could also exist a difference in attitude depending on the time of diagnosis, informal support obtained from families facing similar problem, period of enrollment for therapy and formal support from other agencies. The family demographics and the cultural aspect also have an influence. Though some studies have proposed no difference between genders, considering the very different cultural back ground of India, the hypothesis of a gender difference also seems to be significant. This also paves way for further development in counseling per se; a very important aspect of the betterment of the family as a whole; which in turn would have a positive attitude to the development and improvement of the child.

Review of literature: Autism in children has increased significantly in the past 15 years. The challenges and stressors associated with providing services and caring for a child with autism affects families, educators and health professionals. A descriptive study by Luther, Canham and Cureton (2005) used a survey to collect data on parents' perceptions of coping strategies and social support. Instruments included the Social Support Index and the Family Crisis Oriented Personal Evaluation Scales. One half of the families identified serious stressors in addition to autism. Acquiring social support and reframing were the most frequently used coping strategies. The school nurses were allowed a position to identify needs and refer families to local support groups and agencies, facilitating social support and development of coping strategies. Results suggest that such parent training programs can prove to be very effective for parents of children with autism. The findings highlight the need to assess parental stress while at the same time recognizing that many families bring important strengths in coping and adjusting to the diagnosis of autism. With adequate intervention, the parental stress levels can be reduced and the parents can be taught to use effective coping strategies to deal with their situation.

Twoy, Connolly and Novak (2007) attempted to study the crisis oriented evaluation by the family of children diagnosed as having autism spectrum disorder (ASD). The objectives were to determine (a) the level of family adaptation, as measured by the Family Crisis Oriented Personal Evaluation Scales (F-COPESs) instrument, among families with a child diagnosed with autism spectrum disorder (ASD) aged 12 years and under, (b) if there was a difference in F-COPES scores based on family demographics and (c) the time lag between parent's suspicion of ASD and the actual professional diagnosis of ASD. A descriptive survey was used with a convenience sample derived from ASD treatment agencies and a parental support group in the California Bay Area that supports the children and parents of children with special needs. Overall, the level of adaptation was within the normal limits with coping scores similar to the norm scores of the F-COPES with males scoring slightly higher than females in the coping scale. Subscale scores of the F-COPES indicated that the parents sought encouragement and support from friends, informal support from other families who faced similar problems and formal support from agencies and programs. Reframing revealed similar results as the norm with less use of spiritual support and more passive appraisals were noted from the parents of children with ASD. Within internal comparisons, there were no statistical differences among gender and amount of time a member spent in coordination of services. Comparisons in ethnicity for Caucasians and Asian Americans revealed a higher coping score for reframing in Asian Americans and a higher passive appraisal score among Caucasians. Non-English speakers scored higher on spiritual support, while English speakers scored higher in passive appraisals. The time from parents' suspicions of developmental delays or disability to a professional diagnosis of ASD was at least 6 months or greater. Educating parents to sound therapy approaches to provide them with the skills needed to directly address stressful events and to increase the parent's confidence level as to avoid passive appraisals is also a crucial role of the Nurse Practitioners (NP). NPs may want to use the F-COPES as part of the assessment to ascertain the areas of needs of families. This study reveals the resiliency and highly adaptive nature of these parents who are under severe stress and strain in caring for a child with ASD. The effective ways they coped as a family were in the areas of informal and formal social support networks. Participants also used passive appraisal to cope. The study also supports the need for early recognition and diagnoses of ASD and referral for early intervention for better outcomes for the children and families affected by ASD.

A study by Montes (2009) suggests that having a child with autism has a negative impact on maternal psychological functioning. The objectives of this study were to (1) describe the psychological functioning, physical and mental health, family communication, and parenting support of mothers of a

child with autism compared with other mothers on a population basis and (2) assess the independent relationship between having a child with autism and the outcomes controlling for the child's social skills and demographic background. Mothers of 61772 children who were 4 to 17 years of age were surveyed by the National Survey of Children's Health (2003). Autism was measured from an affirmative maternal response to the question, "Has a doctor or health professional ever told you your child has autism" There were 364 children with autism in the sample. Mothers of a child with autism were highly stressed and more likely to report poor or fair mental health than mothers in the general population, even after adjustment for the child's social skills and demographic background. However, mothers of a child with autism were more likely to report a close relationship and better coping with parenting tasks and less likely to report being angry with their child after adjustment for the child's social skills and demographic background. Having a child with autism was not associated with lower social support for parenting, an altered manner in which serious disagreements were discussed in the household, or increased violence in the household. Mothers of children with autism showed remarkable strengths in the parent–child relationship, social support, and stability of the household in the context of high stress and poorer mental health.

There is dearth for information regarding the coping strategies in parents of children with autism spectrum disorders in the Indian context, which is quite different from the western context in the socio-cultural, emotional and linguistic aspects, which are important variables influencing coping. Hence the present preliminary study was planned to look into the gender differences if any in the coping strategies in parents of children with ASDs.

Methodology

a) Subjects:

Subjects were selected based on the criteria that they are parents of children with autism. These children are currently attending therapy in the ASD Unit at the All India Institute of Speech and Hearing, Mysore. Two of the children included in the study were having autism associated with hearing impairment and mental retardation. All the children except one child are attending either the preschool training or speech therapy and some are attending both for a period of 1 month to 3 years. Majority of the subjects have been attending training for a period of 1 year. The age of the children is in the range of 2 years to 8 years.Subjects were divided into two groups, males and females, ie, fathers and mothers. There were 5 fathers and 12 mothers who participated in the study. Since it was the mothers who were bringing the child for therapy most of the time and the fathers were in their native place, it was difficult to get information from both the parents of the same child. There was only one parent couple who participated in the study.

Table 1: The female participants of the study, their language, age of the child and the duration for which they have been attending therapy is given in the table.

Females	Language	Age of the child in years	Duration of therapy in years
1	Malayalam	4.25	1
2	Malayalam	7	1
3	Malayalam	6	3
4	Malayalam	6	2
5	Malayalam	5.5	2
6	Malayalam	6	1
7	Malayalam	8	1
8	Malayalam	4	1
9	English	5	3
10	Kannada	5.5	1.5
11	Kannada	2	1 month
12	Malayalam	8	1

Table 2: The Male participants of the study, their language, age of the child and the duration for which they have been attending therapy is given in the table.

Males	Language	Age of the child in years	Duration of therapy in years
1	Kannada	3	1
2	Kannada	8	3 months
3	Kannada	2	1 month
4	Kannada	5.5	1.5
5	Malayalam	7.25	10 days

b) Material : The material used for the present study was Brief COPE (see appendix), a questionnaire with 28 questions which had to be rated on a four points rating scale. The way the parents cope with the problem was assessed using the Carver, Scheier and Weintraub's Brief COPE Inventory (1997). Brief COPE is a shorter version of the COPE inventory which had 15 sub-sections each of which had a minimum score of 4 and a maximum score of 16. The inventory contained four items per sub-scale, with a total of 60 items. The shorter item set was created partly because earlier patient samples became impatient at responding to the full instrument (both because of the length and redundancy of the full instrument and because of the overall time burden of the assessment protocol). The choosing of which items to retain for this version (which has only 2 items per scale) was guided by strong loadings from previous factor analyses and by item clarity and meaningfulness to the patients in a previous study. One scale that was not part of the original inventory was a 2-item measure of self-blame was added because this response has been important in some earlier work. The authors have suggested the use of either all scales of Brief COPE or to choose selected scales for use. The authors have suggested the adaptation of language for whatever time scale interested

in. Translated version of the inventory in Malayalam and Kannada language were used for the current study, for those who could not follow English. This questionnaire was distributed to parents of children with autism and the parents were asked to mark the most appropriate answers befitting their situation, independently and the one best suited for them. The items in the questionnaire were grouped mainly under four headings depending on the content for the purpose of analysis. The divisions include positive constructive approach, positive dependant approach, negative approach and denial. There are fourteen items in the positive section, of which ten have been grouped under positive constructive (items 7, 2, 12, 17, 14, 25, 18, 28, 20, 24); four under positive dependant (items 5, 15, 10, 23); four items under negative (items 6, 16, 13, 26, 9, 21) and eight items under denial (items 1, 19, 3, 8, 4, 11, 22, 27). Thus the items were classified under different headings and considered for the current study in order to arrive at a general conclusion about the attitude the parents have in general and to see if the difference in coping strategy exists between the two genders.

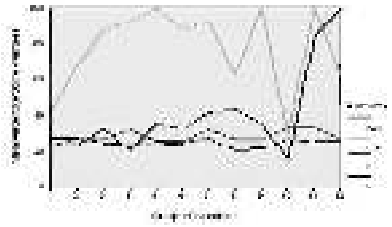
Results and discussion: The data obtained from the questionnaire ratings by the participants in the study was analyzed under different coping strategies adopted by the parents. Table 2 provides means and standard deviation (SD) scores for both father and mother groups on different coping strategies.

Table 3: Mean and SD scores of fathers and mothers for the coping strategies

Coping strategies	Males		Females		Total	
	Mean	SD	Mean	SD	Mean	SD
Positive constructive	3.04	0.16	2.94	0.31	2.97	0.27
Positive dependant	2.88	1.15	3.08	0.94	3.02	0.98
Negative	1.67	0.67	2.47	1.50	2.24	1.34
Denial	1.90	0.47	2.08	0.20	2.03	0.30

As seen in the table both the parents (fathers and mothers) have more positive approach in their coping strategies and although not very significant, the fathers have more positive constructive trends compared to mothers who use more dependency in spite of being positive. Mothers had higher scores for negative and denial coping strategies compared to males. Mothers of a child with autism were highly stressed and more likely to report poor or fair mental health than mothers in the general population, even after adjustment for the child's social skills and demographic background according to Montes. The negative attitude and stress generally associated with the mothers of children with autism however can be overcome with adequate counseling on these aspects and can henceforth a better parental involvement and better coping of the mother can happen.

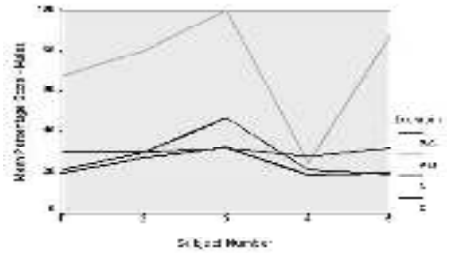
The percentage mean was calculated and for further statistical analysis, the percentage values were considered. Mann-Whitney test, a non parametric test was done to find if there existed any significant difference between the two groups. The results reveal that there was no significant difference between the two genders, for the various categories. This study is dissonance with the study done by Twoy, Connolly and Novak (2007), wherein they found a difference between the genders, males scoring higher than females in the coping scale



Graph 1: Mean percentage scores of 12 mothers for the four domains

P-C (positive-constructive); P-D (positive dependant); N (negative) and D (denial)

From the graph, it can be seen that of all the domains, positive dependant has higher scores followed by negative, positive constructive and denial. The graph also reveals that 3 subjects have reached a maximum score of 100% in the domain of positive dependant. This could be because of relatively longer duration of therapy (more than two years) attended by their children. The educational qualification and the socio economic background of two of these subjects were of higher level compared to the others. The domain negative has also reached a maximum of 100% for one of the subjects. The reason which could be attributed to this is that the child is not attending therapy and the subject's educational level is less. The denial scores are relatively lower, which is a good indicator. The coping strategy widely used by the mothers is positive dependant followed by negative attitudes, positive constructive approach and denial which again is a good indicator.



Graph 2: Mean percentage scores of 5 fathers for the four domains

P-C (positive-constructive); P-D (positive dependant); N (negative) and D (denial)

The graph shows the mean percentage scores for fathers plotted against the four domains. Here also, similar to the mothers, positive dependant scores are higher with one subject reaching a maximum score of 100%. Here again negative

scores and positive constructive scores are varying with many subjects having a better positive constructive approach, unlike the mothers' group in which many subjects had higher negative mean percentage than the positive constructive mean percentage scores. Denial scores were relatively lesser for fathers, similar to mothers. The negative attitude of the parents can be intervened by providing a better counseling and giving emphasis on the approaches of coping and building a positive attitude.

Further, Friedmann test was done in order to find if a significant difference existed between the four domains. The results reveal that a significant difference existed between the groups [$\div^2$ (2) = 29.46, $p<0.05$]. Wilcoxon Signed Ranks test revealed the pairs of conditions for which significant difference existed at 0.05 level of significance. The pairs of domains for which significant difference existed included positive dependant-positive constructive, denial-positive constructive, negative-positive dependant, denial- positive dependant, denial-negative. The only pair of conditions for which there existed no significant difference at 0.05 level of significance is denial-positive constructive.

Research conducted on the reactions of parents by Sullivan, 2002, following the birth of a child with Down syndrome is informed by Pleck's (1981) Gender Role Strain model which attempts to explain the different socialisation processes males encounter which influence their development in our society. Questionnaires from Carver, Scheier and Weintraub's COPE inventory (1989) were given to parents (n = 150) to measure coping strategies and a number of gender differences were found. Females scored significantly higher than males in seeking instrumental and emotional support; in focusing on and venting emotions; which would be grouped under the category of positive dependant in the current study and suppression of competing activities. The overall findings from the study provides mixed implications for Pleck's theory. Gender differences were found but no value can be ascribed to these different coping strategies.

The findings of the current study are not in line with Pleck's Gender Role Strain paradigm. However, differences were not found between the genders. The main problem for Pleck's theory is that it proposes male trauma and dysfunction. This appears not to be the case in this situation. Males demonstrated less negative and denial traits than women. Firstly the figure of the cold unemotional male who is suffering trauma and psychological stress due to his socialisation into the male role seems to be largely false in this case. There does appear to be support for stereotypical gender differences in coping strategies. Here the fathers have scored better for positive constructive coping attitude and mothers seeking and expressing emotions have scored more on the positive dependant, which can be attributed to the positive support provided from their spouse.ng should we do about this. Many theorists, Pleck included, have suggested that men need to change in some way to be psychologically healthy. Gilmore, 1990 has cited cross-cultural studies demonstrating that many aspects of the 'traditional' male role have positive and beneficial aspects for society. It should be recognised that there is great variety among males and within the same man across his lifetime. A better outlook and involvement could be brought about by building up a more positive coping approach. Thus, coping can be stressed and highlighted when interacting or dealing with parents of children with autism.

Summary: The present study was aimed to find if there existed any difference in gender for coping of parents of children with autism. Pleck's Gender Role Strain Model was taken into consideration to explain if any difference existed in Gender. The current study revealed no significant difference in Gender as per the scores obtained in Brief Cope. The mean scores however reveal that males have scored higher on positive constructive strategies and lesser on the other domains of positive dependant, negative and denial. Friedman test revealed that there was a significant difference existing between the four domains and all pairs of domains revealed significant difference other than denial- positive constructive pair. The denial and negative domains could be focused on while counseling and the approach can be made more positive. The drawbacks of the present study are that if it was conducted on a larger sample it could have revealed better results. The father population was lesser in number, as it was the mothers who accompanied the child. The parents of the same child, if considered, the family's attitude and the parental difference for the same child could be considered.

Conclusion: From the present study it can be concluded that, though fathers and mothers are expected to have a different attitude towards the child, the difference is not significant from the present study. The negative attitude and denial attitude, however lesser as revealed by the mean scores. Due to time constraints, the proposed number of subjects of 15 in each category could not be obtained. The mothers being the primary caretaker, spends more time with the child and also needs to have a positive approach for the betterment of the child as well as the family. The mother seems to have a more positive dependant approach as per the mean scores. The family, especially the spouse, the educational set up, professionals, including the speech language therapists, special educators have a significant role in counseling and building a positive attitude for the parents of children with autism.

Reference

Carver,C., Scheier,M.& Weintraub, J. (1989). Assessing coping strategies: A theoriticaly based approach. Journal of Personality and Social Psychology, 56(2), 267-83.

Gillmore,D.(1990). Manhood in the making: Cultural Concepts of Masculinity. New Haven, CT: Yale University Press.

Luther,E.H., Canham, D.L ., & Cureton, V.Y (2005). Coping and social support for parents of children with autism. *The Journal of School Nursing*, 21, 40-47.

Marcus,L.M., Kunce,L.J., & Schopler,E.(1997).Working with

families.In D.J.Cohen and E.R.Volkmar(Eds). Handbook of Autism and Pervasive developmental disorders (pp.631-649).New York :Wiley.
Montes, G (2009). Psychological functioning and coping among mothers of children with Autism: A population based study. *Shouxi*
Pleck, J. (1981). *The Myth of Masculinity*. Cambridge, MA: MIT Press.
Twoy, R., Connolly, P.M., & Novak,J.M. (2007) Coping Strategies used by parents of children with Autism. *Journal of American Academy of Nurse Practitioners* ,19, 251-260.

Acknowledgement: The authors thank the Director, All India Institute of Speech and Hearing; for granting us permission to carry out this study and Swadeshi Vijnana Andolana-Karnataka; for giving the platform to present this paper

Appendix

BriefCOPE

These items deal with ways you've been coping with the stress in your life since you found out you were going to have to have this operation. There are many ways to try to deal with problems. These items ask what you've been doing to cope with this one. Obviously, different people deal with things in different ways, but I'm interested in how you've tried to deal with it. Each item says something about a particular way of coping. I want to know to what extent you've been doing what the item says. How much or how frequently. Don't answer on the basis of whether it seems to be working or not—just whether or not you're doing it. Use these response choices. Try to rate each item separately in your mind from the others. Make your answers as true FOR YOU as you can.

1 = I haven't been doing this at all
2 = I've been doing this a little bit
3 = I've been doing this a medium amount
4 = I've been doing this a lot

1. I've been turning to work or other activities to take my mind off things.
2. I've been concentrating my efforts on doing something about the situation I'm in.
3. I've been saying to myself "this isn't real.".
4. I've been using alcohol or other drugs to make myself feel better.
5. I've been getting emotional support from others.
6. I've been giving up trying to deal with it.
7. I've been taking action to try to make the situation better.
8. I've been refusing to believe that it has happened.
9. I've been saying things to let my unpleasant feelings escape.
10. I've been getting help and advice from other people.
11. I've been using alcohol or other drugs to help me get through it.
12. I've been trying to see it in a different light, to make it seem more positive.
13. I've been criticizing myself.
14. I've been trying to come up with a strategy about what to do.
15. I've been getting comfort and understanding from someone.
16. I've been giving up the attempt to cope.
17. I've been looking for something good in what is happening.
18. I've been making jokes about it. \
19. I've been doing something to think about it less, such as going to movies, watching TV, reading, daydreaming, sleeping, or shopping.
20. I've been accepting the reality of the fact that it has happened.
21. I've been expressing my negative feelings.
22. I've been trying to find comfort in my religion or spiritual beliefs.
23. I've been trying to get advice or help from other people about what to do.
24. I've been learning to live with it.
25. I've been thinking hard about what steps to take.
26. I've been blaming myself for things that happened.
27. I've been praying or meditating.
28. I've been making fun of the situation.

S.L.H.D:-14

NLP: NATURAL LANGUAGE PROCESSING FOR SPEECH RECOGNITION

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KEYWORDS: Speech Recognition, Natural Language Processing (NLP), VoiceXML, voice recognition, grammar, speech-to-text.

ABSTRACT: Natural language processing (NLP) refers to Artificial Intelligence (AI) methods of communicating with a computer in a natural language like English. The main objective of a NLP program is to understand input and initiate action. Speech Recognition is the process of converting spoken input to text. It allows you to provide input to an application with your voice. The speech recognition process is performed by a software component. Speech Recognition will revolutionize the way people conduct business over the web and will ultimately differentiate world-class e-businesses. VoiceXML ties speech recognition and telephony together and provides the technology with which business can develop and deploy voice-enabled web solutions today. These solutions can greatly expand the accessibility of web-based self-service transactions to customers who would otherwise not have, and at the same time, leverage a business' existing web investments. Speech recognition and VoiceXML clearly represent the wave of the Web. It is important to consider the

vironment in which the speech system has to work. The grammar used by the speaker and accepted by the system, noise level, noise type, position of the microphone, speed and manner of the user's speech are some factors that affect the quality of speech recognition. Since, most recognition systems are speaker independent, it is therefore necessary to train a system to recognize the dialect of each user.

1. Introduction

When you dial the telephone number of a big company, you are likely to hear the sonorous voice of a cultured lady who responds to your call with great courtesy saying "welcome to company X. Please give me the extension number you want". You pronounce the extension number, your name, and the name of the person you want to contact. If the called person accepts the call, the connection is given quickly. This is artificial intelligence where an automatic call-handling system is used without employing a telephone operator. AI is the study of the abilities of computers to perform tasks, which currently are better done by humans. AI has an interdisciplinary field where computer science intersects philosophy, psychology, engineering and other fields. Humans make decisions based upon experience and intention. The essence of AI is in the integration of computers to mimic this learning process and this is known as Artificial Intelligence Integration. The goal of this paper is to show how Artificial Intelligence concepts can be used for creating a Speech Recognition System.

2. The Technology

AI involves two basic ideas. First, it involves studying the thought-processes of human beings. Second, it deals with representing those processes via machines (like computers, robots, etc). AI is behaviour of a machine, which, if performed by a human being would be called intelligence. It makes machines smarter and more useful, and is less expensive than natural intelligence.

NLP refers to artificial intelligence method of communicating with a computer in a natural language like English. The main objective of a NLP program is to understand input and initiate action. The input words are scanned and matched against internally stored known words. Identification of a keyword causes some action to be taken. In this way, one can communicate with the computer in one's own language. There is no need to enter programs in a special language for creating software.

VoiceXML takes speech recognition even further. Instead of talking to your computer, you're essentially talking to a web site over the phone.

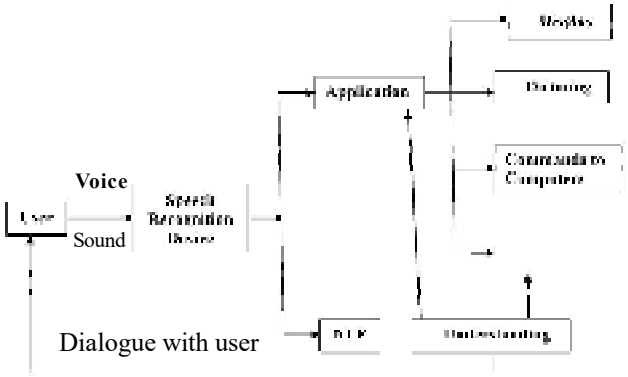
Speech recognition is the process of converting spoken input to text. Speech recognition is thus sometimes referred to as speech-to-text. Speech recognition allows you to provide input to an application with your voice. Just like clicking with your mouse, typing on your keyboard, or pressing a key on the phone keypad provides input to an application; speech recognition allows you to provide input by talking. In the desktop world, you need a microphone to be able to do this. In the VoiceXML world, all you need is a telephone. The speech recognition process is performed by a software component known as the speech recognition engine which processes spoken input and translates it into text.

Then the application can do two things:

a) can interpret the result of the recognition as a command. In this case, the application is a command and control application.

b) If the application handles the recognized text simply as text, then it is considered a dictation application.

SPEECH RECOGNITION PROCESS



Speech Recognition: The user speaks to the computer through a microphone, which in turn, identifies the meaning of the words and sends it to NLP device for further processing. Once recognized, the words can be used in a variety of applications like display, robotics, commands to computers, and dictation.

The word recognizer is a speech recognition system that identifies individual words. Early pioneering systems could recognize only individual alphabets and numbers. Today, majority of word recognition systems are word recognizers and have more than 95% recognition accuracy. One must speak the input information in clearly definable single words, with a pause between words, in order to enter data in a computer.

Continuous speech recognizers are far more difficult to build than word recognizers. You speak complete sentences to the computer. The input will be recognized and then processed by NLP. Such recognizers employ sophisticated, complex techniques to deal with continuous speech, because when one speaks continuously, most of the words slur together and it is difficult for the system to know where one word ends and the other begins. Unlike word recognizers, the information spoken is not recognized instantly by the system.

What is a speech recognition system?

A speech recognition system is a type of software that allows the user to have their spoken words converted into written text in a computer application such as a word processor or a spreadsheet. The computer can also be controlled by the user by the means of spoken commands.

Speech recognition software can be installed on a personal

computer of appropriate specification, The user speaks into a microphone-(a headphone microphone is usually supplied with the product). The software generally requires an initial training and enrolment process in order to teach the software to recognize the voice of the user. A voice profile is the produced that is unique to that individual. This procedure also helps the user to learn how to speak to a computer. After the training process, the user's spoken words will produce text; the accuracy of this will improve with further dictation and conscientious use of the correction
procedure. With a well-trained system, around 95% of the words spoken could be correctly interpreted. The system can be trained to identify certain words and phrases and examine the user's standard documents in order to develop an accurate voice file for the individual.

However, there are many other factors that need to be considered in order to achieve a high recognition rate. There is no doubt that the software works and can liberate many learners, but the process can be far more time consuming than first time users may appreciate and the results can often be poor. This can be very demotivating, and many users give up at this stage. Quality support from someone who is able to show the user the most effective ways of using the software is essential. When using speech recognition software, the user's expectations and the advertising on the box may well be far higher than what will realistically be achieved. 'You talk and it types' can be achieved by some people only after a great deal of practice, perseverance and hard work.

Terms and Conditions

Following are a few of the basic terms and concepts that are fundamental to speech recognition. It is important to have a good understanding of these concepts when developing VoiceXML applications.

Utterances: *W*hen the user says something, this is known as an utterance. An utterance is any stream of speech between two periods of silence. Utterances are sent to the speech engine to be processed. Silence, in speech recognition, is almost as important, as what is spoken, because silence delineates the start and end of an utterance. The speech recognition engine is" listening" for speech input. When the engine detects audio input in either words, a lack of silence - the beginning of an utterance is signaled.

Similarly, when the engine detects a certain amount of silence following the audio, the end of the utterance occurs. Utterances are sent to the speech engine to be processed. If the user doesn't say anything, the engine returns what is known as a silence timeout - an indication that there was no speech detected within the expected timeframe, and the application takes an appropriate action, such as re-prompting the user for input. An utterance can be a single word, or it can contain multiple words (a phrase or a sentence).

Pronunciations: The speech recognition engine uses all sorts of data, statistical models, and algorithms to convert spoken input into text. One piece of information that the speech recognition engine uses to process a word is its pronunciation, which represents what the speech engine thinks a word should sound like. Words can have multiple pronunciations associated with them. For example, the word "the" has at least two pronunciations in the U.S. English language: "thee" and "thuh". As a Voice XML application. These words and defined to the speech recognition engine and are used in the recognition process; you can specify the valid words and phrases in a number of different ways, but in VoiceXML, you do this by specifying a grammar. A grammar uses a particular syntax, or set of rules, to define the words and phrases that can be recognized by the engine.

Grammars: As a VoiceXML application developer, you must specify the words and phrases that users can say to your application. These words and phrases are defined to the speech recognition engine and are used in the recognition process. You can specify the valid words and phrases in a number of different ways, but in VoiceXML, you do this by specifying a grammar. A grammar can be as simple as a list of words, or it can be flexible enough to allow such variability in what can be said that it approaches natural language capability.

Accuracy: The performance of speech recognition system is measurable. Perhaps the most widely used measurement is accuracy. It is typically a quantitative measurement and can be calculated in several ways. Arguably the most important measurement of accuracy is whether the desired end result occurred. This measurement is useful in validating application design. Another measurement of recognition accuracy is whether the engine recognized the utterance exactly as spoken.

Another measurement of recognition accuracy is whether the engine recognized the utterance exactly as spoken. This measure of recognition accuracy is expressed as a percentage and represents the number of utterances recognized correctly out of the total number of utterances spoken. It is a useful measurement when validating grammar design.

Recognition accuracy is an important measure for all speech recognition applications. It is tied to grammar design and the acoustic environment of the user. You need to measure the recognition accuracy for your application, and may want to adjust your application and its grammars based on the results obtained when you test your application with typical users.

Speaker Independency: The speech quality varies from person to person. It is therefore difficult to build an electronic system that recognizes everyone' voice. By limiting the system to the voice of a single person, the system becomes not only simpler but also more reliable. The computer must be trained to the voice of that particular indi

vidual. Such a system is called Speaker-dependent system. Speaker - independent system can be used by anybody, and can be used by anybody and can recognize any voice, even though the characteristics vary widely from one speaker to another. Most of these systems are costly and complex.

It is important to consider the environment in which the speech recognition system has to work. The grammar used by the speaker and accepted by the system, noise level, noise type, position of the microphone, and speed-and manner of the user's speech are some factors that may affect the quality of the speech recognition.

Speaker Dependence Vs Speaker Independence

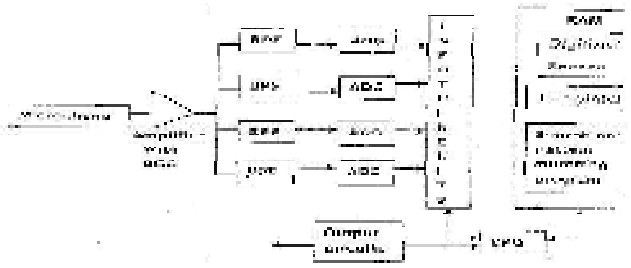
Speaker Dependence describes the degree to which a system requires knowledge of a speaker's individual voice characteristics to successfully process speech. The speech recognition engine can learn how you speak words and phrases, it can be trained for your voice. Speech recognition systems that require a user to train the system to his/her voice are known as speaker - dependent systems. If you are familiar with desktop dictation systems, most are speaker dependent systems. Because they operate on very large vocabularies, dictation systems perform much better when the speaker has spent the time to train the system to his/her voice.

Working of the System

The voice input to the microphone produces an analogue speech signal. An analogue to digital converter (ADC) converts this speech signal into binary words that are compatible with digital computer. The converted binary version is then stored in the system and compared with previously stored binary representation of words and phrases. The current input speech is compared one at a time with the previously stored speech pattern after. searching by the computer. When a match occurs, recognition is achieved. The spoken word in binary form is written on a video screen or passed along to a natural language understanding processor for additional analysis.

Since most recognition systems are speaker - dependent, it is necessary to train a system to recognize the dialect of each user. During training, the computer displays a word and user reads it aloud. The computer digitizes the· user's voice and stores it. The speaker has to read aloud about 1000 words. Based on these samples, the computer can predict how the user utters some words that are likely to be pronounced differently by different users. The block diagram of a speaker - dependent word recognizer is shown in figure below. The user speaks before the microphone, which converts the sound into electrical signal. The electrical analogue signal from the microphone, is fed to an amplifier provided with automatic gain control(AGC) to produce an amplified output signal in a specific optimum voltage range, even when the input signal varies from feeble to loud.

SPEAKER- DEPENDENT WORD RECOGNIZER



The analogue signal, representing a spoken word, contains many individual frequencies of various amplitudes and different phrases, which when blended together take the shape of a complex waveform as shown in the above figure. A set of filters is used to break this complex signal into its component parts. Band pass filters (BFP) pass on frequencies only certain frequency range, rejecting all other frequencies. Generally about 16 filters are used; a simple system may contain a minimum of three filters. The more the number of filter used, the higher the probability of accurate recognition. Presently, switched capacitor digital filters are used because these can be custom built in integrated circuit form. These are smaller and cheaper than active filters using operational amplifiers. The filter output is then fed to the ADC to translate the analogue signal into digital word. The ADC samples the filter output many times a second. Each sample represents different amplitude of the signal. A CPU controls the input circuits that are fed by the ADC's. A large RAM stores all the digital values in a buffer area. This digital information, representing the spoken word, is now accessed by the CPU to process it further. The normal speech has a frequency range of 200 Hz to 7KHz. Recognizing a telephone call is more difficult as it has bandwidth limitations of 300Hz to 3.3KHz. As explained earlier the spoken words are processed by the filters and ADCs. The binary representation of each of these words becomes a template or standard against which the future words are compared. These templates are stored in the memory. Once the storing process is completed, the system can go into its active mode and is capable of identifying the spoken words. As each word is spoken, it is converted into binary equivalent and stored in RAM. The computer then starts searching and compares the binary input pattern with the templates. It is to be noted that even if the same speaker talks the same text, there are always slight variations in amplitude or loudness of the signal, pitch, frequency difference, time gap etc. Due to this reason there is never a perfect match between the template and the binary input word. The pattern matching process therefore uses statistical techniques and is designed to look for the best fit. The values of binary input words are subtracted from the corresponding values in the

templates. If both the values are same, the difference is zero and there is perfect match.

If not, the subtraction produces some difference or error. The smaller the error, the better the match. When the best match occurs, the word templates are to be matched correctly in time, before computing the similarity score.

The search process takes a considerable amount of time, as the CPU has to make many comparisons before recognition occurs. This necessitates use of very high-speed processors. A large RAM is also required as even though a spoken word may last only' a few hundred milliseconds, but the same is translated into many thousands of digital words. it is important to note that alignment of words and speeds as well as elongate different parts of the same word. This is important for the speaker-independent recognizers.

The speech recognition engine has a rather complex task to handle, that of taking raw audio input and translating it to recognized text. The major components are:

* Audio input
* Grammar (s)
* Acoustic model
* Recognized text

The first thing we want to take a look at is the audio input coming into the recognition engine. It is important to understand that this audio stream is rarely pristine. It contains not only the speech data but also background noise. this noise can interface with the recognition process, and the speech engine must handle the environment within which the audio is spoken. As we have discussed, it is the job of the speech recognition engine to convert spoken input into text.

Once the speech data is in the proper format, the engine searches for the best match. It does this by taking into consideration the words and phrases it knows about, along with its knowledge of the environment in which it is operating for VoiceXML, which is the telephony environment. The knowledge of the environment. is provided in the form of an acoustic model. Once it identifies the most likely match or what was said, it returns what it recognized as a text string. Most speech engines try very hard to find a match, and are usually very "forgiving" but it is important to note that the engine is always returning it's best guess for what was said.

Acceptance and Rejection

When the recognition engine processes an utterance, it returns a result. The result can be either of two states: acceptance or rejection. An accepted utterance is one in which the engine returns recognized text. Whatever the caller says, the speech recognition engine tries very hard to match the utterances to a word or phrase in the active grammar. Sometimes the match may be poor because the caller said something that the application was not expecting, or the caller spoke indistinctly. In these cases, the speech engine returns the closest match, which might be incorrect. Some engines also return a confidence score along with the text to indicate the likelihood that the returned text is correct, not all utterances that are processed by the speech engine are accepted. Acceptance or rejection is flagged by the engine with each processed

utterance.

What software is available

There are a number of publishers of speech recognition software. New and improved versions are regularly produced and older versions are often sold at greatly reduced prices. There are two main types of speech recognition software, discrete speech and continuous speech. Discrete speech software is an older technology that requires the user to speak one-word-at-a-time. Dragon dictate classic version 3 is one example of discrete speech, as it has fewer features, is simple to train and use and will work on continuous speech software that allows the user to dictate normally, in fact, it works best when it hears complete sentences, as it interprets with more accuracy when it recognizes the context. The delivery can be varied by using short phrases and single words, following the natural pattern of speech.

What technical issues need to be considered when purchasing this system?

The latest versions of speech recognition software(sep 2001)require a Pentium 3 processor and 256MB of memory. Currently, dragon naturally speaking version 4 arid IBM via voice millennium edition . have been: used in school settings. Very good results can be obtained with these on fast, high-memory machines. When purchasing a machine, it is worth mentioning to the supplier that it will be required for running speech recognition software. Whether choosing a desktop or portable computer, it will also require a good quality duplex sound card,. Poor' sound quality will reduce the recognition accuracy. The microphones supplied with the software may be perfectly adequate, but better results can often be obtained by using a noise-canceling microphone. In addition, mobile voice recorders, allow a no of users to produce dictation that can be downloaded to the main speech recognition system, but be aware of some of the complexities for use.

How does the technology differ from other technologies?

Speech recognition systems produce written text from the users dictation, without using or with only minimal use of a traditional keyboard and mouse. This is an obvious benefit to many people who for any number of reasons do not find it easy to use a keyboard or whose spelling and literacy skills

would benefit from seeing the accurate text.

The Limitations to this type of software:

It is often set up on one machine, and so can create difficulties for a user who works from many locations, for example from school and home. It depends on the user having the desire to produce text and be able to invest the time, training and perseverance necessary to achieve it. A speech recognition system is a powerful application in that the software's recognition of the user's voice pattern and vocabulary improves with use. A useful tip is to ensure that voice files can be backed up regularly.

What factors need to be considered when using speech recognition technology?

The BectaSEN Speech Recognition Project describes the key factors to success as 'The Three Ts': Time, Technology and Training:

Time

Take time to choose the most appropriate software and hardware and match it to the user. One option for new users is to start with discrete speech software. The skills learned whilst using it can be transferred to more sophisticated speech recognition software. If the new user is unable to make effective use of discrete speech recognition software, then it is unlikely they will succeed with continuous speech software. Familiarization with the product and frequent breaks between talking are also helpful when using older computers.

Training

With speech recognition systems, both the software and the user require training. Patience and practice are required. The user needs to take· things slowly, practicing putting their thoughts into words before attempting to use the system.

Technology

The best results are generally achieved using a high-specification machine. Sound cards and microphones are a key feature for success, as is access to technical support and advice.

The Limits of Speech Recognition

To improve speech recognition applications, designers must understand acoustic memory and prosody. Continued research and development should be able to improve certain speech input,. output, and dialogue applications. Speech recognition and generation is sometimes helpful for environments that are hands-busy, eyes-busy, mobility-required, or hostile and shows promise for telephone-based services. Dictation input is increasingly accurate, but adoption outside the disabled-user community has been slow compared to visual interfaces .. Obvious physical problems include fatigue from speaking continuously and the .disruption in an office filled with people speaking. By understanding the cognitive processes surrounding human "acoustic memory" and processing, interface designers may be able to integrate speech more effectively and guide users more successfully. By appreciating the differences between human-human interaction and human-computer interaction, designers may then be able to choose appropriate applications for human use of speech with computers. The key distinction may be the rich emotional content conveyed by prosody, or the pacing, intonation, and amplitude in spoken language. The emotive aspects of prosody are potent for human-human interaction but may be disruptive for human-computer interaction. The syntactic aspects of prosody, such as rising tone for questions, are important for a system's recognition and generation of sentences.

3. Summary

Speech recognition will revolutionize the way people conduct business over the Web and will, ultimately, differentiate world- class e-businesses. VoiceXML ties speech recognition and telephony together and provides the technology with which businesses can develop and deploy voice-enabled Web solutions TODAY! These solutions can greatly expand the accessibility of Web-based self-service transactions to customers who would otherwise not have, and at the same time, leverage a business in existing Web investments. Speech recognition and VoiceXML clearly represent the next wave of the Web. It is important to consider the environment in which the speech system has to work, the grammar used by the speaker and accepted but the system, noise level, noise type, position of the microphone, and speed and manner of the user's speech are some factors that army affect the quality of speech recognition. Since, most recognition systems are speaker independent, it is necessary to train a system to recognize the dialect of each user.

4. Bibliography

* Junqua, J.-C.; Haton, J.-P. (1995), Robustness in Automatic Speech Recognition: Fundamentals and Applications, Kluwer Academic Publishers

* Davies , K.H., Biddulph, R. and Balashek, S. (1952) Automatic Speech Recognition of Spoken Digits, J. Acoust. Soc. Am. **24**(6) pp.637 – 642

* Charniak, Eugene: Introduction to artificial intelligence, Addison-Wesley, 1984.

* Christopher D. Manning, Hinrich Schütze: Foundations of Statistical Natural Language Processing, MIT Press (1999), ISBN 978-0262133609, p. xxxi

* Speech Recognition: The Complete Practical Reference Guide by Peter Foster (Author), Thomas Schalk (Author), CMP Books (July 1993). * VoiceXML: Professional Developer's Guide with CDROM [ILLUSTRATED] by Chetan Sharma and Jeff Kunins John Wiley & Sons Inc, New York

S.L.H.D:-15

TRANSLITERATION BASED SEARCH ENGINE FOR MULTILINGUAL INFORMATION ACCESS

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KEYWORDS: Multilingual, Search Engine, Transliteration, Indian languages, Unicode, Information access

ABSTRACT: Local language computing is essential for developing countries like India, as these countries are diversified by languages and this diversity of languages is the barrier for the penetration of digital revolution. This paper proposes a new methodology to build a search engine which stands on the concept of transliteration and multilingual information querying as its pillars and there by crossing the language barrier. This approach provides multilingual processing functionality for some of the real world deployments like relational database systems. It proposes a unique way of processing multilingual information with back end as English language and the front end as any local language like Kannada, Telugu, Tamil, Hindi etc. This approach mitigates the difficulty of transforming an existing infrastructure of any system to move to Indic based, with little or no extra cost. The reason being, the back end is going to stay in English itself. The front end logic leverages this transformation without any pain points. It demonstrates this approach by taking a case study of state-of-the-art bookstore application which searches for books without worrying about the language boundaries, transliteration schemes etc. It centers around the theme of building the engine based on transliteration but the approach is not inclined to or glued to one particular Indian language. The methodology has been designed with a broader scope in mind that any Indian language can be brought in and clubbed into this engine and thereby the scalability and extendibility is achieved. Using this methodology, any Indian language can be pulled as a plug-in to this engine and the Indic computing based communication can be brought to the next level.

1. INTRODUCTION:

With today's digital world, which is dominated by the tools of the grand old web 2.0 and with the emergence of web 3.0, nowadays people can stay connected with one another like never before. Web 2.0 provided many tools and applications by which people can feed in their thoughts in near real time basis on a specific subject. When different people connect, there will be communities and the communities discusses in different languages. This gets even more interesting in India, where the number of official languages is in double digits and the total number of languages spoken throughout is in triple digits. The future of computing will push all these boundaries so that people can stay connected not only with the flexibility to use their own languages but also to search for multilingual information. This paper is an attempt in that line.

A critical bottleneck for achieving this goal is displaying the multilingual information across operating systems and browsers flawlessly and creation and storage of local language contents. Storing local language content in that natural language itself is a tedious task. This paper attempts to break this idea and uses the English language itself as the persistent medium to store the local language contents. The front end logic takes care of this transformation of converting the English language statements into local language statements. By means of a case study, this paper tries to demonstrate this approach.

This paper attempts to query and process multilingual information, say English and a local language. It uses the popular train of open source for the implementation part. It also uses Open Source concepts, tools like PHP and MySQL. The significance of multilingual content is witnessed in everyday life as a survey says, currently two-thirds of Internet users are non-native English speakers [1] and it is predicted that the majority of web data will be multilingual by 2010[2].

Today the world sees the tools and applications belonging to either one of the two extremes. Either fully depends on the Global English language or the pure local language. But the content to be effectively consumed, the essence of both has to be combined. It tries to bring-in this concept and by means of a case study, demonstrates that the multilingual content can be delivered in reality by means of two proposed algorithms, query-aggregator and word-aggregator, with minimal effort.

2. DESIGN:

To demonstrate the approach a case study of a state-of-the-art bookstore application has been taken which searches for books without worrying about the language boundaries, transliteration schemes etc. Suppose that a user wants to search for a book by combining criterion such as author, category, pricing and publishing information, this paper proposes a simple methodology, which takes input as multilingual query string or primarily local language query (or a combination of multiple languages also) but returns the result in the user-specified set of languages namely English and/or Kannada, Telugu, Tamil etc, with returned tuples phonemically/semantically close to the query string.

The input, i.e. the Query string may contain keywords and/or informal-words, which are used in daily life. To convert this into computer understandable format, each word is scanned to test whether the word under study is a keyword or not, by looking it into the common-word-table. It will not only take care about the keywords but also fetches which language the word belongs to. If it is a commonly used word, it is removed from the search sentence. The 'Query-Aggregator algorithm' discussed below, follows a mechanism wherein

the keywords form a group in such a way that a query will be formulated and can be applied to the master database

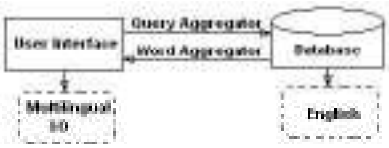


Fig.1. Execution environment of Multilingual Querying and Information Processing

The design of the methodology is such that the database information will be stored in character-based foreign language, namely English. The local language is glyphs-based. To map the two, 'Word-Aggregator algorithm' is used, as there is no one-to-one mapping between English and Indian languages. By the concept of Backtracking, the letters of local language are being formed from the foreign language words. The letter formed is searched in the Phonetics-based-Unicode [3] database, which is an architecture neutral flat file. The combination of backtracking and searching makes the word-aggregator algorithm to display the local language content.

3. IMPLEMENTATION STRATEGY: The case study of this implementation is web oriented and hypertext markup language is used as core part. The underlying mechanism, Unicode, which is in hex format, is not applicable to hypertext markup language. For this we have a mapping table, called Unicode-mapping-table that stores the four digit decimal equivalent of all Unicode characters. For searching multilingual information, there exists two methodologies, one is based on Phonemes and another is based on semantic matching. For the first kind namely multilingual phonemic matching, which is matching text strings based on their phonetic equivalence,[4] the Unicode-mapping-table is used. Example of this kind is name of authors and publisher names, which does not involve any translating functionality.

For the later kind namely multilingual Semantic matching, which is matching text strings based on their generalized meanings, irrespective of languages [5], the local language names are mapped to the global English language words and then the searching is done by means of proposed Query-Aggregator algorithm. For example, the English language word 'we' will be translated into 'hum' in Hindi or 'namadhu' in Tamil language.

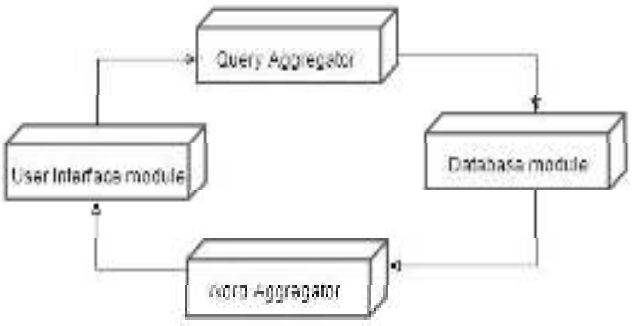


Fig.2 Modules involved in the Implementation strategy

The various modules involved in the implementation strategy are shown in Figure 2. The user interface module is the initial module and the search is being requested by means of available kinds (i.e.) with respect to author, title, category, publisher, price, advanced search, search engine or translator engine. The User Interface module has the provision to key-in multilingual content in a single text box. The input can be given from three ways. (1) The drop-down box having commonly used words, selected categories and author names of local language content, (2) the built-in local language keypad and (3) the ordinary keyboard.

3.1. QUERY AGGREGATOR: The multilingual query contains both languages. The Query-Aggregator module, shown in Figure 3, applied in this environment scans through each word in the query string and transforms the multilingual statement into a database understandable query by checking each word, whether a keyword or not by looking onto the common-word-table in the database

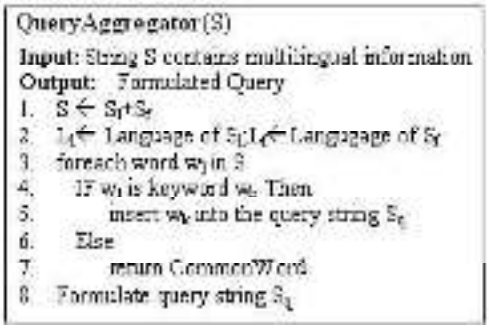


Fig.3. Query - Aggregator Algorithm

The multilingual query string can be converted into local language words using other standard linguistic resources also, such as WordNet. [6].The database module is responsible for the following sequence of operations.

1. The formulated query from the Query-aggregator module is given to the database.
2. The required fields to be displayed from the result set are chosen.
3. A result table is created based on the query and the required fields.

3.2. WORD AGGREGATOR: The strategy for matching multilingual data based on Phonemes is shown in Figure 4. To achieve the Phonetic mapping, Backtracking and Searching concepts are used. First, from the foreign language word, maximum number of possible characters is grouped to form a sub word and they are given a Backtracking criterion. The sub word is matched with the Unicode-mapping-table and if found, the equivalent Unicode character sequence is replaced in the output. Else it is omitted as a common word.

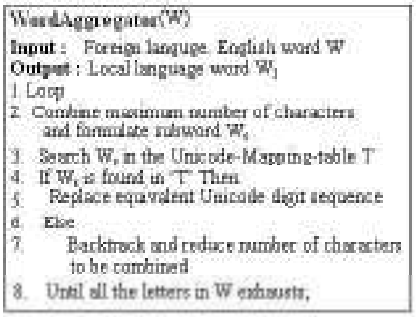

WordAggregator(W)
Input : Foreign language English word W
Output : Local language word W_l
1. Loop
2. Combine maximum number of characters and formulate subword W_s
3. Search W_s in the Unicode-Mapping-table T
4. If W_s is found in 'T' Then
5. Replace equivalent Unicode digit sequence
6. Else
7. Backtrack and reduce number of characters to be combined
8. Until all the letters in W exhausts;

Fig.4. Word-Aggregator Algorithm

The performance of this matching can further be enhanced using the classic Soundex algorithm or by adopting q-gram techniques [7]. The matching algorithm and its performance are discussed by A.Kumaran et al. [8]. The other approaches for Phonemic matching strategy are using International Phonetic Alphabet (IPA). The IPA phoneme strings are also stored in the Unicode encoding format, as specified by the Unicode Consortium, using basic Latin and IPA supplement code characters.

When in the final stage, i.e, the report module or the User Interface module, each row of the result-table is checked to see, in which language the output is to be displayed. If it is foreign language, it directly publishes the row information. On the other hand, if it is local language, the word aggregator module is called to display the information in the local language. The final output information can be copied into a storage place like WordPad etc. or they can be pasted in the text field of the E Mail to transfer it over the Internet.

3.3. PERFORMANCE ISSUES: Since this paper's back-end-database is in English, the reported slowness in comparison with standard Latin based scripts will not cause any adverse effect on the performance. Since the storage, querying etc. like database operations solely rely on English, this implementation will be on par with the monolingual- English -database operations' performance.

4. CONCLUSION: This paper proposes an architecture for processing multilingual data transparently across natural languages with the focus being given to Indian languages by using the concept of search engines. It also comes close to the traditional information processing platforms, such as relational database management systems. A survey on the functionality and performance of the current systems indicate that they fall short of the requirements on several counts,[9] motivating further research on multilingual systems.

From the functionality perspective, the proposed two algorithms, Query-Aggregator and Word-Aggregator work with the Semantic and Phonemic domains respectively. Thus the paper's case study on processing multilingual querying and displaying the result is achieved in a very minimal amount of time.

From the efficiency perspective, since the database and its related operations only involves English, the paper's Unicode [10] based multilingual querying will be more like ASCII querying only. The rest of the mapping is done by means of the above-discussed modules effectively.

This paper intends to address the problems related to accessibility and publication of content in local Indian languages. As previously mentioned, the algorithms have been designed with a broad range of scopes so that it can support any Indian language as when it is needed. Through this concept, the paper intends to make computing and Internet be habitually accessible to everyone in India. By following this sort of approaches, in future, digital communication in India will grow to a level wherein, exchanging the information by translation among the Indian languages and also using the speech related material will be possible.

References:

1.http://www.nua.ie/surveys

2.http://www.unicode.org

3. J. Zobel and P. Dart. Phonetic string matching: Lessons from information
retrieval. In Proc.of 19th ACM SIGIR Conf., Zurich, Switzerland, 1996.

4. G Apama, G L Jayavardhana Rama and A G Ramakrishnan. "Machine reading of Tamil Books - An aid for the blind". Proc. Biovision 2001, IISc, Bangalore

5.ISO/IEC 8859 Information Processing - 8bit Single-Byte Graphic Coded Character Sets. lSO/lEC 8859-15,1999

6.D.E.Knuth, The Art of Computer Programming (vol:3 Sorting and Searching) Addison-Wesley, Reading, Massachusetts, United States, 2nd Edition,1999

7.A.Kumaran and J.R.Haritsa. On the costs of multilingualism in database systems. In Proc. of the 29th VLDB Conf., Berlin, Germany,2003

8.A.Kumaran. MIRA: Multilingual Information processing on Relational Architecture, Dept. of Computer Science and Automation, Indian Institute of Science, Bangalore,2003

9. http://www.multilingual.com

10. M. Davis. Unicode Consortium Technical Report, 2001.

S.L.H.D:-16

DEVELOPING PROTOCOL TO ENHANCE WORD RETRIEVAL ABILITY USING COMPONENTIAL ANALYSIS FOR INDIVIDUALS WITH APHASIA

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INTRODUCTION: Aphasia therapy has always seen a challenging affair for the speech language pathologist. This is mainly because of the varied nature of the disorder itself. Aphasia manifest as an impairment of all or selected parameters of language. The symptomatology varies with the site of lesion. However no two aphasic individuals, diagnosed as suffering from similar subtype of aphasia, exhibit an identical symptom profile. So accordingly, the rehabilitation process has to be modified to suit the needs of a particular client. Various therapy techniques have been devised over the years for the treatment of specific impairment in the parameters of the language.

The ability to refer to objects by names may be at the root of human language development, in Phylogeny as well as in Ontogeny (Terrace, 1985). Yet, naming is a relatively straight forward cognitive operation, whose outlines are well understood. Naming uses only a limited number of cognitive processing stages and the nature of these stages are fairly well known. Naming difficulties result from impairment at different stages of the naming process: decoding, storage, selection, retrieval or encoding.

The terms "word retrieval" and "word finding" refers to the processes involved in mentally identifying and then producing the word or the words needed to express a thought or name an object. A word retrieval problem represents temporary difficulty gaining access to and retrieving a known and understood word. It is also referred as "Dysnomia/anomia", a common deficit which all aphasic patients demonstrate. Anomia has been described as "the most consistent feature of aphasia" (Davis, 2000) because virtually all people with aphasia experience word finding problems. Their prevalence and affect on communication make them a natural target for treatment. Word retrieval difficulties restrict the participation of individuals with aphasia in most meaningful communication activities, particularly conversation (Goodglass and Winfield, 1997).

There are several treatment approaches which have been employed to aid aphasic individuals in word retrieval. Consequently, a variety of interventions have been developed to improve word retrieval of individuals with aphasia (Nickels and Best, 1996). Speech language pathologists teach many successful strategies that help individuals with word finding difficulties.

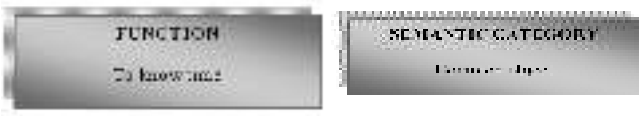
According to componential analysis or semantic feature analysis complex meaning can be made out of combination of simple ones (called as semantic feature). Semantic feature analysis (SFA) was developed by Haarbauer and Krupa, 1985. SFA is a treatment approach which is thought to improve the retrieval of conceptual information accessing semantic networks (Boyle and Coelho, 1995). In this technique the patient is encouraged to produce words semantically related to the target word (e.g. listing its: group, use, action, properties, location and association). By activating the semantic network surrounding the target word, that word may be activated above its threshold thereby facilitating retrieval. According to the spreading activation theory of semantic processing (Collins and Loftus, 1975), by activating the semantic network surrounding the target, the target itself may be activated above its 'threshold' level, increasing the probability that its name can be retrieved. Boyle and Coelho (1995) investigated whether SFA would be successful for individual with word retrieval deficits secondary to aphasia.

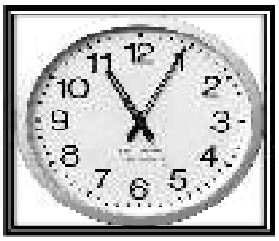
Theoretically, SFA improves word retrieval by strengthening the connections between the target word and its semantic network, raising the word's threshold for being retrieved, or possibly repairing a damaged semantic system (Boyle, 2001; Coelho, 1995; Hillis, 1989; Maher and Raymer, 2004). According to authors SFA training improves word retrieval of individuals with aphasia, with good generalization to untrained items and maintenance. It is unclear whether it improves discourse. The effect of SFA intervention is also reflected in an increase in communicative efficiency (i.e. an increase in the proportion of CIUs to total words produced).

NEED FOR THE STUDY: Though the history of aphasia treatment is long, the literature mostly refers to the western culture and English language. The content relevancy has a strong impact on communication abilities (Longerich and Bordeaux, 1954). The vast differences in the cultures and the language differences make it impossible to implement the therapy techniques directly in the clinical situations. But no substantial work has been done in Indian context. There is a dearth of training material in Indian languages. Although earlier researchers have proved remarkable improvement using componential analysis in aphasics, no standardized tool has been developed addressing the need of aphasics. This study attempts to provide guidelines for speech language pathologists to implement componential analysis in remediation of word retrieval difficulty for aphasics. Thus the present protocol in Hindi is an attempt to develop remediation strategy of word retrieval deficit in all aphasics which can provide readymade material to the clinician and care givers.

METHOD : The protocol was developed in Hindi which consists of nine lexical categories, 20 words in each category. These words were given to ten judges for rating their familiarity. The judges were native Hindi speaker and proficient in Hindi. A three point rating scale was used as mentioned be

low:
0= least familiar
1= familiar
2= most familiar
The judges were asked to rate the words using this scale.
Forty five words were rated as "familiar" and "most familiar" which included five words in each category and these words were used in the protocol.
The words were decomposed into smaller units (semantic feature) in terms of their "function", "description" and "semantic category" and arranged in a **semantic feature chart** as follows:
For example:
CLOCK





The above mentioned semantic features **(SF)** were arranged in a **grid** for each category individually which is as follows:

	Living	Common object	round	breakable	time	education
Clock	-	+	+	+	+	-
Book	-	+	-	-	-	+
Pen	-	+	-	+	-	+

+ = 'presence of semantic feature'
- = 'absence of semantic feature'
* = 'not applicable'

PROCEDURE: Following steps can be followed while using SFA for the treatment of individuals with aphasia. A picture presented in the centre of feature analysis chart and naming response will be requested.

1. If the patient is not able to name the picture then he/she will be guided to verbalize the semantic features of each target with the aid of the **semantic feature analysis chart** and **grid** filled by the clinician.

2. If the patient is still **unable to name** the picture after all features are written on the chart, then the clinician names **aloud** and patients will be asked to **repeat** it. Later on, a review of all its features will be done by the clinician.

3. If the patient is able to **name** the target word after few semantic features then, also to establish and encourage use of this technique, all features will be produced for all pictures (even for those that patient had named on initial conversation or those that he named during semantic feature production).

4. If the patient is able to name the picture then he/she will be asked to say the semantic features of the target picture to establish and encourage use of this technique. The clinician will write the appropriate semantic feature in the chart and grid after the patient responds correctly.

These steps are arranged in a hierarchical order of increasing cues or assistance. According to different author cueing hierarchies improves naming (Linebaugh and Lehner 1977, Pease and Goodglass 1978, Thompson and Kearns 1981). These have been adopted because the systematic presentation of carefully selected cues is fundamental in aphasia treatment (Rosenbek *et al*. 1989).

RESULTS

Semantic feature analysis and grid was developed for various categories, which included nine lexical categories. Each lexical category included five words, a total number of 45 words were analyzed using semantic feature analysis. Which are as follows:

1. Vehicles
» Car »Scooter
» Train » cycle
» Truck
2. Furniture
» Cupboard » Table
» Bed »Stool
» Chair
3. Electronic items
» Fridge » Fan
» Bulb » telephone
» Television
4. Utensils
» Knife » Pressure cooker
» Glass » spoon
» Plate
5. Vegetables
» Potato » Lemon
» Onion » tomato
» Peas
6. Fruits
» Grapes » Banana
» Mango » Pomegranate
» Apple
7. Eatables
» Roti » Bread
» Milk » Egg
» Rice

8. Animals
» Dog » Snake
» Lion » Cow
» Monkey
9. Professionals
» Postman » Priest
» Police » Teacher
» Doctor

Semantic feature analysis was carried out in Hindi. Further phonemic transcription and English translation of material was done for better understanding by everyone. This material is attached as an **appendix-1.**

CONCLUSION: The present protocol is designed to improve word retrieval ability in aphasics using SFA. This protocol is developed in Hindi consisting of nine lexical categories. Words were selected based on their familiarity. These words were further analyzed into simpler units in terms of their "function", "description" and "semantic category" and arranged in a **semantic feature chart and grid.**

Scope of the protocol: The manual can be used by trained speech language pathologist and student clinicians. Further, the clinicians can easily modify the training material according to the individual patient's needs. It is expected that the present protocol will also be helpful for care givers of patients with aphasia. Further research is required to carry out SFA for other lexical categories and in other Indian languages.

Limitations:

The protocol has not been administered on the clients due to time constrains. Hence efficacy of the protocol needs to be looked up on.

REFERENCES:

Benton, A.L., Smith, K.C., and Lang, M., (1972). stimulus characteristics and object naming in aphasic patients. Journal of communication disorders.5,

Boyle, M., and Coelho, C. A. (1995). Application of semantic feature analysis as a treatment for aphasic Dysnomia. *American Journal of Speech- Language pathology*, 4 (4), 94-98.

Boyle, M., (2001). Semantic feature analysis: the evidence for treating lexical impairments in aphasia. *Neurophysiology and Neurogenic Speech and language Disorders*, 11(2), 23-28.

Davis, G. A. (2000). *Aphasiology: Disorders and clinical practice*. Boston: Allyn & Bacon.

Goodglass, H. and Wingfield, A., (1997). *Anomia: Neuroanatomical and cognitive correlates*. San Diego, CA: Academic Press.

Haarbauer-Krupa, J., Moser, L., Smith, Sullivan, D. M., and Szekeres, S. F. (1985). Cognitive rehabilitation therapy: Middle stages of recovery. In M. Ylvisaker (Ed.), *Head injury rehabilitation: Children and adolescents* (pp. 287-310). San Diego, CA: College- Hill Press.

Linebaugh, C. W. and Lehner, L. H. 1977. Cueing hierarchies and word retrieval : a therapy program. In, R. H. Brookshire (Ed.) *Proceedings of the Clinical Aphasiology Conference* (Minneapolis : BRK Pub), pp. 248±260.

Longerich, M.C. and Bordeaux, (1954). *Aphasia Therapeutics*. New York: The Macmillan Company.

Maher, L. M., and Raymer, A. M. (2004). Management of anomia. *Topics in Stroke Rehabilitation*, 11, 10-21.

Nickels, L. and Best, W., (1996a). Therapy for naming deficits (Parts 1). Principles, puzzles and progress. *Aphasiology*, 10, 21-47.

Nickels, L. and Best, W., (1996b). Therapy for naming deficits (Parts 2). Principles, puzzles and progress. *Aphasiology*, 10, 21-47.

Pease, D. and Goodglass, H. 1978. The effects of cueing on picture naming in aphasia. *Cortex*, **14**, 178±189.

Rosenbeck, J. C., LaPointe, L. L. and Wertz, R. T. 1989. *Aphasia*, *A Clinical Approach* (Boston: College-Hill).

Thompson, C. K. and Kearns, K. D. 1981. An experimental analysis of acquisition, generalization, and maintenance of naming behaviour of a patient with anomia. In, R. H. Brookshire (Ed.) *Proceedings of the Clinical Aphasiology Conference* (Minneapolis : BRK Pub), pp. 35±45.

S.L.H.D:-17

PARENTAL AWARENESS OF THEIR CHILDREN'S COMMUNICATIVE BEHAVIOUR: A SURVEY IN MYSORE CITY

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Introduction: Among the many developmental phenomena of young children, the development of speech and language may be considered as one of the most impressive accomplishments because language is a unique human possession which helps us to connect with the external world. From a baby's first cries to his future verbal expression every skill would contribute to his/ her success in life in terms of academic, vocational and social life. This process of development of speech and language may vary amongst children. However, a natural progression or "timetable" for mastery of skills for each of the component of language termed as 'milestones' is most often universal. The milestones are identifiable skills that can serve as a guide to normal development. Typically, simple skills need to be acquired before the more complex skills for which a general age and time for its acquisition. Majority of children pass through these periods wherein beginning signs of communication occur during the first few days of life when an infant learns that a cry will bring food, comfort, and companionship. Research has shown that

by six months of age, most children recognize the basic sounds of their native language. Even before they can talk, babies as young as 8 months are beginning to indicate some of their wants and needs to parents (reaching for or pointing to a cookie, giving mummy the book). The language skills of children continue to develop and refine throughout the school years.

Research carried out on child speech and language maturation reveals that the most intensive period of speech and language development for humans is during the first three years of life, a period when the brain is developing and maturing. There is increasing evidence suggesting that there are "critical periods" for speech and language development in infants and young children. This means that the developing brain is best able to absorb a language, during this period. The ability to learn a language will be more difficult, and perhaps less efficient, if these critical periods are allowed to pass without early exposure to a language. In some children, this complex business of language learning does not progress so smoothly wherein children are likely to show instances of atypical development in their communication behavior and in such instances, the prime individuals involved in the identification would be the parents themselves since they know their child better than others. It is important for the parents-the mother and the father of the child- to pay attention to the child's language development and to keep a note on the developmental pattern of their child. The sooner they identify the better it is for the early intervention purpose. But how much do parents actually know about children and their development remains a question in itself. This becomes more important when it comes to Indian families because in the Indian scenario the community consists of male dominated families wherein man in the family takes up the responsibilities of the members and supports the family on a whole but when it comes to parenting and child rearing it is the mother who carries the responsibility of the child and plays a major role in the up bringing of the child. A study carried out by Dessen, and Braz (2000) on the Brazilian population reveals that Mothers have traditionally assumed primary responsibility for early childcare and participate in child rearing activities more frequently than fathers although fathers offered support for mothers. Hoffman (2003) also stated that the mothers assumed the principal responsibility for household and child rearing activities.

Culture and parenting: In the literature, the issue of parental knowledge about child development is raised often within the context of parent child interaction and the parenting knowledge. Studies of parenting knowledge in themselves cover many domains. In an extensive review Bornstein, Hahn, Suizzo,Cote, and Haynes (2005) identified three main domains of knowledge:

1) Knowledge about child development (i.e.,knowledge about basic child requirements, abilities, and accomplishments as well as expectations about when a child will achieve a particular developmental skill)

2) Knowledge about health and safety and,

3) Knowledge about strategies to meet the physical, biological, socioemotional, and cognitive needs of children as they develop Parenting knowledge has been conceptualized in part as a product of personal experience with children and in part as a product of social interactions (Goodnow, 1995; McGillicuddy-De Lisi, & Sigel, 1995). Ecological views (e.g., Bronfenbrenner, 1986; Harkness, & Super, 1994,1995)

The parenting knowledge regarding child's speech and language developmental milestones has been suggested to be a prerequisite for appropriate understanding and expectations from the child. When parents lack this basic knowledge, their expectations toward children are often unrealistic, which in turn may contribute to detrimental effects in children.. A survey conducted by Paradis (2005) involved parents of young children, who had just watched their kids go through the normal development in which they had to answer a questionnaire. The parents were asked 11 questions designed to test their knowledge of a baby's development and the results revealed that one-third of the parents of babies had a surprisingly low knowledge of child development.

A majority of the studies concerning knowledge of child development have focused on adolescents and young adults. Research has found that urban adolescents have inadequate knowledge of child health and development as revealed by the study done by Showers, and Johnson, (1985). Study conducted by Shaner, Peterson, Roscoe (1985) reported that the knowledge of normal development in children is both over and underestimated by older adolescent females .Other researchers have looked at the knowledge base of fairly specific population groups such as married adolescents (Lissovoy 1973) black grandmothers and black adolescent mothers (Stevens,1984), black and white mothers of various socioeconomic status (Stevens 1984), and parents of clinic and non clinic referred children (Richard, Graziano and Forehand,1984) . Overall, the studies suggest that individuals lacked knowledge about child development and had unrealistic expectations of their children.

Research focusing on males have indicated that there is a considerable body of knowledge that fathers do not have adequate knowledge about child development (Kliman and Vukelich, 1985), and urban adolescent males are less knowledgeable than their female counterparts(Showers and Johnson,1985). Although all the male subjects indicated that it is important to be informed about child development, they appear to be less informed and less knowledgeable regarding child development, based on the results Earhart (1980) emphasized the need for the attention of professionals in the field. Because many of these adults, especially males, are not receiving adequate information, it was suggested that child

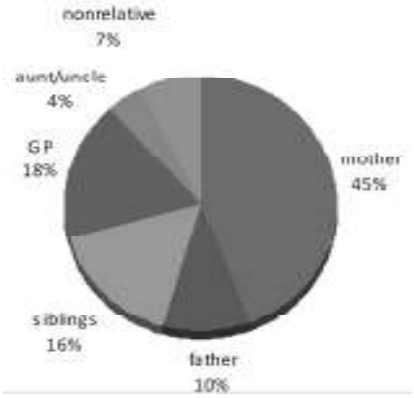
development and parenting courses need to be integrated in the curriculum at the high school level in rural areas and be required for both men and women as these courses would help as a means of preparing adults to become "effective family members and parents".

In the Philippines, Williams, Williams, Lopez, and Tayko (2000) examined expectations about children's development and childrearing practices in rural and urban mothers. In general, urban mothers and mothers with more education had higher developmental expectations (e.g., believed that children start to sit or to talk earlier) Accordingly, mothers with higher expectations also reported implementing earlier a variety of specific childrearing practices (e.g., talking to the baby, telling stories, reading the first book, introducing solid foods, teaching cognitive skills like color names).

Gender difference in parenting knowledge: Research focusing on males have indicated that there is a considerable body of literature to state that the fathers do not have adequate knowledge about child development (Kliman, & Vukelich 1985), and urban adolescent males are less knowledgeable than their female counterparts(Showers,& Johnson,1985). Although all the male subjects indicated that it is important to be informed about child development, they appear to be less informed and less knowledgeable regarding child development. Based on the results obtained . Earhart 1980 in his paper has emphasized the need for the attention of professionals in the field. Because many of these adults, especially males, are not receiving adequate information, and it has been suggested that child development and parenting courses need to be integrated in the curriculum at the high school level in rural areas and be required for both men and women. As these courses would help as a means of preparing adults to become "effective family members and parents" .The findings also reported that adults with children were more knowledgeable about child development than those without children, The results clearly indicate that these adults do not have a great deal of knowledge about child development norms.

A study conducted by Ribas and Bornstein (2005) compared the Parenting knowledge its similarities and differences in Brazilian mothers and fathers and they reported that the average knowledge score obtained by mothers was significantly greater than the average score obtained by fathers, and also the mothers and fathers in the same family were correlated in their parenting knowledge. For mothers, education and child age predicted knowledge score, but for fathers only education predicted knowledge score. It is also reported that the educational attainment in mothers and fathers played a significant r

ole in parenting knowledge. It is observed that generally males are less important care takers than the female.(i.e. mothers are more important than fathers, aunts are more important than uncles, sisters are more important Than brothers etc.



Graph 1 : Pie chart illustrating the proportion of care interaction that children aged 0-4 years spend with different categories of kin.(Source: Flinn.M.V.,1988, pp.)

Mothers have higher proportion of interaction with offspring during infancy (10-12 months) than father .this sex difference in paternal care is reduced , but still substantial during early childhood. It was also reported that the fathers interact slightly more with adolescent and adult offspring than with infants and pre adolescents. The higher rates of mother- offspring interaction during 0- 5 age category reflects the fact that mothers are usually much more important than fathers in day-to- day care of infants and children of both sexes. A study conducted by Bumpus (1999) reveals that fathers work demands were related to lower levels of parental knowledge, that is the high paternal work demands, were associated with lower levels of parental knowledge.

Cultural differences in parenting by father: In both Asian American and Asian families there is a general finding on the characterization of father's role in the family. That is the strong commitment to the bread winner role for the family and this has resulted in men's limited involvement with the care for the children compared to other countries.(Ishii-Kutz 2000). Compared to the other cultures, Japanese fathers are less involved with their children than the other countries. That is the Japanese fathers according to 1994 survey; spend 3.8 hours per day with their young children. (3 years or younger). Compared to the fathers in other countries like , United states, Korea, Thailand. In a survey conducted by Miwa 1995 over 90% of fifth graders, saw outside work as father's primary responsibility while over 80% viewed mothers as best suited to be the primary care givers. A low level of father's involvement have been reported for Chinese families (Jankowiak 1992) as well as in Taiwanese families (Sun & Roopnarine1996) they were less involved in child care with their infants than the European or American fathers and in china fathers were viewed as not sufficiently competent and trustworthy to care for infants. Shek (2000) found that Chinese adolescents perceived maternal parenting as being positive than the paternal parenting. However, Shii Kutz(2000) notes that, the centrality of men's role among Japanese . In fathers is changing. In a recent study 81% of Japanese fathers ranked the parental

role as first important among five parental roles.

Socio- economic status and parenting knowledge: In Israel, Ninio (1979) reported that mothers of low socioeconomic status (SES) and low educational level (EL) believed that children acquire basic cognitive skills (e.g., vision, hearing, and speech comprehension) at a later age than high SES and EL mothers. In the same direction, he also reported that low SES and EL mothers believed that the introduction of certain cognitively stimulating activities (e.g., start talking to the baby, start telling stories, start talking of absent objects, buy first book) should occur later than did high SES and EL mothers.

Educational level and parenting knowledge: In the Philippines,Williams, Williams, Lopez, and Tayko(2000) examined expectations about children's development and childrearing practices in rural and urban mothers. In general, urban mothers and mothers with more education had higher developmental expectations (e.g., believed that children start to sit or to talk earlier) Accordingly, mothers with higher expectations also reported implementing earlier a variety of specific childrearing practices (e.g., talking to the baby, telling stories, reading the first book, introducing solid foods, teaching cognitive skills like color names).

Benasich and Brooks-Gunn (1996) examined the effects of maternal knowledge concerning child development and childrearing on the quality of home environment and on child cognitive and behavior outcomes in a longitudinal study of a low-birth-weight, preterm cohort. They employed several questionnaires to evaluate maternal knowledge, including items extracted from the Knowledge of Infant Development Inventory (KIDI, MacPhee, 1981). They found that maternal knowledge about children's development and childrearing significantly affected the quality children's cognitive and behavioral outcomes. Bornstein (2005) carried out a study which targeted mothers' knowledge about children's development and child rearing, where mothers obtain their knowledge, and what factors principally influence the amount and accuracy of that knowledge. The study was conducted over different groups, the first group of 1331 U.S. mothers participated, and their age, education, and access to written materials contributed to higher scores. adult mothers scored higher than adolescent mothers, and mothers improved in their knowledge of parenting from their first to their second child. The second group included 252 mothers representing six additional countries: Argentina, Belgium, France, Israel, Italy, and Japan. U.S., Israeli, and Belgian mothers scored highest in parenting knowledge. Moreover, written materials and attendance at childbirth classes contributed to parenting knowledge. This study supports the view that educational attainment is a principal indicator of parenting knowledge. In general, evidence suggests that one of the best strategies to improve parenting knowledge is to improve parent's education.

. Bullock (1998) studied the differences between rural parents and non-parents knowledge about child. 249 men and women with and without children participated in the study and their responses for the questionnaire regarding the child development was compared. The results indicated that adults' knowledge in general was limited. The women and parents with children scored higher on the child development measures than men, with or without children. This suggests that the parenting experience influences the level of knowledge in the individual.

A survey conducted by Association for all Speech Impaired Children (AFASIC) in 1993 revealed that there is an inadequate knowledge amongst the parents about the development of communication skills especially during the stage of infancy. The survey reported that the first sign was noticed by the parents in 83% of cases before intelligible speech is expected that is to say from birth to approximately 18 months. The signs included no infant babbling, baby did not cry, constant crying, child silent/withdrawn. However despite early recognition 2 out of 3 children received help depending on the extent to which parents recognize early signs of communication difficulty and wait for several months and years to express their concern. This reveals their lack of knowledge about the need for early identification.

Therefore the importance of parental knowledge of child development and the difference in the parenting knowledge within fathers and mothers has been noted as a strong theme in the literature. The present study examines the parental awareness on child development with reference to communication behavior. in parents of toddlers.

Aim : 1) To check the parental knowledge regarding the child's communicative behavior.

2) To examine the difference between the fathers and the mothers, if any, regarding their knowledge about the child's communicative behavior.

Method : A survey was designed to find out the parental awareness on the speech and language developmental milestones of their children. For this purpose a questionnaire was designed by incorporating items related to the speech and language development of children from zero to five years. The age group was divided by 3 months and each group consisted of a set of questions. The questions that were included in the questionnaire were taken with the reference to the questions from the checklist "Check your child for communication disorders" developed by the department of Prevention of Communication Disorders, at All India Institute of Speech and Hearing, Mysore (2002). The questions were of yes/no type where in the participant had to choose 'yes' or 'no' as the answer. The questionnaire was distributed among forty parents, that is both mothers and fathers of the same family of the typically developing children. The subjects who participated in the study were selected on a random basis from three different preschools in and around Mysore city.

Subject selection criteria: The criteria to choose the parents were,

1) The Parents who had only one child at the time of survey were taken up for the study
2) All the participants were matched for their qualification that is they were graduates
3) the participants were matched for their socio economic status.
4) All of the participants were staying in the urban city

Out of the eighty questionnaires that were distributed sixty responses were obtained (75%). And the responses were subjected to appropriate statistical analysis by scoring 1 for each right answer and zero for the wrong answer. The mean scores were calculated to find the differences within the parents regarding their knowledge about their child's milestones. Further, Independent- t test was carried out to check for the level of significance.

Results and Discussion: The aim of the study was to find out the parental (mother and father) knowledge about their children's communicative behaviour. The mean and standard deviation was extracted for the two groups that is both for fathers and mothers for each of the age group. Table1 shows the overall mean scores of responses to questionnaire on parental awareness of their child's communicative behavior. The mean scores of mothers are greater than that of the fathers. The higher mean scores obtained by the mothers reveals that the mothers have a relatively greater knowledge about the child's communicative behaviour. Further, independent t-test was administered to find out the significant differences between the parental knowledge in each of the age group. The results reveal that a significant difference was obtained in the age group 0-3 months [t (60) =0.30, p<0.05], 4-7 months [t (24) =0.04, p<0.05] and ,7-1 year [t (60) =0.00, p<0.05] and 4-5 years [t (60) =0.00, p<0.05]

Age group	Fathers		Mothers		t-value
	Mean	SD	Mean	SD	
0-3 mths	3.30	0.74	3.70	0.69	0.03*
4-6 mths	3.03	0.61	3.54	0.72	0.04*
7-1yrs	1.93	0.25	2.48	0.72	0.00*
1-2 yrs	3.96	0.80	4.25	0.85	0.17
2-3yrs	5.60	0.85	5.80	1.30	0.46
3-4yrs	5.10	1.47	5.06	1.50	0.92
4-5yrs	2.10	0.99	3.29	0.46	0.00*

[*p < 0.05] Table 1: Mean , SD and t-values for responses of mothers and fathers.

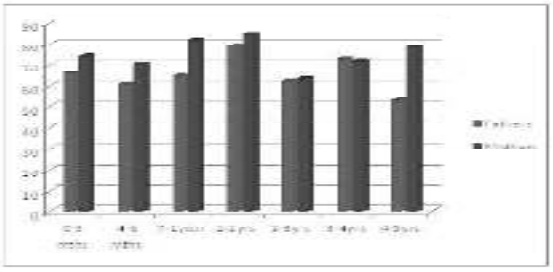


Figure 2: Mean percentage scores on the questionnaire

Figure 2 reveals that the mean percentage scores of the mothers is higher than the mean percentage scores of fathers in all the age groups. It is also observed that the fathers have less than 75 percent knowledge about the overall developmental milestones. And have lower knowledge about the initial stages of the child development that is 0 to 1 year which is the most crucial stage for the early identification of any speech and language delay or deviations. The mothers have scored relatively better scores than the fathers. The overall percentage score of both the mothers and fathers is less than 85 percent and in most of the age groups it is less than 60 thus indicating that parents do not have a complete knowledge about child's communicative behaviour. This finding is supported by studies done by (Showers & Johnson, 1985; Shaner, Peterson, Roscoe, 1985; Lissovoy, 1973; Stevens,1984; Richard , Graziano, & Forehand,1984) in which their findings suggested that individuals lacked knowledge about child development and had unrealistic expectations of their children.

In the present study it can be observed that the father's knowledge is significantly less during the early infancy period and during the school going age of the child. Whereas, in between that is from the age of one to four years the knowledge is approximately closer to that of the mother. This can be attributed to the reason being one to four years can be considered as a enjoyable period where in the child is more verbal and gives pleasure to the parents and in turn the parents also enjoy interacting with the child. Whereas during the early infancy period and the later school age the mother plays the major role in taking up the responsibility of the child. It is evident from the present study that there is a gender difference within the parental knowledge where in the mothers have a better knowledge when compared to the fathers regarding the child's communicative behavior. Similar observations have been made by several authors in their research studies where in it has been indicated that fathers do not have adequate knowledge about child development (Kliman, & Vukelich 1985). The results of the present study correlates with (Showers and Johnson,1985). The results of the present study also correlates with the findings of Ribas and Bornstein (2005) wherein they reported that the average knowledge score obtained by mothers was significantly greater than the average score obtained by fathers. The reason for the mothers being more knowledgeable than the fathers may have been because of their educational background and their parenting experience whereas for the fathers it is only the education which predicts their knowledge scores. The age of the parents, their educational level, the access to information and their socio-economic status also may have been an indicator for the scores obtained by the parents in the present study. The parents in the present study were of the urban population and this has been a contributing factor in their knowledge about child development .Williams, Williams, Lopez, and Tayko (2000) revealed that urban mothers and mothers with high education had higher developmental expectations and

incorporate earlier child rearing strategies. The reason behind the better scores of the mothers can also be explained due to their experience in child rearing. Traditionally, Indian mothers have been taking up the primary responsibility for early childcare and participate in child rearing activities more frequently than fathers and they put in the time and attention required right from giving birth and nursing the children when compared to the fathers, also the father's stress and professional work demands can be related to their lower parental knowledge which is also reported by Bumpus (1999).

As parents are the clinician's primary sources of outside information about the child, Mothers and fathers are usually asked for their expectations, opinions, and concerns about their children's health and development during visits to clinicians and other health practitioners. The quality of clinical evaluations and the efficacy of clinical recommendations can be significantly improved when parental knowledge and expectations are taken into account. Therefore, these findings also suggest that a need exists for sensitization of child development and parenting programs for both parents and prospective parent group and this requirement is more in both urban and rural isolated areas. This would require creative and collaborative efforts among professionals like the gynecologists and the pediatricians etc. involved in the field. It may be through developing telecommunication programs, video and resource lending libraries, as well as on-site programs in local communities. Such services and opportunities have the potential to meet an extremely important preventive health need for rural parents and children, and potential parents. Although many parents do learn through experience, it appears that many adults could benefit from acquiring knowledge and skills to assist in more responsible parental knowledge.

The appendix provides information about the normal speech and language development of children from zero to five years which is a checklist developed as a part of a project conducted in All India Institute of speech and hearing. This checklist has been standardized on the Indian population (Kannada speaking children).

Conclusion: The present study aimed at finding the level of parental knowledge about the child's communicative behavior. And the difference within the mothers and fathers was also studied. The overall results indicated that

1) The parents did not have a complete knowledge about the child's communicative behaviors and significantly lacked knowledge in certain age groups.

2) A significant difference amongst the mothers and fathers regarding their level of knowledge was observed.

It can be inferred from the findings that there is a great need in creating awareness among the parents regarding the speech and language development and the communicative behaviours of children.

Implications of the study: The results of the study emphasize the importance of the parental knowledge about the child's communicative behaviour. The study also emphasizes the need for enhancing the knowledge of fathers regarding their involvement in parenting and be informed about the child's normal communicative behaviour.

The study generates a new direction to the outreach program of speech language pathologists and audiologists to dissipate knowledge among the public and create public awareness regarding the child speech and language development because many of these adults, prospective parents and parents themselves especially males, are not receiving adequate information.

It emphasizes on the role of parents in prevention, early identification and early rehabilitation of speech and language disorders .the earlier the parents are able to identify and sought professional help the better would be the outcome of the rehabilitative program.

References: Bornstein, M. H., Hendricks, C., Hahn, C. S., Haynes, O. M., Painter, K. M.& Tamis-LeMonda, C. S. (2003b). *Contributors to self-perceived competence, satisfaction, investment, and role balance in parenting: A multivariate ecological view.* Unpublished manuscript. National Institute of Child Health and Human Development, Bethesda, MD, USA.

Bornstein, M. H., Hahn, C. S., Suizzo, M., Cote, L. & Haynes, O. M.(2005). *Experiential, Sociodemographic, and Cultural Factors Predicting Mothers' Knowledge about Child Development and Childrearing: National, Immigrant, and Cross-National Studies.*

Unpublished manuscript, National Institute of Child Health and Human Development,

Earhart, E.M. Parent-education: A life long process. *Journal o/Home Economics,* 1980, 39-43.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology, 22,* 723-742.

Bronfenbrenner, U. & Morris, P. A. (1998). The ecology of developmental processes. In R. M. Lerner (Ed.), W. Damon (Series Ed.), *Handbook of child psychology: Vol. 1. Theoretical models of human development* (5th.ed., pp. 993-1028). New York, USA: Wiley.

Flinn.M.V.,cited in *Father child relations:cultural and biosocial contexts*.,Barry.S.Hewelett 1992 Walter de gruyter ,Inc.

Goodnow, J. J., Cashmore, J.; Cotton, S., & Knight, R. (1984). Mother'sdevelopmental timetables in two cultural groups. *InternationalJournal of Psychology, 19,* 193-205.

Harkness, S., & Super, C. M. (1994). The developmental niche: A theoretical framework for analyzing the household production of health. *Social Science & Medicine, 38,* 217-226.

Harkness, S., & Super, C. (1995). Culture and Parenting. In M. H. Bornstein (Ed.), *Handbook of parenting* (Vol. 3, pp. 211-234). Mahwah, NJ, USA: Lawrence Erlbaum

Hoffmann.J'Today'sparent'2003citedinhttp://www.fira.ca/cms/documents/34/Mother_Knows_Best.pdf.

Jankowick 1992., In *Parenting: An Ecological*

Perspective.,Tom Luster.,Lym Okagaki,2005
Kliman, D.S., & Vukelich, C. Mothers and fathers: Expectations for infants. *Family Relations.* 1985, 34, 305-313.
MacPhee, D. (1981). *Manual: Knowledge of Infant Development Inventory.* Unpublished manuscript. University of North Carolina at Chapel Hill,USA.
Mc Gillicuddy-De Lisi, A. V., & Sigel, I. E. (1995). Parental beliefs. In M. H.Bornstein (Ed.), *Handbook of parenting: Status and social conditions of parenting* (Vol. 3, pp. 333-358). Hillsdale, NJ, USA:Lawrence Erlbaum.
Miwa.,1995 In *Parenting: An Ecological Perspective.*,Tom Luster.,Lym Okagaki,2005
Paradis.2005Hcitedinhttp://brighamandwomens.staywellsolutionsonline.com/RelatedItems/6,615157
Ribas, R. C., Jr., Seidl de Moura, M. L., Gomes, A. A. N., Soares, I. D., & Bornstein, M. H. (2003). Socioeconomic status in Brazilian psychological research. Part 1: Validity, measurement, and application. *Estudos de Psicologia, 8,* 375-383.
Richard, K.M., Graziano, W., & Forehand, R. Parental expectations and childhood deviance in clinic referred and nonclinic children. *Journal o/Clinical Chrld Psychology.* 1984, 13, 179-186.
Shaner,.M., Peterson, K.L., & Roscoe, B.Olderadolescent female's knowledge of child development. *Adolescence.* 1985.20,53-59.
Shek .,2000 In *Parenting: An Ecological Perspective.*,Tom Luster.,Lym Okagaki,2005
Shii-Kuntz.,2000 In *Parenting: An Ecological Perspective.*,Tom Luster.,Lym Okagaki,2005
Showers, J., & Johnson, C.E Child development, child health and child rearing knowledge among urbanadole scents: Are they adequately prepared for the challenges of parenthood? *Health Education.* 1985, 37-41.
Stevens,J.H. Black grandmothers' and black adolescent mothers' knowledge about parenting. *Developmental Psychowgy.* 1984.20, 1017-1025.
Stevens,.H. Child development knowledge and parenting skills. *Family Relations.* 1984.33, 237-244.
Sun., Roopnaraine1996 In *Parenting: An Ecological Perspective.*,Tom Luster.,Lym Okagaki,2005
Survey by AFASIC cited in *Children's Communication Skills from birth to five years*
Belinda Buckely 2003
Swapna, N., Jayaram, M., Prema, K.S., & Geetha, Y.V. (2006). An ARF project undertaken at AIISH, Mysore
Williams, P. D., Williams, A. R., Lopez, M., & Tayko, N. P. (2000). Mothers' developmental expectations for young children in the Philippines. *International Journal of Nursing Studies, 37,* 291-30.

Appendix

AGE	COMPREHENSION	EXPRESSION
0-3mths	Regards speakers' face and shows interest in the process of talking	Cries to indicate discomfort/pain/ hunger
	Looks about in search of the speaker	Vocalizes and uses some intonation patterns
3-6mths	Stops crying when someone talks to him/her Regularly localizes source of voice with accuracy	Plays by making sounds and noises (cooing) Vocalizes in response to others' speech
6-9mths	Frequently appears to listen to whole conversations between others	Utters series of syllables (babbling) and longer vocalizations with varied intonation patterns
	Responds to name call	Exhibits repetitive & variegated babbling
	Recognizes family members (parents)	Often mimics the sounds and number of syllables used in vocal stimulation by others
	Responds to pitch and loudness changes in voice of others	Often uses jargon (short sentence like utterances of 4 or more syllables without true words)
9-12 mths	Often gives objects on request	Mimes/vocalizes when an action is named, e.g. how does a car go?
	Understands denial (responds to the word 'no')	Utters at least a word meaningfully, generally 'amma' to indicate mother
	Points to or indicates in some way when an object is named, e.g. where is the ball?, get the ball, etc.	Says 'finished' to signify completion of action
12-15 mths	Points to body parts when named, also understands the psychological feelings/facial expressions of the speaker	Asks for objects by saying give or naming the object, e.g. bikki
	Comprehends simple 'whose' questions, e.g. points to self when asked 'whose shirt is this'?	Imitates sounds of animals or vehicles, e.g. 'bow bow - dog', 'meow - cat, ' 'drrrrr – car etc.
	Comprehends simple instructions, e.g. 'call mummy', ' bring the plate', 'point to your eyes' etc.	Begins naming objects, animals using some true words along with gestures

15-18 mths	Comprehends 3-4 items in lexical categories (body parts, animals, family members, vehicles and common objects)	Utters sounds like /m/, /w/, /b/, /p/ consistently, speech is 25% intelligible
15-18 mths	Comprehends simple 'what' & 'who' questions	Begins to use 1-2 word utterances
	Carries out two consecutive directions with any object, e.g. take the ball and roll it	Begins repeating words overheard in conversa tion, has an expressive vocabulary of 10-15 words
18-21 mths	Selects an item from a group of 5 or more varied items	Requests for actions, e.g. 'mama bikki' , 'mama come' etc.
	Understands and provides appropriate responses to action verbs, e.g. "sit down", "put that down," "stop that" etc.	Requests for information, e.g. 'mama what?', 'mama who?', 'where ball' etc. along with appro priate facial expressions
	Understands around 50 words (few more items in lexical categories mentioned above and others like fruits, household materials, insects, birds, food etc.)	Rejects and protests , if not satisfied with others' decision or opinion, ('don't want', 'no')
	Follows one step command (simple but related) with three linguistic elements, e.g. give me the book and the pencil , close the door and come here etc.	Uses possessives, e.g. daddy's, mummy's etc.
	Remembers and associates new words by categories, e.g. cake-food, frock-clothing, lion-animal, etc.	Greet others by saying 'hello' or 'hi' on request
21-24 mths	Detects simple rhymes (responds by action, if a familiar rhyme is heard)	Utters more sounds like /n/, /h/, /k/, /g/, speech is 25-50% intelligible
	Comprehends pronouns (I, mine, you, this, that)	Uses rising intonation pattern to ask questions
	Comprehends questions concerning habitual behavior of named objects, e.g. what does mummy cook?– chapatti	Says his/her name. Has expressive vocabulary of minimum 30-50 words
	Comprehends complex verbal sentences, e.g. "when we get to the stores, I'll buy you an ice cream"	Uses few negatives like 'no', 'gone'
	Understands questions regarding object manipulation, e.g. will you comb Daddy's hair?	Imitates/ verbalizes 2 or 3 word sentences, e.g. mama give bikki
24-27 mths	Increase in receptive vocabulary of already learnt categories (up to 7-8 items in each category) and other lexical categories like stationary items, vegetables, flowers and clothes	Asks for help with some personal needs such as washing hands, going to toilet etc.
24-27 mths	Demonstrates an understanding of several action verbs by selecting appropriate pictures, e.g. correctly chooses the picture which depicts eating, running, jumping, etc.	Initiates topic for conversation and takes 1 or 2 about many things at a time indicating frequent shifts in topic)
	Recognizes prepositions (in, on)	Uses past, present and future tense appropriately to describe events
	Recognizes pronouns and possessives (he, she, him, his, her, they, you, and your)	Uses question markers (what & where)
	Understands size differences, e.g. big, small	Uses pronouns (I, my, you, me, this, that)
27-30 mths	Comprehends 'how' questions, e.g. how is the chocolate-mmm, nice; how did you get hurt? Etc.	Uses negatives (not, don't, won't and can't), e.g. I don't want, I can't do etc.
	Comprehends interrogatives like 'what are you going to do?' and responds appropriately	Apart from bilabials & velars, utters /t/, /d/, speech is 50-60% intelligible
	Recognizes common adjectives, e.g., fat, thin, short, tall etc.	Modifies speech in relation to social situations, e.g. talking in the presence of dolls, young chil dren etc.
	Recognizes common adverbs, e.g. dry, wet, slow, fast, etc	Produces a yes-no question by adding a rising intonation to the end of a sentence and responds appropriately, e.g. you took ball?
	Comprehends prepositions, e.g. out, under, in front and behind	Uses some prepositions and adverbs
	Understands word association through functional identification, e.g. what do you hear with?	Uses pronouns (he, she, him, his, her, they, we, you, and your)

30-33 mths	Understands cause and effect relation, e.g. don't go out, it is raining	Asks simple 'why' questions using verbs, e.g. why are you crying?, why are you cutting?
	Comprehends questions of all types (who, where, what, why, how, how many)	Uses correct gender forms
	Comprehends descriptive statements about objects, e.g. what do you do with a pen?	Expresses in 3-4 word sentences, Have the ability to maintain topic beyond several turns
	Comprehends sequentially related events and situations	Utters sounds such as /f/, /s/, /j/, /l/, /ng/, /d/, speech is 60-75% intelligible
33-36 mths	Comprehends two step verbal commands with four linguistic elements, e.g. switch on the light and close the door; go to the kitchen and get the glass etc.	Uses complex sentence construction incorporat ing if-then, e.g. what shall I do if my dress gets spoilt?, if I fall down, I will get hurt etc.
	Comprehends questions related to imaginary situations, what will you do if it rains when we go out?	Have the ability to comment on own utterances and those of others (disagreeing, correcting, ar guing etc.)
	Comprehends descriptive statements about individuals, e.g. who cooks at home?, who gives you a bath?	Uses conjunctions 'and', e.g. Papa and I went to the hospital
3-3.6 years	Shows gradual increase in receptive vocabulary (including all lexical categories, and in other semantic and syntactic aspects)	Uses complex sentence construction incorporat ing if-then, e.g. what shall I do if my dress gets spoilt?, if I fall down, I will get hurt etc.
	Comprehends pronouns such as them, us etc. e.g., Ravi played with them, Who is sitting with us?, and possessives such as its, our(s), their(s) e.g., This is our umbrella, It is their puppy etc. *	Have the ability to comment on own utterances and those of others (disagreeing, correcting, ar guing etc.)
	Comprehends quantitative adjectives such as few/some, something, many/much, another, little/no, all, how far, any, enough/ sufficient, e.g., I want another balloon, I want some water, He has enough rice, How far is your house from the school? etc.*	Uses conjunctions 'and', e.g. Papa and I went to the hospital
	Comprehends syntagmatic relations, e.g., fish-swims; bird – flies; night- moon; day-sun, elephant- big , mouse- small etc.	Shows gradual increase in expressive vocabulary (including all lexical categories, and in other se mantic and syntactic aspects)
	Comprehends more prepositions such as 'at side of / next to / beside', ahead of, 'between', around, across etc., e.g., Her house is next to my house, She is sitting between the two tables etc. *	Sings or says nursery rhymes along with the cor responding actions/movements, e.g., twinkle, twinkle————, and attempts to tell stories (re calls or sequences 3 or 4 events of a familiar story)
	Comprehends conjunctions such as but, or, because, when, so in most contexts, e.g., Show me the pen, but not the pencil, Show me the pen or pencil, The boy fell downbecause the cow hit him, When it rains, she uses umbrella, The boy hit her, so she is crying*	Describes objects, events (e.g., visit to the zoo, park etc.), 2-3 related actions (e.g., painting a pic ture, carrying out a household work etc.).
	Understands and detects semantic anomaly, e.g., Fire is cold, Sun is seen in the night, Sugar is salty in taste etc.	Uses present and past forms of the modal verbs such as can(could), will(would), shall(should), may(might), must, etc., e.g., I can dance, I will eat chocolate, Shall I cut this apple?, It may rain to day?, You should go etc. *
	Comprehends three and four step commands, e.g., come here, take this book, give it to your sister; go to the kitchen, fill a glass of water, bring it to me etc.	Uses he-remote/proximate or she-remote / proxi mate, e.g., this boy or that boy and also uses other pronouns and possessives such as them, us, its, our(s), their(s), your(s) e.g., Take us to the pond, He is taking them in his car, Its their car, Those books are ours, Your dress is pretty etc. *
	Comprehends case markers (prepositional phrases) containing with, to, in on, at, from, under, next to, for, over,	Uses question markers such as how much/many, which and questions with a tag, e.g., How many

	near, by, through, of, like, etc. e.g., Dog is with her, I am going to the park, The ball is in the bowl, The cat is on the table, He is standing at the gate, He jumped from the wall, He went under the chair, His house is next to the school, The flower is like sun, He pushed the stick through the table, He kept the stick over the table etc. *	flowers are there?, Which is big?, He is cute, isn't he?, He is not going, is he?, It's a dog, right? *
	Responds to questions related to daily routine activities, e.g., What did you do in the morning? etc.	Uses polite/indirect language form of requests, e.g., please, or thank others, "would you ——")
	Comprehends singular/plural contrasts for nouns, e.g., Give me a pencil, give me pencils etc	Uses repair strategies such as self correction, re phrasing, etc, (e.g., While narrating an event, if the child makes mistake, does s/he say 'no' and then corrects himself /herself, rephrase if the lis tener fails to understand him/her?)
3.6-4 years	Comprehends demonstrative nouns such as these, those, here and there, e.g., These are pencils, Those are pencils etc*	Uses conjunctions in sentences such as but, or & because and case markers containing with, to, in, on, at, from, under, next to, for, over, near, by, through, of & like in sentences. *
	Understands PNG (person, number and gender) markers, e.g., The cat is/cats are sleeping, He is/ they are sleeping, Mother is sleeping, This is my glass, These are my glasses etc.*	Utters sounds such as /t/, /d/, /n/, /l/, /v/, /tS/, /dz /, /n/, and blends such as nt, nt, nd, nk, e.g. to mato, doll, kannu (kannada), Kalla (Kannada), van, chair, judge, king, etc.
	Understands causatives, e.g., The girl is made to brush her teeth. , The baby was made to drink milk etc *	Speaks in sentences of five or more words. e.g., My school is near his house, I went to the market with my mother etc.
	Understands and identifies primary and secondary colors*	Uses plural forms in sentences, e.g., The girl is playing, The girls are playing etc. *
	Identifies basic shapes such as square, circle and triangle*	Expresses different subordinating conjunctions such as when, then, and then, while & so, e.g., It was raining, so we did not go out, We take medi cine when we get fever", He dropped him and then went home etc.
4-4.6 years	Understands reflexive pronouns such as myself, themselves, yourself, himself, herself, itself, e.g., he brushed his teeth himself, She took bath herself. *	Uses causatives, e.g., The girl is made to brush her teeth, The child is made to take bath, the child is made to take bath, he is made to eat his food etc.
	Understands quotatives, e.g., he said "She took her home", mother said "take the pencil" etc. Knows common antonyms (opposites), e.g., big x small, hard x soft, heavy x light etc. *	Utters sounds / /, /z/, /r/ and few blends such as bl, kr, dr, pr, ks, br, sk, tr, rtS etc. Names all colors and shapes (circle- round; square-box)etc*
	Understands conditional clauses (if, unless), e.g., If there is picture of fan in this page, clap your hands, Unless I call your name you should not touch the picture *	Describes short stories in simple and compound sentences
	Comprehends long stories when told or read and retells itand can answer content related questions based on the story	Expresses demonstrative nouns such as here and there, these and those e.g., These are my books; Those are my brother's books etc.
	Processes longer and more complex language structures, e.g., "Ccan you find something that lives in a tree, has feathers and a yellow crest" etc.	Uses PNG (person, number and gender) markers, e.g., The cat is/cats are sleeping, He is/ they are sleeping, mother is sleeping , This is my glass, these are my glasses etc.
4.6-5 years	Understands synonyms (meanings), e.g., shut–close, sad -grief etc.*	Speaks of imaginary conditions such as such as "I hope, I feel……."e.g., I hope it rains, I feel that she will come to play with me, etc.
	Understands small paragraphs	Asks for clarification /asks for explanation, rep etition etc. (e.g., In a conversation with the mother

		or when a specific request is made if the child doesn't understand, does s/he ask for repetition or explanation?)

S.L.H.D:-18

THE AUDITORY & NON-AUDITORY EFFECTS OF NOISE POLLUTION: AN OCCUPATIONAL HEALTH STUDYSTUDY NEED

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Occupational Noise Prevalence*:* Industrial noise levels in India are well above the permissible ambient noise standards stipulated by the Central Pollution Control Board (Appendix 1) (Saxena, S.K., 2005). Due to the relocation of hazardous industries induced by globalization, there might be a further increase in occupational noise levels. It is hence necessary to conduct additional research on the risk noise poses to the Indian workplace and workforce, to enable timely construction of interventions to minimize the damage. More importantly, these studies will have to be conducted in India, since incentives for such research might no longer exist in other countries.

Ageing Workforce: With the present trend towards a lower birth rate, an increasing life expectancy and spreading industrialization, there is a strong likelihood of the future emergence of an aging work force (Ageing Workforce, 2001) in the Asia Pacific region. These workers would have sensory problems of ageing like age-induced hearing loss, visual impairment etc., in addition to the noise-induced hearing loss created at work, substantially increasing national workforce impairment. Future occupational health interventions would then demand additional financial outlays and construction of complex work protocols and settings to accommodate this increased hazard. Hence, construction and implementation of interventions for the primary prevention of NIHL is an urgent need of the present times.

Neglected Occupational Hazard: Multiple other concerns in the industrial environment's of India like lung and skin diseases, musculoskeletal injuries etc have been examined in a number of research investigations led by the National Institute of Occupational Health (NIOH). Unfortunately, health impacts and ergonomic issues associated with ambient noise are seldom recognized. This could be due to a lack of requisite awareness about the noise hazard, as well as an acute shortage of technical manpower for routine industrial hygiene evaluations.

NIHL Management: Due to its significant and expansive health & performance impacts, NIHL prevalence needs to be minimized. It can be fully reversed in the initial stages; however it becomes irreversible in its later stages. This underscores the acute need for its early identification. Unfortunately there are multiple barriers to early NIHL diagnosis.
Barriers to Early Identification: NIHL has no specific or exclusive audiological signs. The disorder is identified on the strength of a high probability conclusion and as a result of an exclusion process (Arslan, E. & Orzan, E., 1998). The multifactor etiology of NIHL, its multiple confounders, a lack of specific biological markers and the high degree of variability in its signs & symptoms further complicate diagnosis (Surjan, L., Devald, J., & Palfalvi, L., 1973). However on the basis of an occupation-specific, reference & detailed database, new hearing loss models that include consideration of its multiple confounders can be developed. This will make NIHL diagnosis less complicated and will offer better possibilities for its early identification.

Multiple Hazard Exposures**:** Research and legislation usually consider a pollutant in isolation. This is not often representative of the real-life situation, where employees are more likely to be exposed to multiple hazards (noise, shift work, organic solvents etc). Paucity of information on the dose-response characteristics of noise when it occurs combined with other hazards raises considerable barriers in the formulation and implementation of hearing conservation interventions. To address this issue, the researcher attempted a study of noise-induced health effects, with noise occurring in combination with multiple environmental hazards, routinely present in the occupational environments of India.

Occupational Health Database: India does not have a national level NIHL database. Apart from early identification, it facilitates communication with administrative bodies about the magnitude of the noise problem and the degree of urgency for its prioritization. Data generated by the present study will lay the foundation for this much-needed reference database.

Noise – Induced Non-Auditory Health Effects**:** Until the recent past, the primary noise-induced health effect was thought to be a permanent noise induced hearing loss (NIHL) which usually occurred after a worker retired from the workforce. However over the last decade, short-term non-auditory health effects of noise are also being studied extensively, with most studies concluding a high potential in noise to cause them. But most of these studies are co relational in nature and statistically insufficient to endorse specific damage-risk criteria. They hence demand additional studies for their validation. Apart from health, recent research has also demonstrated noise-induced performance impacts on hu-

mans. "There is no doubt that noise has a definite effect on human performance. But the precise nature of the effect depends on the type of noise and the task being performed" stated Smith (Smith, A.P., 1990)

Study Objective: To document & study over a period of one calendar year, auditory and non-auditory health effects of occupational noise exposure

Methodology: To enable identification of occupational stressors, the American National Institute of Occupational Safety and Health (NIOSH, 1999) has formulated a model of occupational health which, while not ignoring the role played by individual factors, states that working conditions viz. heat, vibration, noise, illumination etc. play a primary role in causing job stress. It calls these stressful working conditions "job stressors" and states that they have a direct influence on worker safety and health (Karasek, R.A. & Theorell, T., 1996). Based on the above theoretical framework the researcher identified two occupational environments for study, a high-noise (power loom) weaving section of the textile industry and a low-noise indoor office. A panel-type of a prospective and longitudinal study was then designed to study the auditory & non-auditory health effects of ambient noise.

Sampling : Convenience, non-proportional quota sampling was used to recruit 120 male subjects aged between 20 years and 50 years from an indoor office for the control group. For the experimental group, 120 subjects matched on sex and age, were recruited from the weaving (power-loom) section of a textile industry. To stratify age as a variable, each group was further sub-divided into three age-based sub-groups (21 to 30 yrs, 31 to 40 yrs & 41 to 50 yrs), with each sub-group consisting of 40 subjects.

Study Parameters: Indian Council of Medical Research states that the selection of a health outcome for study should be made principally on the strength of the evidence of causality and on the availability of information for quantifying health impacts. It is also important that the particular health outcome has been previously assessed within the study population, or can be reasonably extrapolated from other populations (ICMR, 1980). Of all the noise-induced health effects, only the link between occupational noise and hearing loss is biologically obvious i.e. there is a clear mechanistic pathway between the physical properties of noise and damage to the hearing system. Although multiple confounders viz exposure to vibrations, ototoxic drugs, chemicals etc also contribute to hearing loss, its association with occupational noise remains robust even after accounting for these influences. (van Kempen et al., 2000). A recent meta-analysis by van Kempen et al. (2002) reviewed the effects of occupational noise on a variety of non-auditory cardiovascular health outcomes and behaviors, concluding the causal link between noise exposure and cardiovascular health outcomes as plausible and providing support for further investigation(van Kempen et al., 2000). Based on the above rationale, the study parameters selected were hearing sensitivity, blood pressures (systolic, diastolic), pulse rate and anxiety-state & -trait.

***Instrumentation & Data Collection Procedure Hearing Sensitivity*:** A portable pure tone audiometer was used to conduct a comprehensive (with air- & bone- conduction masked thresholds where required) pure tone audiometry for all the study subjects, at every level of the study. The specifications of the audiometer used were as follows; Arphi Model 500, MK 111, Serial Number-265. Audiometric testing was done at the beginning of the workday, after ensuring that the subject had no noise exposure for 16 hrs prior to it to avoid the effect of Temporary Threshold Shift (T.T.S.) on the measured hearing thresholds (Dobie, R.A., 1990).

***Anxiety-State & Trait*:** Spielberger's State Trait Anxiety Inventory (STAI) is a long established and well-researched instrument designed for measuring anxiety in adults (Kendall, P.C., Finch, A.J. Jr., Auerbach, S.M., Hooke, J.F. & Mikulka, P.J., 1976). It differentiates between the temporary condition of "state-anxiety" that is influenced & altered by environmental conditions and the more general and long-standing quality of "trait anxiety" that does not alter with environmental changes. The STAI-trait was administered at the beginning of the workday to the study subject's at all three levels of the study. The STAI-State required administration two times in a day. First, at the beginning of a typical work-day and the second time at the end of the work day. This gave enough reason to attribute to the workday activities of the subject, any observed fluctuations in state anxiety levels.

***Blood Pressures (Systolic & Diastolic) & Pulse Rate*:** An electronic digital sphygmomanometer was used to measure blood pressures & pulse rates of all the subjects in the study. Measurements were carried out twice in a day. First, at the beginning of a typical work-day and the second time at the end of the work day. This gave enough reason to attribute to the workday activities of the subject, any observed fluctuations in blood pressures and pulse rates.

***Subject Profile*:** A detailed questionnaire (schedule) was filled out for all the study subjects by the researcher. A standard questionnaire was modified to obtain a complete history of the subject that was relevant to hearing.

Ambient Noise Measurement: The researcher used a Type II Sound Level Meter (SLM) to manually measure ambient noise levels in the work environments of the study groups, following guidelines stipulated by American National Standard Institutes, Measurement of Occupational Noise Exposure (ANSI 1996). Measurements were carried out twice, a year apart from each other. This was done to factor in any incidental changes occurring in ambient noise levels, in the 2 yr data collection period

Data Collection Schedule: Each subject of the study was monitored on the study parameters for one calendar year. The study levels were designated as Level 1 at the beginning of the study period, Level 2 six months after Level 1, and

Level 3 six months after Level 2 & one year after Level 1.

Results: The principal objective while analyzing the data was to generate and compare summary statistics of parameter prevalence's in the study groups and test the significance of their correlation using the paired "t-test" and the Mann Whitney Non-Parametric test.

Ambient noise levels in the control group are 92dBA with a range of 82 dB (A) to 101 dB (A). In the experimental group they are an average of 102 dB (A), with a range of 99dB (A) to102dB (A).Hearing loss prevalence in the control group is 28% and in the experimental groups is 77%. In the control group mean systolic blood pressure is 122+-11 mm Hg. and in the experimental group it is 117+-11 mm Hg. .The t-test (p = 0.0412) & Mann Whitney (6104.5000) stated the correlation as non-significant. In the control group mean diastolic blood pressure is 82+-8 mm Hg. and in the experimental group it is 78+-7 mm Hg. .The t test (P= 0.1136) & the Mann Whitney test (6351.5000) indicated a non-significant correlation. In the control group mean pulse rate is 78+-11 BPM and in the experimental group it is 75+-6 BPM. The t test (p =8.9882) indicated no significant difference. However the Fishers statistic (Mann Whitney =9303.0000) is low and seems to tend towards significance. In the control group mean STAI-State score is 32+-7 and in the experimental group it is 37 +-8 .The t-test (p=0.0064) & the Mann Whitney test (8664.0000) stated the correlation as being highly significant. In the control group mean STAI-Trait score is 40+-8 and in the experimental group it is 41+-5 .The t-test (p=0.4166) & the Mann Whitney test(6763.5000)state the correlation as being non-significant.

Discussion: An unequivocal relationship between noise exposure & hearing loss and noise exposure & elevations in STAI-State levels is found. However no such relationship is observed between systolic blood pressure, diastolic blood pressure, pulse rates and noise exposure.

Contrary to the study hypothesis, measured noise levels in the indoor office environment are beyond permissible limits. Although not hazardously high, they are of moderate to high intensity. Gary Evans an environmental psychologist and a leading expert on environmental stressors like noise and crowding states "Even low levels of noise can have a potentially stressful effect" and might contribute significantly to health problems such as heart disease (due to elevated levels of epinephrine) and musculoskeletal problems (Evans, Gary. W. & Johnson, D., 2000). Apart from causing a hearing loss, moderate to high ambient noise levels interfere with verbal communications and can be distracting and annoying. Noise levels from 35 dB (A) and above are seen to interfere with speech communication. In environments like indoor offices, where noise levels are high enough to impede communication or disturb intended activities, noise can act as a general, non-specific stressor and lead to higher levels of stress and lower task motivation" (Evans et al., 2000). Measured ambient noise levels in the weaving section are in good agreement with other studies conducted in India & abroad. As hypothesized, they exceeded the CPCB-stipulated noise standards. Hearing loss prevalence in the control group is 23% which is perceptibly lower then the 77% prevalence observed in the experimental group. Control group hearing loss prevalence seems unexpectedly high for people working in low-noise indoor offices, especially for a condition known primarily as an occupational hazard. However ambient noise levels recorded in the office are beyond permissible limits and could be partly responsible for this increased prevalence. In addition, despite the fact that subjects of both the study groups were matched for age and sex, the subjects of the experimental group had higher mean hearing thresholds as compared to the control group. The primary etiologies of an acquired adult hearing loss are known to be; the ageing process, pathologies of the auditory system and noise exposure (Cruickshanks, K.J., Wiley, T.L., Tweed, T.S., et al., 1998) To control for age-related hearing loss, the researcher recruited subjects of less than 50 yrs in age (Frachet, B., 2009).In addition to this, study subjects of study groups were matched on chronological age and sex. The otoscopic screening procedure for each study subject, helped control the study for active pathologies of the auditory system viz discharging ears, perforated membranes, impacted wax etc. A different level of occupational noise exposure is the sole hearing risk factor on which the study group's differed. The researcher hence attributes the significant difference in hearing loss prevalence and audiometric thresholds to the different noise exposures of the study groups.

The anxiety-state level of a person is dependent on very specific environments and changes on a regular basis (Landers, D. M., & Arent, S. M., 2001). Hence noisy environments can modify anxiety states in an exposed population. Based on this rationale, the researcher postulates that higher ambient noise levels in the experimental group generate higher state-anxiety levels that are demonstrated as higher STAI-state scores in subjects from the experimental group as compared to the control group. Trait-anxiety is markedly less affected by environmental factors like ambient noise, and has more to do with a person's personality & temperament (Zeidner, 1988).Hence the different ambient noise levels in the study groups do not modify trait-anxiety levels of subjects exposed to it. No specific trends in the mean state-anxiety & trait-anxiety scores of the study groups could be identified. However when tested for significance and as hypothesized, the correlation in state-anxiety was found to be highly significant, while between mean anxiety-trait scores of the study groups no significant relation could be found.

No specific trends in average blood pressures (systolic & diastolic) & pulse rates of the study groups could be identified. No statistically significant difference was found in systolic & diastolic blood pressures between the two groups. For parameter of pulse rate, the P statistic indicated no significant difference. However the Fishers statistic was low

and seemed to tend towards significance. These findings are supported by multiple other studies. In spite of using a variety of research methodologies, most studies concluded that the extreme variability in blood pressure & pulse rate levels and their multiple confounders make predictions complicated. One such confounder identified in a recent study is the cognitive requirement of the job being performed (Melamed, S. & Froom, P., 2002) in noise. In the present study too, the office worker needs a higher level of cognition as compared to the powerloom worker. It causes blood pressure to increase in the high-cognitive office job and decrease in the low-cognitive loom job. In future noise studies, blood pressure & pulse rate effects might be better demonstrated, if they are controlled for cognitive demands of jobs along with controlling for personal variables like age & sex. However as dependant variable's they are plausible and hence warrant further study. Some studies suggested a documentation of results so as to create a large national occupation-specific database with detailed information on their multiple confounder's .This database might facilitate blood pressure & pulse rate predictions in future studies.

In the present stage of development in India, ONIHL needs to be addressed at multiple levels. Reduction in noise levels at source or consistent use of hearing protection devices in the industry might not always be feasible. To facilitate adequate coping with noise stress however, workers could be encouraged to make life style alterations. They could be educated about the benefits of de-stressing behaviors like community games, exercise etc. Multiple studies demonstrating such life styles and their positive health impacts need to be conducted. The conclusions drawn from these studies should not be restricted to the academic community, but need to be communicated to the high-noise exposed population at large; repeatedly and in a language they are able to relate to. The schedule generated data that would facilitate this.

Conclusions

In conclusion, this study supports the general observation that work-related exposures to noise, especially in industries like textiles; continue to play a major role in damaging hearing ability. Since ONIHL is a fully preventable medical condition, an annual & comprehensive audiometric testing of the noise-exposed workforce should be made mandatory. An important concept needs to be internalized about ONIHL. Although costs of its prevention may be high, the costs incurred due to worksite accidents, productivity drops and hearing-loss compensation awards are equally large.

Since permanent ONIHL cannot be pharmacologically reversed, the only way to manage it is by implementing a health intervention called hearing conservation. This health intervention will address long-term noise effects like a hearing loss as well as short-term & immediate effects like noise-induced stress, productivity drops & accidents. However the present paucity of data from multiple-hazard exposure environments raises barriers in the formulation of such interventions. Field data generated by studies like the present one can be directly used not only for their construction but also for formulating policies, finalizing compensation awards, prioritizing public health control efforts and increasing awareness about the damage-potential of noise exposure.

Effective environmental pollution abatement requires a scientific and technical database coupled with a broader interdisciplinary approach, including legal and management aspects. A professional healthcare infrastructure well equipped to guide the growing industrial sector in India is an urgent need of the moment.

References

Arslan, E. & Orzan, E. (1998). Audiological management of noise induced hearing loss. *Scand Audiol Suppl. [Electronic Version]*, 48:131-45.

Ageing Workforce (2001). The Magazine of the ILO, *World of Work, [Electronic Version]* Jan-Feb, No 38. Retrieved in June 2009. URL: www.ilo.org/public/english

American National Standard Institute's *Measurement of Occupational Noise Exposure*, ANSI S12.19-1997 [ANSI 1996a].

Cohen, S. & Weinstein, N. (1981). Non-auditory effects of noise on behavior and health. *J Social Issues [Electronic Version]* 37: 36–70.

Cruickshanks, K.J., Wiley, T.L., Tweed, T.S., et al. (1998). Prevalence of hearing loss in older adults in Beaver Dam, Wisconsin. The epidemiology of hearing loss study *Am J Epidemiol.* [Electronic Version] *148(9)*: 879–86.

Dobie, R.A. (1990). The Relative Contributions of Occupational Noise and Aging in Individual Cases of Hearing Loss. *Ear and Hearing [Electronic Version] 13(1):* 19-27.

Evans, Gary. W. & Johnson, Dana. (2000). Stress and open-office noise. *Journal of Applied Psychology. [Electronic Version] Vol 85*(5), Oct, 779-783

Frache, B. (2009). Adult deafness: hearing aid or hearing repair. *Rev Prat [Electronic Version] 59(5)*, May 20,639-43.

Indian Council of Medical Research (1980). *National ethical guidelines for biomedical research in India [Electronic Version]* Downloaded on 16th August 2009 from ww.icmr.nic.in/ethical_guidelines.pdf

Landers, D. M., & Arent, S. M. (2001). Arousal-performance relationships. In: J.M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance [Electronic Version]* (4th Ed.) (pp. 206-228). Mountain View; CA: Mayfield

Suter, A.H. (1986). Hearing conservation. In: Berger EH, Morrill JC, Ward WD, Royster LH, eds. Noise and hearing conservation manual. [Electronic Version] Akron, OH: American Industrial Hygiene Association, pp. 1-18.

Saxena, S.K. (2005). Perspectives on occupational safety, health & environment of workers at the national level; Current scenario and path ahead. *INDOSH [Electronic Version]* Jan-Mar. www.dgfasli.nic.in/newsletter_html/ jan_mar05/coverfeature.htm

Smith, A.P. (1990). Noise, performance efficiency and safety.

International Archive of Occupational and Environmental Health [Electronic Version] 62: 1-5
Surjan, L., Devald, J., & Palfalvi, L. (1973). Epidemiology of Hearing Loss. *Audiology, [Electronic Version]* 12: 396-410.
Suter, A. H. (1992). Noise sources and effects - a new look. *Sound and Vibration [Electronic Version] 25th anniversary issue*: 18-38.
Stress at Work (1999) *DHHS (NIOSH) Publication 99-101[Electronic Version]*, Downloaded from http://www.cdc.gov/niosh/pubs/html on 24th September 2009
Taylor, S.M. (1984). A path model of aircraft noise annoyance. *J Sound* Vib *[Electronic Version]* 96: 243 - 260.
Karasek, R.A. & Theorell, T. (1996). Current Issues relating to psychosocial job strain and cardiovascular disease research *J Occup Health Psychol [Electronic Version]* Jan; 1(1):9-26
Kendall, P.C., Finch, A.J. Jr., Auerbach, S.M., Hooke, J.F. & Mikulka, P.J. (1976). The State-Trait Anxiety Inventory: a systematic evaluation *Consult Clin Psychol.[Electronic Version] Jun;44(3)*:406-12.
Melamed, S. & Froom, P. (2002). The joint effect of industrial noise exposure and job complexity on all-cause mortality - The CORDIS study. *Noise Health [Electronic Version] 4*:23-31
Öhrström, E., Rylander, R. & Bjorkman, N. (1988). Effects of night time road traffic noise—an overview of laboratory and field studies on noise dose and subjective noise sensitivity. *J Sound Vib [Electronic Version] 127*: 441–8.
van Kempen et. al. (2002). The association between noise exposure and blood pressure and ischemic heart disease: a meta-analysis. *Environ Health Perspect. [Electronic Version] 110(3)*: 307–317.
Zeidner, M. (1988). Health and demographic correlates of trait anxiety in Israeli adults. *Anxiety Research [Electronic Version] 1 :(2)* 127-135

APPENDIX 1

The Noise Pollution (Regulation and Control) Rules, 2000

Ambient Air Quality Standards in respect of Noise

Area Code	Category of Area/Zone	Limits in dB(A) Leq Day Time	Limits in dB(A) Leq Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Note

1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is defined as an area comprising not less than 100 metres around hospitals, educational institutions and courts. The silence zones are zones which are declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

*dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq : It is an energy mean of the noise level, over a specified period.

S.L.H.D:-19

ACOUSTIC SIMILARITIES AND DIFFERENCES WITHIN AND BETWEEN SPEAKERS IN DISGUISED CONDITIONS

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Introduction: Voice prints are 3-D spectrograms that can be used to make a decision about a speaker. In speaker verification one has to decide whether two samples of speech are similar and belong to the same speaker or not. This is depending on the fact that there are between and within speaker differences (Nolan, 1983).

A major problem to both machine and human voice identification is the disguised voice condition. The fact that voice disguise or alteration in the voice can be present during the commission of a crime, either by the criminal intentionally affecting voice alteration or by virtue of experiencing a range of emotional states could have physiological effects upon voice production. Under disguised voice conditions, the voice characteristics of the speaker gets modified or altered in terms of pitch, loudness, and quality, rate of speech or articulatory abilities. Hence it creates more problem in speaker identification, as the originality of the speaker is lost.

One of the previous study by Pamela (2002), on reliability of voice prints suggested that two speech samples can be considered to be from different speakers when more than 67% of measurements are different. But this was in natural speaking condition and not under any disguise. Till date it is not known as to what percent of matching would indicate similarity or dissimilarity of speakers in disguised conditions and the

benchmarking is not established. Hence the present study investigated acoustic similarities and differences within and between speakers in speech disguise conditions.

Method

Material: Five sentences with six target/key words taken from the earlier speech samples on forensic voice identification were used as the recording material. The words included / complaint/ /ghante/ /ma:tu/, /na:nu/, /fo:n/, and /rupa:yi/.

Subjects: Fifty Kannada speaking normal subjects in the age range of 18-25 years participated in the study. All the subjects had normal speech and hearing abilities, normal oral structures and no other associated neurological or psychological problems.

Procedure: Subjects were instructed to speak the sentences 5 times under 3 conditions namely normal, disguise like hypernasal voice and slow rate on direct recording. PRAAT software was used for the analysis. The keyword in the sentence was displayed as waveform and wide-band spectrogram and whole word duration, duration of phonetic events such as burst, frication, closure, transition, and frequencies of first 3 formants of vowels were measured for all the six words and compared.

Two experiments were conducted to obtain just noticeable difference (JND) in duration and F_1, F_2, F_3. Phonated /a/, /i/ and /u/ were the material in the first experiment. Vowels were truncated in steps of 5 ms. A vowel with duration of 100 ms was paired with the same vowel with a truncated duration of 95 ms, 90 ms, 85 ms etc. These pairs were given for a discrimination task. If 100% of subjects discriminate 5 ms difference it will be considered as JND. Otherwise, the least duration discriminated by all subjects would be considered as JND for duration.

Tones at 300 Hz, 900 Hz, 700 HZ, 1200 Hz, 2100 Hz and 3100 Hz (frequencies of the 1st three formants if vowels) were generated using PRAAT software. Frequency was truncated in steps of 10 Hz and pairs of tones were prepared in experiment II. The discrimination task and the subjects were same as in experiment I.

The JNDs were considered to decide whether two durations or frequencies are similar or different. Percent same and different within and between subjects was calculated for all parameters.

Statistical analysis: The mean of all the parameters were calculated. Repeated measure of ANOVA for conditions with gender as main factor was used to find out the significant difference between the three conditions. Pair wise comparisons were administered using Bonferroni's multiple comparison tests.

Results and Discussion: Each of the six words was analyzed for different acoustic parameters.

Complaint (Word I): Results of repeated measures of ANOVA revealed significant difference across conditions on {WD = [$F(4, 192) = 89.043, p < 0.001$], F_1 /e/ = [$F(4, 128) = 2.589, p < 0.05$], CD = [$F(4, 180) = 2.824, p < 0.05$], TD_1 = [$F(4, 60) = 9.232, p < 0.001$], TD_2 = [$F(4, 56) = 8.505, p < 0.001$], TD_3 = [$F(4, 40) = 4.303, p < 0.01$]}. However no significant difference was observed on formant frequencies of /a/, burst durations of /k/, /p/ and /t/, F_2 /e/ and F_3/e/ . Table 1 shows the mean and SD of parameters across conditions and table 2 shows results of post hoc test.

Conditions	Normal	Hypernasal	Slow rate
WD	529 (63)	704 (117)	923 (183)
CD	55 (17)	83 (29)	104 (104)
TD_1	18 (7)	20 (5)	23 (6)
TD_2	17 (4)	21 (8)	23 (6)
TD_3	17 (4)	20 (7)	23 (10)
F_1 /a/	746 (136)	836 (157)	774 (1474
F_2 /a/	1358 (279)	1445 (171)	1397 (195)
F_3 /a/	2438 (346)	2391 (423)	2531 (356)
F_1 /e/	606 (422)	620 (133)	486 (87)
F_2 /e/	2179 (338)	2010 (639)	2197 (352)
F_3 /e/	3205 (1700)	2702 (364)	2733 (278)
BD /k/	18 (4)	21 (15)	32 (57)
BD /p/	14 (5)	16 (5)	17 (6)
BD /t/	13 (4)	14 (5)	19 (10)

Table 1: Mean and SD (parenthesis) of acoustic measures for the word [complaint].

Sl No	Parameter	Conditions
1.	Word duration	Normal Vs hypernasal, slow rate hypernasal Vs slow rate
2.	Closure duration	Normal Vs hypernasal, slow rate
3.	Transition duration	Normal Vs hypernasal, slow rate
4.	F1 /a/	Normal Vs slow rate
		hypernasal Vs slow rate
5.	F1/e/	hypernasal Vs slow rate

Table 2: Results of Bonferronni's multiple comparison tests for the word [complaint]

Ghante (Word II): Results of repeated measures of ANOVA revealed difference across conditions on {WD = [$F(4, 192) = 39.529, p < 0.001$], F_1 /e/ = [$F(4, 156) = 6.620, p < 0.001$], CD = [$F(4, 172) = 21.922, p < 0.001$], TD_2 = [$F(4, 120) = 3.388, p < 0.05$]}. However no difference was observed on F_1, F_2, F3 of /a/, BD of /t/, F_2 /e/, F_3 /e/ and TD_1. Table 3 shows the mean and SD across conditions and table 4 shows results of post hoc test.

Conditions	Normal	Hypernasal	Slow rate
WD	358 (59)	508 (85)	715 (165)
CD	55 (13)	73 (24)	90 (22)
TD_1	68 (247)	19 (5)	23 (7)
TD_2	15 (5)	17 (5)	20 (6)
F_1 /a/	625 (89)	747 (127)	822 (923)
F_2 /a/	1708 (331)	1906 (1244)	1695 (151)
F_3 /a/	2671 (401)	2637 (350)	2584 (418)
F_1 /e/	495 (50)	554 (107)	484 (55)
F_2 /e/	2703 (3379)	2181 (658)	2183 (405)
F_3 /e/	2707 (249)	2771 (296)	2785 (286)
BD /t/	11 (2)	12 (3)	14 (4)

Table 3: Mean and SD (parenthesis) of acoustic measures for the word [gante].

Sl No	Parameter	Conditions
1.	Closure duration	hypernasal Vs slow rate
2.	Transition duration	Normal Vs slow rate, hypernasal Vs slow rate
3.	Burst duration	Normal Vs hypernasal, slow rate hypernasal Vs slow rate
4.	F1/e/	Normal Vs hypernasal hypernasal Vs slow rate
5.	F1 /a/	Normal Vs hypernasal

Table 4: Results of Bonferronni's multiple comparison tests for the word [gante]

Ma:tu (Word III): Results of repeated measures of ANOVA revealed significant difference across conditions on {WD = [F (4, 192) = 68.097, $p < 0.001$], F_1 /a/ = [F (4, 124) = 17.034, $p < 0.001$], F_2 /a/ = [F (4, 132) = 2.842, $p < 0.05$], CD = [F (4, 192) = 3.917, $p < 0.01$], TD_1 = [F (4, 92) = 7.719, $p < 0.001$], TD_2 = [F (4, 76) = 5.180, $p < 0.01$]}. However no significant difference was observed on formant frequencies of /u/, burst duration of /th/ and F_3 /a/. Table 5 shows the mean and SD across conditions and table 6 shows results of post hoc test.

Conditions	Normal	Hypernasal	Slow rate
WD	399 (113)	523 (126)	734 (200)
CD	75 (17)	92 (21)	122 (31)
TD_1	18(8)	21(9)	25(9)
TD_2	16(8)	18(6)	22(6)
F_1 /a/	759(149)	1029 (929)	800 (140)
F_2 /a/	1426 (149)	1416 (169)	1324 (145)
F_3 /a/	2978 (647)	2745 (459)	2762 (480)
F_1 /u/	566 (588)	522 (95)	458 (58)
F_2 /u/ F_3 /u/	1485 (226) 2748 (312)	1347 (259) 2722 (358)	1322 (446) 2706 (251)
BD /th/	13 (3)	18(31)	18(5)

Table 5: Mean and SD (parenthesis) of acoustic measures for the word [maathu].

Sl No	Parameter	Conditions
1.	Word duration	Normal Vs hypernasal, slow rate hypernasal Vs slow rate
2.	Closure duration	Normal Vs hypernasal, slow rate hypernasal Vs slow rate
3.	Transition duration	Normal Vs slow rate hypernasal Vs slow rate
4.	Burst duration	Normal Vs slow rate
5.	F1 /a/	Normal Vs hypernasal, slow rate
6.	F2 /a/	Normal Vs slow rate hypernasal Vs slow rate
7.	F1 /u/	hypernasal Vs slow rate
8.	F2 /u/	Normal Vs hypernasal

Table 6: Results of Bonferronni's multiple comparison tests for the word [maathu]

Na:nu (Word IV): Results of repeated measures of ANOVA revealed significant difference across conditions on {WD = [F (4, 188) = 88.959, $p < 0.001$], F_2 /a/ = [F (4, 112) = 4.238, $p < 0.01$], F_1 /u/ = [F (4, 72) = 10.838, $p < 0.001$], F_3 /u/ = [F (4, 12) = 18.339, $p < 0.001$], TD_1 = [F (4, 80) = 8.080, $p < 0.001$], TD_2 = [F (4, 76) = 6.226, $p < 0.001$], TD_3 = [F (4, 56) = 8.056, $p < 0.001$]}. However no difference was observed on F_1 /a/, F_3 /a/ and F_2 /u/. Table 7 shows the mean and SD of parameters across conditions and table 8 shows results of post hoc test.

Conditions	Normal	Hypernasal	Slow rate
WD	375 (70)	534 (114)	769 (156)
TD_1	21(14)	27(18)	32(20)
TD_2	19(10)	25(20)	30(19)
TD_3	17(7)	20(11)	27(14)
F_1 /a/	830(124)	870 (183)	823 (150)
F_2 /a/	1560 (177)	1475 (155)	1489 (174)
F_3 /a/	2790 (385)	2632 (557)	2797 (395)
F_1 /u/	655 (168)	742 (163)	591 (154)
F_2 /u/	1592 (388)	1467 (346)	1690 (487)
F_3 /u/	2655 (462)	2685 (349)	2552 (104)

Table 7: Mean and SD (parenthesis) of acoustic measures for the word [naanu].

Sl No	Parameter	Conditions
1.	Word duration	Normal Vs hypernasal, slow rate hypernasal Vs slow rate
2.	Transition duration	Normal Vs hypernasal, slow rate hypernasal Vs slow rate
3.	F2 /a/	Normal Vs hypernasal, slow rate
4.	F1/u/	Normal Vs slow rate hypernasal Vs slow rate
5.	F3/u/	Normal Vs, slow rate

Table 8: Results of Bonferronni's multiple comparison tests for the word [naanu]

Fo:n (Word V): Results of repeated measures of ANOVA revealed significant difference across conditions on {WD = [F (4, 180) = 99.256, p < 0.001], FD = [F (4, 180) = 29.310, p < 0.001], F_1 /o/ = [F (4, 124) = 8.079, p < 0.001], F_2 /o/ = [F (4, 112) = 4.249, p < 0.01], F_3 /o/ = [F (4, 40) = 2.966, p < 0.05], TD_1 = [F (4, 104) = 4.662, p < 0.01], TD_2 = [F (4, 96) = 8.078, p < 0.001]}. All the parameters of this word showed significant differences unlike other words. Table 9 shows the mean and SD of parameters across conditions and table 10 shows results of post hoc test.

Conditions	Normal	Hypernasal	Slow rate
WD	304 (55)	428 (75)	617 (150)
FD	84 (24)	92 (22)	134 (46)
TD_1	17 (12)	23 (14)	28 (14)
TD_2	21 (17)	25 (18)	28 (17)
F_1 /o/	541 (85)	606 (117)	531 (101)
F_2 /o/	979 (277)	990 (179)	936 (278)
F_3 /o/	2775 (321)	2507 (365)	2806 (272)

Table 9: Mean and SD (parenthesis) of acoustic measures for the word [phone].

Sl No	Parameter	Conditions
1.	Word duration	Normal Vs hypernasal, slow rate hypernasal Vs slow rate
2.	Frication duration	Normal Vs slow rate hypernasal Vs slow rate
3.	Transition duration	Normal Vs hypernasal, slow rate hypernasal Vs slow rate
4.	F1/o/	Normal Vs hypernasal hypernasal Vs slow rate

Table 10: Results of Bonferronni's multiple comparison tests for the word [phone]

Rupayi (Word VI): Results of repeated measures of ANOVA revealed significant difference across conditions on {WD = [F (4, 188) = 5.615, p < 0.001], F_1 /u/ = [F (4, 156) = 8.133, p < 0.001], F_2 /u/ = [F (4, 120) = 4.163, p < 0.01], TD_1 = [F (4, 104) = 22.245, p < 0.001], TD_2 = [F (4, 100) = 17.311, p < 0.001]}. However no significant difference was observed on formant frequencies of /a/, burst duration of /p/, closure duration and F_3/u/. Table 11 shows the mean and SD of parameters across conditions and table 12 shows results of post hoc test.

Conditions	Normal	Hypernasal	Slow rate
WD	409 (93)	627 (260)	807 (212)
CD	79 (19)	111 (81)	112 (26)
TD_1	18 (9)	22 (9)	27 (12)
TD_2	16 (6)	21 (9)	25 (11)
F_1 /u/	462 (44)	502 (103)	434 (58)
F_2 /u/	1314 (113)	1225 (128)	1201 (170)
F_3 /u/	2482 (299)	2553 (389)	2617 (383)
F_1 /a/	728 (116)	833 (160)	783 (115)
F_2 /a/	1533 (193)	1492 (216)	1419 (163)
F_3 /a/	2566 (254)	2588 (362)	2615 (319)
BD /p/	11 (1)	12 (3)	14 (4)

Table 11: Mean and SD (parenthesis) of acoustic measures for the word [rupa:yi].

Sl No	Parameter	Conditions
1.	Word duration	Normal Vs hypernasal, slow rate hypernasal Vs slow rate
2.	Closure duration	Normal Vs hypernasal, slow rate hypernasal Vs slow rate
3.	Transition duration	Normal Vs hypernasal, slow rate hypernasal Vs slow rate
4.	Burst duration	Normal Vs slow rate
5.	F1 /u/	Normal Vs slow rate hypernasal Vs slow rate
6.	F2 /u/	Normal Vs hypernasal, slow rate
7.	F1 /a/	Normal Vs hypernasal, slow rate
8.	F2 /a/	Normal Vs slow rate

Table 12: Results of Bonferronni's multiple comparison tests for the word [rupa:yi]

The results indicated *significant differences between normal and other conditions on temporal parameters* – word durations, closure duration and transition duration. Disguised conditions – old age, hoarse voice - had significantly longer durations compared to undisguised normal condition. However, the spectral measures of conditions were not always significantly different. The results indicate that it would be difficult to compare a normal and disguised speech for speaker verification.

Secondly, results indicated *significant differences between genders on spectral parameters* – females had significantly higher formant frequencies compared to males. Table 13 shows parameters that significantly differed between gender at <0.05 level of confidence.

Word	**Parameter**	**F**
Complaint	TD_2	9.7
	TD_3	9.1
	F_1 /a/	16.8
	F_2 /a/	6.6
	F_3 /a/	50.7
	F_2 /e/	13.4
Ghante	TD_2	5.4
	F_2 /a/	16.3
	F_3 /a/	6.8
	F_1 /e/	8.3
	F_3 /e/	21.3
Ma:tu	TD_1	11.5
	TD_2	14.0
	F_1 /a/	17.0

	F_2 /a/	34.0
	F_3 /a/	6.3
	F_3 /u/	25.8
Na:nu	TD_1	9.3
	TD_2	12.5
	TD_3	10.5
	F_1 /a/	37.4
	F_2 /a/	8.1

Table 13: Parameters that significantly differed between gender at <0.05 level of confidence.

Before computing percent similarity and differences JNDs were calculated as detailed in the method. The JNDs obtained are presented in table 13

Material	JND
Vowels	14 ms
300 Hz	10 Hz
700 Hz	30 Hz
900 Hz	30 Hz
1200 Hz	20 Hz
2100 Hz	30 Hz
3100 Hz	40 Hz

Table 13: JNDs for vowels and tones at various frequencies.

Based on JNDs similarities and differences were calculated.

The Benchmark: Within subjects

1. *Spectral parameters in undisguised condition*: The frequency of the first formant was similar 68% of times, F2 50% of the times and F3 40% of the times. It appeared that the benchmark for F1 was above chance level.

2. *Temporal parameters in undisguised condition*: The percent similarity for word duration, closure duration, burst duration and transition duration were above chance level. Figure 1 shows the percent same for spectral and temporal parameters in undisguised conditions.

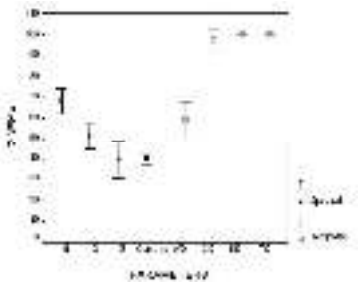


Figure 1: Percent similarity in undisguised conditions.

Between subjects between conditions

1. *Normal Vs disguised condition:* No spectral parameter was similar more than 50% of times when the undisguised speech was compared to disguised speech. However, the temporal parameters burst duration and transition duration were more than 80% similar in disguised and undisguised conditions. But these parameters wee similar within subjects also. Figure 2 shows Percent similarity between undisguised and disguised conditions for both spectral and temporal parameters.

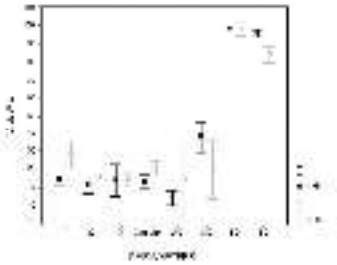


Figure 2: Percent similarity between undisguised and disguised conditions.

2. *Hypernasal Vs Slow rate (between disguised conditions)*: No spectral parameter was similar more than 50% of times when one form of disguised speech was compared to other. However the temporal parameters burst duration and transition duration were more than 90% similar in hypernasal and slow rate disguise condition. Figure 3 shows percent similarity between the disguised conditions for both spectral and temporal parameters.

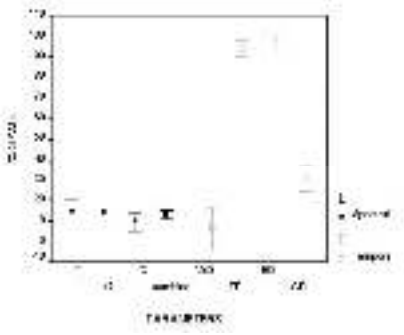


Figure 3: Percent similarity between the disguised conditions.

Conclusions: No speech samples differing in disguises can be confidently claimed to be belonging to the same person. Under undisguised conditions, the frequency of the first formant can be the only acoustic parameter which can confidently indicate two samples as belonging to the same person. Also in this study, single parameters are selected. Therefore, the results cannot be generalized to parameters other than those studied. Instead, vectors comprising of 2 or 3 parameters may be more beneficial for comparison.

Acknowledgements

The authors wish to thank AIISH Research Fund for providing grants towards the project. We would like to thank Dr. Vijayalakshmi Basavaraj for permitting us to carry out this study and to present it in the conference.

References

1. Nolan, F. J. (1983). The Phonetic bases of Speaker Recognition. London: Cambridge University Press.

2. Pamela, S. (2002). Reliability of Voiceprints. M. Jayaram & S. R. Savithri (Eds.). Dissertation abstract: Research at AIISH, Vol. 4, pp. 184

THEME 12

FOCAL THEME
NEED FOR WOMEN LEADERSHIP IN SCIENCE & TECHNOLOGY

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F/T:-1

WOMEN ENTREPRENEURESHIP IN SCIENCE AND TECHNOLOGY

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Introduction: The Science and Technology have been an integral part of any countries civilization and culture. Since independence, Indians have been promoting Science and Technology has one of the most important element of National Development. The major scientific revolutions of the last century have opened the doors to many remarkable technologies in the fields of Health, Agricultures, Communication and the like. Science and Technology are powerful instruments in the tasks of national reconstruction, economic development and national security.

Women in the field of Science and Technology: In the 17th, 18th & 19th centuries, most of the women did not have an access to institutions of higher learning and laboratories which prevented them from participation in the scientific revolution. It was an untapped resource due to social rigidities over the years, women have overcome the traditional mindsets and have excelled in professions like teaching, medicine, pure science and in almost all walks of life. The role of women in national development cannot be over-empathized.

The concept of Entrepreneurship: Entrepreneur refers to a person who undertakes and operates a new venture and assume some accountability for the inherent risks. Being an entrepreneur is about taking risks and confronting challenges. Thus entrepreneurship is the practice of starting new organizations, particularly new business .

* It is a difficult undertaking
* It is multiskilled
* Confident at the time of difficulties and discouraging circumstances
* Result oriented
* Risk taking
* Challenging
* Needs hard work, competent, single mindedness.

In this context, women entrepreneurs face some problems due to socio-cultural factors.

Factors discouraging women scientists' entrepreneurs

a) Socio-cultural factors : The socialization of the process was not given enough opportunity for freedom to develop. This is due to gender related limitations. The women are bound to struggle hard to develop entreprenuentail competency. It is a great hurdle to develop adequate and appropriate skills that can enable them to have entrepreneuntial competency.

b) Financial factor : The women generally face the problems due to lack of funds that is why they do not have enough financial support to start a businessor sustain an existing one. Financial factors may be more difficult for female entrepreneurs to raise than for their male counter parts. The women do not have an informal financial networks. Even to get the Bank loans is also not as much easy as compared to male entrepreneurs. The women have little assets compared to the men. As such the majority of leading businesses rely on a significant extent of self-guaranteed finance during the starting period of their business. The risk facto also is a major hurdle in the financial matter.

c) Not adequate Technological know – how : The world of women is not so open as compared to men due to this, they lack assess to market information. Most of the women are ignorant to market trends concerning costing, pricing and so on. They could not benefit maximum knowledge from readings price movements & fluctuations.

d) Poor Networking –Linkage : Women are not properly connected. Many as noted earlier are poor uneducated and unconnected. As such good networking or linkage for support services even when available may be beyond the reach of women.

e) Punctuality of women scientist entrepreneurs: The women and brought up in an environment which is totally different from men. The approach of up bringing girl child and to prepare her to become a good wife rather that as u c - cessful human being. During schooling, their main streaming is arts related courses. The girls were not encouraged to offer science courses for reasons ranging from the perception of sciences as a male's domain. Due to social believe girls students are not interested in science courses unless they have a goal. As such not many of women scientists could be produced. This in future would decrease the number of women scientists in establishing business enterprises as entrepreneurs.

f) Fear of failure : House is considered as the main domain of the women as such they are usually afraid to invest their hard earned and much needed income into business for fear of failure.

g) Lack of Mentors : It is pertinent to role that women have not mentors that they could look up in the area of entrepreneurship. The women scientist lack of business issues in their industries and they also do not have easy assess to mentors and role models.

h) Unfavorable Conditions – Policies : Women entrepreneurs have faced the strong barriers to enterprise development in prevailing laws and regulations. Obtaining licenses, registering the business in their own name and applying for loans are easy to handle.

Suggestions for encouraging or promoting women scientists' entrepreneurship :

1. Socio – cultural factors : Like should be treated alike. Males and females are human beings therefore women should be treated alike and should be given equal opportunities to

acquire needed skills for entreprenential competency.

2. Female awareness campaign and sensitization Workshops – Seminars : There is an argent need for awareness and sensitization workshops to be organized by women organizations, associations, government gender agencies and units, non-government agencies and allied organizations to educate the women scientists entrepreneurs.

3. Improvement in the policy /legal frame works : There is argent need to improve on the existing policy and legal frame work in a manner that would practically reach a satisfactory level so as to encourage females entrepreneurs.

4. Encouraging female education in science and Technology: for female should be encourage to study science and technology in schools and colleges with this they could gain assess to know -how , technologies appropriate and adequate skills Training to upgrade their technical capabilities and their entrepreneurs and business Skills whether in artisan production or in high-tech industry.

5. Encouraging women scientist networking : Women's scientist to be encouraged to be appropriately connected .Networking is vital to women's ability to assess information, technology, markets and raw materials relevant to the development, sustainability or expansion of their business. As such women networking nationally and internationally should be adequately facilitated.

6. Successful women scientists entrepreneur should be encouraged to share their experiences, council on problems and encouraged on prospects with upcoming women scientists.

7. Fund – Finance : The government of India should provide adequate funds in the form of soft loans for prospective women scientist entrepreneurs to start business – enterprises and or progress in their business.

Conclusion : The importance of promoting women in economic and development activities is being realized in all the countries. To ensure their involvement in the development of science and technology is inevitable. There is a need to provide adequate training to ensure that women can enter in all sectors of science and technology having an equal footing with men.

To meet the long felt need to empower women by bringing them into the main stream of development by improving their economic status and by providing them new employment opportunities by way of income generation and self employment in general and to create awareness about technologies in particular.

F/T:-2

NEED FOR WOMEN LEADERSHIP IN SCIENCE AND TECHNOLOGY!

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The Hand that rocks the cradle, rules the world.

Women hold up half the sky-It is indeed a Global Agenda. There is a significant Need for Women Leadership in Science and Technology this
is essential in boosting the economic growth. Investments in female education could yield a "growth premium".

Women bake cakes, women design homes, women run luxury stores and women run manufacturing units. A women is delicate and sensitive by nature. Here is no denying that physically a man is stronger than a woman and we all know that "The mighty holds the reins"-which is true even today, so in this mans world , a woman has to carve a niche for herself in every walk of life. She has to create a place for herself with many sacrifices. Women's self confidence, decisiveness and determination give a level of confidence and emotionally secure personality. The involvement of women in the field of medical and medicine have been recorded in early civilization. Cultural biases against women were prominent in the Middle Ages, which affected the education and
participation of women in science remained an amateur profession during the early part of nineteenth century. There was a need for Women's contributions in formal scientific education and inventions. Some of their advances in the technology sector were limited. According to the National centre for Women and Information Technology 37% of computer science undergraduate degrees went to women.

The sheer number of women in technology roles is almost increased to 9%. A notable share of great leaders is history have been women. Research of psychologists find that women excel in consensus technology building and scientific skills useful in leadership . There is a trade off in qualitative associated with top leadership. A woman can be perceived as competent or likeable, but not both. Since mid 1990's required woman leaders in one-third of village councils. They maintained better and took lesser bribes.

It was nice to see female leaders in action. Women have to be twice as good as man to get into a notable leadership quality.

The fragrance of flowers spreads only in the direction of the wind. But the goodness and ambience of a woman spreads in all directions. A sincere balanced and kind attitude towards women is the key to happiness and success in life's all avenues. Women love challenges and mostly rely on the power of dreams. Remember how Eliza Doo little was transformed from a lonely flower seller to a confident grande dame in 'My Fair lady'.

The biggest challenge is finding creative ways to come up in life. Our imaginations and thoughts rush to Kiran Mazumdar who is on a height of heroine worship. She rose from humble beginnings to become the chief of the bio-technology industry in India. She has risen as a role model for women in the

field of science and technology. Ayaan Hirsi risks her life to fight for oppressed women, she is lone voice of carnage. Kiran Bedi was the first women IPS officer who had been transferred every time she fought for justice and pointed out crime stories. She made a pathway for women to become immune to fear theories.

Women seldom speaks about their struggle against dowry and violence, these are not ficticious episodes from daily soaps but real –life experiences of battered and exploited women. Women are now recreating their lives. Today's women are bold yet shy, strong yet romantic. She is a multi-tasker and extremely confident. In every women's heart, there is the greatest need for a strong leadership of women in the fiels of science and technology. Today we find many woman CEO's in banking and financial sectors. In the political Arena we are prod of Sonia Gandhi and her behind the scene control and planning of all affairs of the country and mention must also be made of Nirupama Rao-spokesperson of the ministry of external affairs. Thus technology empowers women to make a mark in the society with great amount of confidence and power.

In modern times women have access to and are exposed to higher education and science and technology as they want literacy to enter their lives so that they can we knowledge to and apply life and accept all challenges to face boldly the tsunami's of life. After 30years of Independence we have seen a women prime minister and after 60 years of Independence we have a women President. This is an indication we have a women progress Swami Vivekananda predicted that the downfall of our country is due to continuous neglect of women.

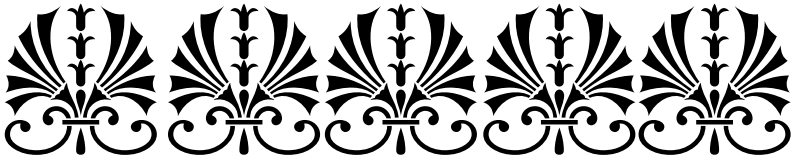
We need to bring up the girl child and inculcate education at all levels so that we can forecast the women leadership and involvement in the field of science and technology. In order to see the increase in the number of women in the field of science and technology we have to work at the grass root level of womanhood in India. Literacy is the greatest solution at all levels and we should helpi in our own way to see growth of women in all fields especially in science and technology. This can be summarized in a Poetic form.

Womanhood and its Success

A woman hood building movement
That is what ladies struggle represent
To promote every step with grass root level involvement
results in a voluntary embodiment.
Getting educated in Life's university creates job
Learning techniques on life
Enlargement engulfing in a Scientific temperament
To help them in their problem resolvement
Catering to the higher needs of fulfillment,
A proud race it is, far women empowerment
Creating a feeling of work enjoyment,
Womanhood fills them with a sense of achievement
Having their own hierarchical structure, It has patience, tolerance and stress management
For their growth and as its texture strength they need gods nurturewhich goes beyond the lessons of nature.
Womanhood stories have both success and failures to tell
Its concepts sorrows and suffering vows to sell
And act as their facilitators as well
To overcome all hurdles and ring the success bell
Starting their life as a fad,
Resulting in a journey only sad.
Launching wishes and wisdom with a lot of fanfare blast
For a long hopeful life that will never last.
Doing every task with commitment and dedication
Resulting it will in everything worthy of mention
For those who have a suffering and wounded in a different notion
Hope the poem has sounded a note of caution.



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PROCEEDINGS OF THE PANEL DISCUSSION ON THE FOCAL THEME " NEED FOR WOMEN LEADERSHIP IN SCIENCE & TECHNOLOGY"

PROCEEDINGS OF THE PANEL DISCUSSION ON THE FOCAL THEME "NEED FOR WOMEN LEADERSHIP IN SCIENCE AND TECHNOLOGY"

Date: 7th November 2009 Time: 2.30 to 4.30 pm

Chairperson: Dr. Vijayalakshmi Basavaraj, Director, AIISH

Panalists:

1. Dr. Ganga Murthy, Addl Economic Advisor, Ministry of Railways, New Delhi

2. Dr. K. Sudha Rao, Ex-VC of KSOU and currently Prof. & Head, Dept of Educational policy, National University of Educational Planning and administration, New Delhi

3. Dr. Vaidehi Ganeshan, Sr. Scientists, Indira Gandhi Centre for Atomic Research

4. Dr. Leelavathy, Director, Avinashlingam University for Women Studies

5. Dr. K. S. Ramaa, Chairperson, Matru Vedike-SVAK

6. Smt. D. Meena, Scientists, LRDE-DRDO

Moderator: Prof. R. Manjula, Prof. of Speech Pathology & HOD, POCD Dept of AIISH

The Chairperson opened the session by welcoming the panel speakers and introducing them to the audience. Subsequently the panel speakers expressed their views on the focal theme one by one.

Dr. Ganga Murthy spoken on the **need and methods of utilizing Science and Technology to empower women**. Dr. Vaidehi Ganeshan emphasized the need for working towards a set goal, need for networking and need for women to **pursue science as a passion**. Dr. Leelavathi insisted that Science and Technology need not be in terms for high ended research, but should be addressed even in terms of application of S&T to ground level and semi skilled professional work and she drew examples from the NABARD sponsored state that **women empowerment is a continuous process** and only thing that is required is for the women to "put the torch inward" in women. Dr. K. S. Ramaa, quoting the anectodotal basis of education to women from punished and stated that finally it is the "mid set" of the women that is limportant in promoting education in women. Dr. Meena, in her talk stated that 'leadership qualities' in women are different from knowledge. With the inbuilt qualities of women they can turn out to be better leaders as they are equipped with skills to manage crisis, have patience and endurance to sustain the stress involved in day to day living. Dr. K. Sudha Rao stated that there is need for removing biases about women's capabilities. She emphasized that there is **need to identify the women who have aptitude and train them.**

This was followed by questions received from the audience as well as the moderator addressed to the panelists. The questions spanned a wide range of domains including issues related to empowerment of women, multitasking, job reservation, attitudes of women, need for networking and need for a workable action plan which can be practically implemented.

Concluding the session, the chairperson summarized the outcome of the panel discussion (including the feedback obtained from the audience). An action plan was suggested so that it may be implemented with in once calendar year

The action plan and the nature of action for 2010 is suggested as follows:

* Recommend "Gender responsive budgeting" to Government of India / State to promote the cause of women in the country.

Action: Mathru Vedike to send a request regarding the above. The request may be drafted and circulated to member of Matru Vedike before finalizing the same.

* Initiate a network of women to establish a database regarding issues such as finance, work, training skills etc.

Action: It is recommended that a sub committee be formed to:

· Network the members of SVAK and Matru Vedike to ensure continued communication amongst the members

· Survey the existing networks and the data available in different domains for further plan.

* Work towards overcoming the myth about science to reach and involve the lowest strata of the society in order to:

* Make science as passion

* As a means of living

* To initiate a social movement and thus promote societal change.

Action: It is recommended that a sub committee be formed to survey the existing organization already working in this area and to join hands with the existing educational, health and other national schemes which are being implemented.

* Address the realistic needs of women such as opportunities for flexible working hours for the women scientists, relaxation of upper age limit in educational setup, promotion of girl child empowerment, provision of crèche, transport facilities etc.

Action: It is recommended that the sub committee including members from multidisciplinary specializations to:

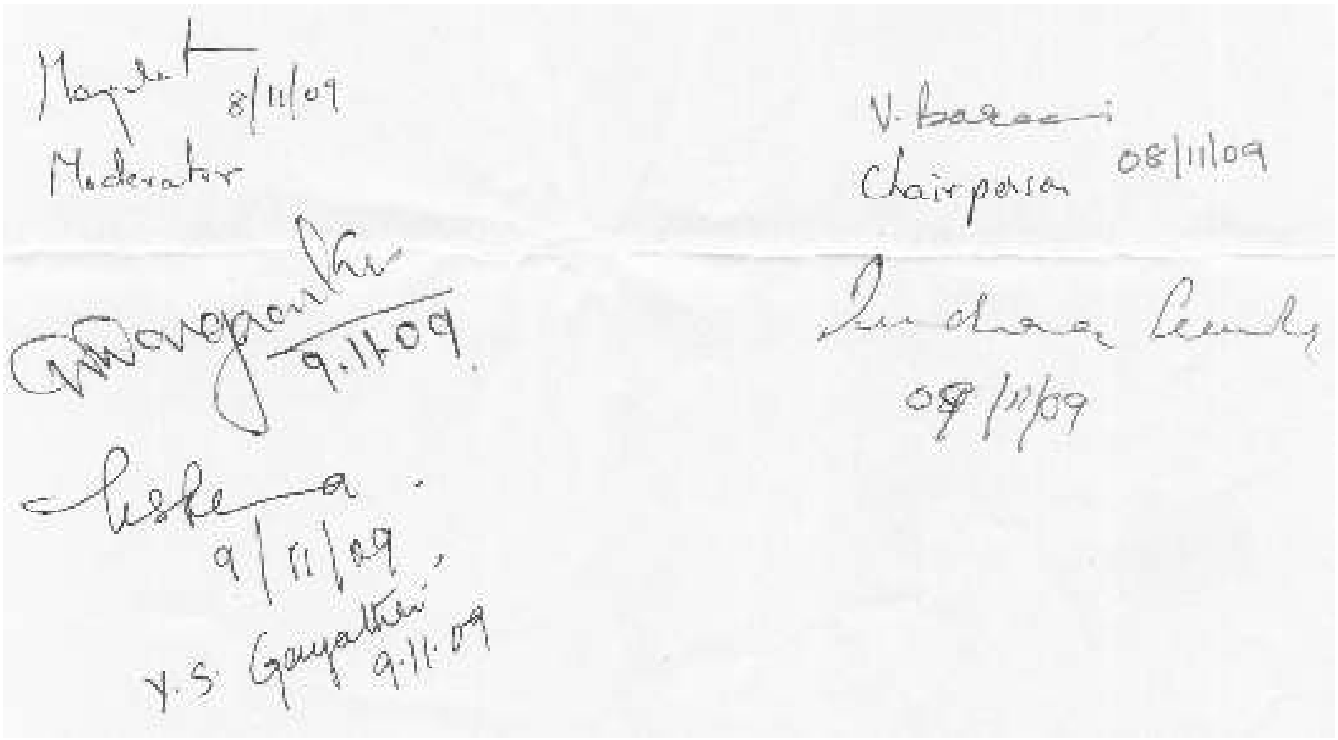
· Prepare a proposal for submission to the Government of India and the State for initiating action.

· Present the proposal at various platforms to get feedback on the proposal, sensitize and motivate various organizations to consider the same for implementation.

It is recommended that the above action plans be subjected to quarterly review to monitor and guide the progress.

The session ended with thanks to the chair.

Minutes prepared by: Prof. R. Manjula, Prof. of Speech Pathology & HOD, POCD Dept. AIISH.



VOTE OF THANKS

I am greatly privileged to propose vote of thanks to the august audience present here.

1. Our hearfelt thanks to Dr. Indira Amla, Paediatrician, for having accepted our invitation to be the Chief Guest of this concluding function. I thank Dr. Indira Amla on behalf of SVAK, AIISH and every one here.

2. I thank profusely Dr. Deepti Dongaokar, Dean, Govt. Medical College, Nagapur, She was with us for all the three days. Your guidance has contributed much to the seminar. Thank you Madam.

3. Our hearfelt thanks to Dr. Vijayalakshmi Basavaraj, Director, AIISH who is the pivotal in organizing this seminar. All the arrangements were made systematically and excellently. I thank you Madam, on behalf of SVAK & all the Delegates.

4. I thank Dr. Saroj Choodamani Rajagopal, VC, Chatrapati Shivaji Maharaj Medical University, Lucknow, for having accepted our invitation, grace the occasion, and Inaugurated the Seminar with here Inagural address.

I thank Prof. K. Sudha Rao, Ex-VC, KSOU, Mysore, for having presided over the function.

I thank Dr. Leelavathi, Director, Women Studies, Avinashlingam University, Coimbatore, for having graced the occasion with her presence.

5. I thank Dr. G. V. Satyavathi, recepient of Marie Curie Mahila Vijnana Puraskara and Dr. Sujatha Ramadorai, receipient of Sir. C. V. Raman Mahila Vijnana Puraskara, for having accepted our invitation and received the awards.

6. I thank Prof. K. I. Vasu, Chief Patron of SVAK. This semianr is his brain child. He is the motivator for all the activities of SVAK. Our hearfelt thanks to you Sir.

7. I thank Prof. S. R. Savithri, who extended her co-operation and support to the grand success of the Seminar. We thank you once agian Madam.

8. I thank all the VC's from differenct universities who contributed to the success of the seminar.

9. We profusely thank all the Teaching & Non-Teaching Staff and Students of AIISH. Every thing was taken care of in a systematic way. They have worked hard to make the seminar in a bifitting manner. I thank them on behalf of every one present here.

10. I thank all those who participated in plenary lectures, panel discussions and invited lectures.

11. I thank Dr. K. S. Ramaa, Chairperson of Matru Vedike of SVAK

12. I thank profusely, all those who sponsored the seminar. Our special thanks to INFOSYS FOUNDATION, DST, CSIR, ISRO & WOMEN UNIVERSITES

13. I thank all the persons from Electronic Media, News Papers for having given wide publicity and coverage for this programme

14. I thank all the delegates and audience who have come from the differenct parts of the country, without whom, the seminar wouldn't have been taken place. Your participation and contribution through presentation has enhanced the quality of the seminar.

15. I thank Sri. H. Ramesh, General Secretary of SVAK and all the members of SVAK, espeically the members of Matru Vedike who have worked day and night to make this seminar a grand success.

16. I once again thank all the people who have worked, co-operated, helped, directly and indirectly for the grand success of the seminar.

I thank you one and all once again.

Dr. Y. S. GAYATHRI
Treasurer, SVAK & Working Chairperson, Matru Vedike