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EXPLORE A METHOD TO POSSIBLY COMMUNICATE WITH ALIENS FROM ANOTHER PLANET OR SOLAR SYSTEM

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ABSTRACT

The purpose of this paper is as mentioned above to explore possible means of communicating with aliens with the objective of Averting a war or conflict between Aliens and the Human race on our planet Earth; We try to achieve the above by possibly communicating to Aliens that, we are friendly beings and mean no harm to them and simultaneously expect no harm from them (Aliens);We must realize that a slight misunderstanding in communications between Aliens and Humans could result in adverse reactions – possibly wars and even annihilation of either Aliens or Humans or both.

Keywords: Aliens; Solar System

INTRODUCTION

Definitions and Assumptions

We assume that communication consists of the following communication blocks namely, Thoughts (as captured by a Thought waves – more on this in point 3 of Definitions and Assumptions), Expressions (as seen on the Face), Gestures (as demonstrated by appropriate appendages like Hands/Feet etc.), Images (could be mathematical diagrams such as Venn diagrams or statistical bar charts or pictorial as in Egyptian drawings in pyramids or Cave drawings etc.), Writing (such as English text or French scripts or Hindi scripts etc.), Speech (as expressed by Natural languages such as English, German, Nordic or Mandarin etc. or some other language(s))and other senses such as Touch, Smell, Taste, Sight and their corresponding languages for the same and/or the last but not the least Behavior/Actions such as expressing anger/violence/love/empathy etc.

Each of the communication blocks can be internal or external. Internal communication blocks are those communication blocks generated internally or due to some external source but are **suppressed** and not exhibited while external communication blocks are those which are **exhibited externally** either due to internal/external communication. What is of interest to us in this study are only external communication blocks and for all practical purposes the communication blocks referred in this discussion are external communication blocks.

For each of communication blocks Thought/Gesture/Images/Writing/Speech and other senses (Touch, Smell, Taste, Sight) and Behavior/Actions we assume that they can be identified, captured, understood and interpreted e.g. for

- Thoughts[1]
- Expressions[2]
- Gestures[3]
- Writing[4]
- Images[5]

- Speech and other senses such as Sight, Touch, Smell and Taste[5]
- Behavior and Action[6]
    1. Communication can be expressed as follows e.g. –
        - Thought1 or
        - Thught1/Gesture1/Behavior or Action 1
        - Behavior or Action 1
    2. In general, the communication blocks can be expressed as –
        - Thought (0, n) and similarly for the other communication blocks such as Gesture (0, n) etc.

Where the notation (0, n) implies there are zero or no Thoughts or there are 'n' Thoughts e.g. Thought1 followed by Thought2 followed by Thought3 etc. till thought n

Similarly, for the other communication blocks such as Expression, Gesture etc. the communication blocks are expressed as follows e.g.

Gesture (0, n1) / Speech (0, n2) / Behavior or Action (0, n3) which means that there can be 0 or n1 Gestures, 0 or n2 Speeches and 0 or n3 Behaviors or Actions

This notation is commonly used in BachusNaur forms for Lexical/Semantic analysis in Compiler design etc.

In general, the communication blocks may follow a "**forward linkage path**" such as Thought/Expression/Behavior or Act (e.g. one might think of going to the Bank for depositing money which for you is an unpleasant activity say due to the drudgery – here the Thought is of going to the bank, the look of boredom/drudgery on your face is an Expression and the Act or Behavior of walking, going to the bank and depositing money maybe a Behavior/Act); or the communication blocks may follow a "**backward linkage path**" such as Behavior or Act/Expression/Thought (e.g. one might touch an object and realize that it is "hot" – here Behavior or Act of touching an object is a Behavior/Act, the expression of pain expressed on your Face is an Expression and the feeling that the object is "hot" is a Thought – all of the above occurring in reverse order first Behavior/Act then Expression and then Thought).

Or in general the communication blocks especially the intermediate stages maybe a **permutation/combination** of **forward linkage path and backward linkage path.**

Communication maybe one-to-one, one-to-many or many-to-many, similarly response maybe one-to-one, one-to-many or many-to-many.

We define communication patterns as follows e.g. –

'p1' = Thought1/Behavior or Act 1/Speech 1 or

'p2'= Speech 1/Thought1

In general, there can be 'k' patterns 'pk' where k=1,2, …. n

We assume that there might be several input streams in a pattern 'pk' but the endpoint is single and unique e.g.

Let 'p1' = Thought1/Gesture1/Behavior or Act 1 | Thought2/Speech 1/Gesture1

Here, the pattern 'p1' consists of two streams Thought1/Gesture1/Behavior or Act 1 and Thought2/Speech 1/Gesture1 – here the second stream joins the first stream at Gesture1 and the endpoint of both the streams is Behavior or Act 1.

We assume that there could be multiple streams in a pattern but the endpoint is unique and single. In this context, a pattern might look like a graph with multiple nodes, edges (something like an inverted hierarchical tree) ending in a single leaf.

We assume that the "languages of the Human Race" as illustrated in point 3 of this section are Institutional or Institutionalized or Formal System languages which can be Country/Culture/People/Industry or Domain specific e.g.

Let us say the language used by traffic police in a country to control vehicular traffic on the roads is say an Institutional or Formal language using Hand signals, Sound (whistles) and Traffic lights or

Let us say the language used by Air Hostesses/Cabin Crew to communicate safety norms in an Aircraft at the beginning of a flight are again Institutional or standard for Airlines or

Let us take the Natural languages such English, Hindi, French, American etc. are pretty much standard or institutionalized or

Let us take the language of Medico's again pretty much standard or

The language of lawyers and law again more or less standard or

Again the language spoken by Medico-legal experts again there are standards or

Languages spoken in different engineering streams or the engineering parlance used in an engineering stream is again we presume standardized or

The Pharma-Legal language as embodied in the HIPAA Act is standard

We assume that "languages of the Human race" are a permutation/combination of above languages for different communication blocks e.g. Hindi-English or Indian law as related in German language etc.

Similarly, for the other communication blocks such as Thought/Gesture/Image/Speech and Senses & Behavior or Act

A) We assume that we have constructed a suitable "Turing Machine" or a computer (which we call as Mr. H) that has stored all possible "languages of the Human Race" as illustrated in point 3, 10 of this section and is capable of generating all permutation/combination(s) of patterns 'pkH' with these Earth languages where k=1, 2, 3… n and 'H' stands for pattern generated by Mr. H

B) We assume that the patterns communicated by aliens is 'pjA' where j=1, 2, 3 …. m and 'A' stands for Alien

Similarly, we might name the understanding/interpretations of patterns 'pkH' and 'pjA' as 'ik1H' and 'ij1A' respectively for Mr. H and Aliens for k=1, 2… n and j=1,2, … m and k1=1,2, …. L and j1=1,2, … U.

We assume that for a pattern pkH there might be one or more understanding/interpretations, similarly for a pattern pjA there might be one or more understanding/interpretations.

To distinguish between patterns and interpretations, the following example might suffice e.g. we may say something but we mean really something else.

Now for pattern matches, they are of three kinds – Total, Partial and No match

For a Total match (Tm),

pjA=pkH e.g.

pjA=Gesture1/Speech1 and pkH=Gesture1/Speech1 here we can see clearly that,

pjA=pkH

For a Partial match (Pm),

One or more communication blocks of pjA match those in pkH but not all as in a Total Match

e.g.

If pjA=Thought1/Thought2/Gesture1/Speech1 and

p1H=Thought3/Thought2/Gesture4/Speech2 here Thought2 matches in pjA and p1H,

p2H=Thought1/Thought2/Gesture4/Speech2 here Thought1 and Thought2 match in pjA and p2H

Here we see there are two partial matches for a pattern pjA, hence for a Partial match there can be one or more matches.

For a No match (Nm),

pjA ≠ pkH e.g.

pjA=Gesture1/Speech1 and pkH=Gesture2/Speech2 here we can see clearly that,

pjA ≠ pkH

That there is zero matches

Similarly, for Understanding/Interpretations there can be Total match, Partial match and No match as in point 12 of this section. The reason to differentiate between pattern matches and understanding/interpretation matches will become more clear as we take this up in the section Observations and Methods. Needless to say understanding/interpretations are more important than patterns though patterns are the means to understanding/interpretations.

We also assume that we have with us appropriate state-of-the-art signaling/capturing devices such as those used in Astro-Physics and modern devices especially in the domains of matter, space and time to identify, capture, understand and interpret the communication blocks

OBSERVATIONS AND METHODS

Let us take on a case by case basis for pattern matches and their interpretations

Let us assume there is a Total match in patterns and there is a Total match in understanding / interpretation. This is a no-brainer as we completely understand the communication being communicated to us by the Alien the moot point is how we respond to the communication (more on this in this section).

Let us assume that there is a Partial match between the patterns (let there be 'n' matches) but there is a Total match between understanding/interpretations of each alien pattern with that of Mr. H's patterns. Again the Partial match between patterns (of Alien and Mr H) is not of much significance except that by comparison with the understanding/interpretations of the Alien pattern and Mr H's pattern it **might** assist us in decoding the alphabet/language of aliens e.g. for a pattern pjA and pkH let us say there are n1 interpretations for pjA and for each of these interpretations of pjA there corresponds a Total match with an interpretation of pkH where there are 'k1' pkH. Hence we may conclude that the pattern pjA is equivalent to pkH where k=k1. Similarly, for the other interpretations of pjA we might obtain k2, k3 patterns etc. of pkH equivalent to a single pattern pjA which **may** assist us in decoding the Alien alphabet/language.

Let us assume that there is a Partial match between the patterns (let there be 'n' matches) and there is a Partial match between understanding/interpretations of each alien pattern with that of Mr H's patterns. Again the Partial match between patterns (of Alien and Mr H) is not of much significance except that by comparison with the understanding/interpretations of the Alien pattern and Mr H's pattern it **might** assist us in decoding the alphabet/language of aliens e.g. for a pattern pjA and pkH let us say there are n1 interpretations for pjA and for each of these interpretations of pjA there corresponds a Partial match with an interpretation of pkH where there are 'k1' pkH. Hence we may conclude that the pattern pjA is **possibly** equivalent to pkH where k=k1. Similarly, for the other interpretations of pjA we might obtain

k2, k3 patterns etc. of pkH equivalent **possibly** to a single pattern of pjA which **may** assist us in decoding the Alien alphabet/language.

The possible techniques/methods that could be used in narrowing the matches/choices in the above discussion could be either Differential Analytics, Text Analytics (as used in Social Media) and its equivalent in other communication blockssuch as Gestures, Speech, Behavior or Action (or some other suitable Analytic technique/method, including Artificial Intelligence/Machine Learning, Deep Learning etc.) and or use plain Guessing/Instincts (Refer to Reference 7 in the References section for paper on Instincts). Also the techniques/methods used in the game of Dumb charades or other Guessing games (and their equivalents) would assist Humans in deciphering/decoding Alien languages/alphabets, other than Mr H and other Analytical techniques

Let us assume that there is a Total match between the patterns and there is a Partial match between understanding/interpretations of each alien pattern with that of Mr H's pattern. Again the Total match between patterns (of Alien and Mr H) is not of significance in the sense that the interpretations of Mr H maybe the same as that of pjA. By comparison with the understanding/interpretations of the Alien pattern and Mr H's pattern it **might** assist us in decoding the alphabet/language of aliens e.g. for a pattern pjA and pkH let us say there are n1 interpretations for pjA and for each of these interpretations of pjA there corresponds a Partial match with an interpretation of pkH where there are 'k1' pkH. Hence we may conclude that the pattern pjA is **possibly** equivalent to pkH where k=k1. Similarly, for the other interpretations of pjA we might obtain k2, k3 patterns etc. of pkH equivalent **possibly** to a single pattern of pjA which **may** assist us in decoding the Alien alphabet/language. As there is a Total match between pjA and pkH the choices for the understanding/interpretations for the Partial matches between the interpretations might be statistically and significantly be made narrow and closer than in other cases except for point 1 in this section.

The possible techniques/methods that could be used in narrowing the matches/choices in the above discussion could be either Differential Analytics, Text Analytics (as used in Social Media) and its equivalent in other communication blocks such as Gestures, Speech, Behavior or Action (or some other suitable Analytic technique/method, including Artificial Intelligence/Machine Learning, Deep Learning etc.) and or use plain Guessing/Instincts (Refer to Reference 7 in the References section for paper on Instincts). Also the techniques/methods used in the game of Dumb charades or other Guessing games (and their equivalents) would assist Humans in deciphering/decoding Alien languages/alphabets, other than Mr H and other Analytical techniques.

Now let us take the case of No match, here in order to decipher/decode the communication blocks and their interpretations one could either use Analytics, Guessing or Instincts, Artificial Intelligence and/or Machine learning as described in points 3, 4 of this section.

Again let us take the patterns/interpretations on a case by case basis,

The patterns/interpretations of Aliens and those understood/interpreted by Mr H/Humans can be as follows –

Let us take on a case by case basis for pattern matches and their interpretations

1. Let us assume there is a Total match in patterns and there is a Total match in understanding/interpretation. This is a no-brainer as we completely understand the communication being communicated to us by the Alien the moot point is how we respond to the communication (more on this in this section).
2. Let us assume that there is a Partial match between the patterns (let there be 'n' matches) but there is a Total match between understanding/interpretations of each alien pattern with that of Mr H's patterns. Again the Partial match between patterns (of Alien and Mr H) is not of much significance except that by comparison with the understanding/interpretations of the Alien pattern and Mr H's pattern it might assist us in decoding the alphabet/language of aliens e.g. for a pattern pjA and pkH let us say there are n1 interpretations for pjA and for each of these

interpretations of pjA there corresponds a Total match with an interpretation of pkH where there are 'k1' pkH. Hence we may conclude that the pattern pjA is equivalent to pkH where k=k1. Similarly, for the other interpretations of pjA we might obtain k2, k3 patterns etc. of pkH equivalent to a single pattern pjA which may assist us in decoding the Alien alphabet/language.

3. Let us assume that there is a Partial match between the patterns (let there be 'n' matches) and there is a Partial match between understanding/interpretations of each alien pattern with that of Mr H's patterns. Again the Partial match between patterns (of Alien and Mr H) is not of much significance except that by comparison with the understanding/interpretations of the Alien pattern and Mr H's pattern it might assist us in decoding the alphabet/language of aliens e.g. for a pattern pjA and pkH let us say there are n1 interpretations for pjA and for each of these interpretations of pjA there corresponds a Partial match with an interpretation of pkH where there are 'k1' pkH. Hence we may conclude that the pattern pjA is possibly equivalent to pkH where k=k1. Similarly, for the other interpretations of pjA we might obtain k2, k3 patterns etc. of pkH equivalent possibly to a single pattern of pjA which may assist us in decoding the Alien alphabet/language.

4. The possible techniques/methods that could be used in narrowing the matches/choices in the above discussion could be either Differential Analytics, Text Analytics (as used in Social Media) and its equivalent in other communication blockssuch as Gestures, Speech, Behavior or Action (or some other suitable Analytic technique/method, including Artificial Intelligence/Machine Learning, Deep Learning etc.) and or use plain Guessing/Instincts (Refer to Reference 7 in the References section for paper on Instincts). Also the techniques/methods used in the game of Dumb charades or other Guessing games (and their equivalents) would assist Humans in deciphering/decoding Alien languages/alphabets, other than Mr H and other Analytical techniques

5. Let us assume that there is a Total match between the patterns and there is a Partial match between understanding/interpretations of each alien pattern with that of Mr H's pattern. Again the Total match between patterns (of Alien and Mr H) is not of significance in the sense that the interpretations of Mr H maybe the same as that of pjA. By comparison with the understanding/interpretations of the Alien pattern and Mr H's pattern it might assist us in decoding the alphabet/language of aliens e.g. for a pattern pjA and pkH let us say there are n1 interpretations for pjA and for each of these interpretations of pjA there corresponds a Partial match with an interpretation of pkH where there are 'k1' pkH. Hence we may conclude that the pattern pjA is possibly equivalent to pkH where k=k1. Similarly, for the other interpretations of pjA we might obtain k2, k3 patterns etc. of pkH equivalent possibly to a single pattern of pjA which may assist us in decoding the Alien alphabet/language. As there is a Total match between pjA and pkH the choices for the understanding/interpretations for the Partial matches between the interpretations might be statistically and significantly be made narrow and closer than in other cases except for point 1 in this section.

6. The possible techniques/methods that could be used in narrowing the matches/choices in the above discussion could be either Differential Analytics, Text Analytics (as used in Social Media) and its equivalent in other communication blocks such as Gestures, Speech, Behavior or Action (or some other suitable Analytic technique/method, including Artificial Intelligence/Machine Learning, Deep Learning etc.) and or use plain Guessing/Instincts (Refer to Reference 7 in the References section for paper on Instincts). Also the techniques/methods used in the game of Dumb charades or other Guessing games (and their equivalents) would assist Humans in deciphering/decoding Alien languages/alphabets, other than Mr H and other Analytical techniques.

7. Now let us take the case of No match, here in order to decipher/decode the communication blocks and their interpretations one could either use Analytics, Guessing or Instincts, Artificial Intelligence and/or Machine learning as described in points 3, 4 of this section.

Again let us take the patterns/interpretations on a case by case basis,

The patterns/interpretations of Aliens and those understood/interpreted by Mr H/Humans can be as follows –

Communication Errors and Remedies

1. Probably the best type of communication for most people is one-to-one, face-to-face, across the table where one can read body posture and body language etc. But in this kind of communication one can easily be provoked into making decisions hastily and perhaps wrongly. Hence a Behavior or Act not intended can possibly be made resulting in a communication error.
2. Communication via electronic medium such as phone/TV etc. is again prone to error as the message being conveyed by a Leader or Speaker using the phone/TV maybe misinterpreted by listeners due to bad sound quality, unable to read body language and the message being conveyed may mean different things to different people as humans are often conditioned to listen toonly the things they want to listen and ignore the remaining or the relevant parts of the message. A human being might not even realize that something or a message is trying to be conveyed to him/her. Again this can lead to a communication error.
3. Different people have different communication styles such as Thinking and Speaking; Thinking, Writing and then Speaking; Thinking, making Images/Diagrams and then Presenting etc. Personally I prefer drafting, thinking, editing and making a final written copy. Here in India and I think in other parts of the world the written word carries more weight than the spoken word – but I believe that both the written word and the spoken word are like arrows released from the bow which often cannot be taken back, hence both these forms I think should be used with restraint and caution. But in modern times this is becoming more and more like an anachronism in popular culture and lifestyles. Hence, a communication not intended to be made is often made resulting in communication errors.
4. Private communication should be private only and only those people privy to such a communication should only have access to it. Public communication should be public only and only the Public People who have the authority and responsibility should have access to it. Again in modern life this is more and more becoming an anachronism especially for celebrities, politicians, industrialists and other such public figures private life is often in public glare. Hence, a communication not intended to be interpreted is often made resulting in communication errors. Privacy and Security of Celebrities/Public figures etc. should be respected.
5. Suppose a person makes an unreasonable request from his colleague/superior "that he/she wants to drink poison", commonsense naturally dictates that that for a mature colleague/superior he/she should not comply with such a request because this can possibly lead to a conflict. Especially if the age difference between the person making the request and his/her colleague/superior is considerable because as we all know that poison is a harmful substance.
6. A "propagation delay" in communication can often lead to communication errors e.g. An Alien communicates A1 and the Human interprets this as B1, let us say due to no response by the Human the Alien might assume that the Human is interpreting his/her communication A1 as A2 (due to no response) which might result in a conflict. Similarly, if a Human does not receive an appropriate response in a reasonable amount of time he/she might jump to

conclusions and can result in a conflict. Hence as far as possible communication has to be instantaneous, accurate and reliable

7. If there is no trust between the communicating party's communication easily breaks down leading to a conflict. Once trust is broken it can only be restored by positive reinforcement and reestablishing communication lines. A past conflict between communicating parties can linger over several lifetimes for certain clans/tribes and across geographies.
8. Offensive communication often leads to provocation resulting in conflicts.
9. A momentary lapse of reason can often result in a conflict due to people misconstruing what is being communicated resulting in breakdown of communication.
10. The above points are mainly referred to in the context of the spoken and written word but as we have described there are also unspoken and unwritten words such as thoughts(including psychological)/gestures/expressions, the senses (Sight, Sound, Taste, Smell, Touch) and Behavior or Act which have a language of their own, and the communication errors described above and below also apply to these unspoken/unwritten words which could lead to hostility and conflict if not suitably addressed quickly and efficiently
11. Also refer to References 8, 9, 10 – here we see the medium and interface can play a vital role in Communication
12. Companies often use psychometric tests to determine the true purpose or objectives of an individual's communication such as e.g. why is he/she applying here for a job, lie-detector tests to know whether a person is lying or not etc. for communication purposes.

CONCLUSIONS

Aliens might be of inferior, same or superior intelligence than Humans – again for this the use of suitable computers such as Mr H described in this discussion, a suitable "Turing machine", Artificial Intelligence such as Machine Learning, Deep Learning etc. and the "Human touch or intelligence" matching the intelligence of the Alien would be indispensable rather than leaving the Communication to Humans alone.

REFERENCES

1. Computer that can read thoughts leading to Thought Controlled Computers (Reference Stephen Hawking's show "Science of the Future").
2. Man watching by Desmond Morris, also refer to Intel Real Sense Technology similar to HCL's gesture/expression Human Computer Interface (HCI) and Microsoft's patented expression based HCI. Also one can refer to Performing Arts & Dance such as Kathak, Kuchipudi, Spanish-Flamingo dance, Ballad etc. for information on understanding expressions etc.
3. For understanding Gestures one can refer to the Game of Dumb Charades, Acting, Mime and for a more scientific/system approach one can refer to Film Institutes such as Academy of Motion Picture and Arts, FTII (Film and Technical Institute of India), Sign language used by Deaf and Dumb children, Silent movies of Charlie Chaplinetc.
4. For writing one refer to ancient Sumerian, Indus Valley Civilization tablets and Egyptian/Chinese civilizations who started paper writing and actual alphabets (all of these were the precursor to modern writing). Modern writing is mainly either Sanskrit or Phonetically based used across different mediums.
5. In ancient times there were pictorial drawings to communicate such as those seen in the tombs of Egyptian pharaohs and Cave paintings etc. (N.B. There are languages to understand them such as Hieroglyphics etc.). For mathematical, scientific, statistical etc. also there are different languages to understand and interpret them. Also see Personal Assistants from Microsoft (Cortana), Apple, Facebook (software that can see, hear and speakand other Image recognition software etc.), IBM's

Watson, Google's AphaGoetc. For more details on some of the above apps refer to Times of India, Mumbai Edition, Sci-Tech dated 06/04/2016. 5'. For Speech there are Natural languages such as Hindi, German, English and languages Country/Culture/People/Industry/Domain specific. Similarly, there are languages of Sight, Smell, Taste and Touch as well.

6. Behavior and Action is mainly based on the verbs of the above languages in Reference points 1, 2, 3, 4, 5
7. Instinct and its Relationship to the Human Brain / Memory under Different situations, Author=Hatim Kanpurwala, Sept 2013, Volume No. 2, Issue No. 9 ISSN 2277-1174, National Abhinav Journal of Research Science and Technology (The use of instincts and good guess-work would aid in interpretation of alien communication)
8. Google's "finger free" User Interface for Android based devices
9. Microsoft's Haptic User Interface
10. Google Glasses – both User Interface and Content provider
11. George Bernard Shaw's book/play "My Fair Lady" and movie based on the same starring Audrey Hepburn
12. Understanding autistic children and such would be nice, especially with the assistance of parents/teachers to know how/what such children think and their mechanisms of communication. This might not only be useful for this study but also assist autistic children in communication.

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A STUDY ON GROWTH AND DEVELOPMENT OF TECHNICAL EDUCATION IN KARNATAKA

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ABSTRACT

Technical education needs to respond continually to both socio-economic changes and scientific and technological advance. In all the developed countries technical education has received much attention because of its contribution in securing economic prosperity for the people, and even more so, because of its long-range relationship to social order. The need for technical manpower is increasing day by day due to the application of science and technology to industry, agriculture, transport and communication, public health and other activities becomes wider and more intensive. The rapid and sudden change in technology along with the desires of the people for more comfort and luxury has increased the demand for technocrats, scientists and engineers. The terms Engineering and Technology are sometimes used synonymously and sometimes differently, to distinguish between different subjects. Technical institutions are sometimes referred to as engineering colleges; sometimes as technical colleges; and in some cases as colleges of engineering and technology. The provision for technical education is at the core of all these activities. The main objective of this paper is to understand the structure, composition, growth and development of technical and engineering education in Karnataka.

Keywords: Globalization; Liberalization; Technical Education Compounded Annual Growth Rate; Correlation Coefficient; Polytechnic Education; Percentage Growth; Regional Distribution; Year On Year Growth

INTRODUCTION

Engineering or Technical education is one of the most potent means for creating skilled scientific and technical manpower required for development of various sectors of the economy. Technical education incorporates the technological dimension, which is a vehicle for development. There is no universally accepted definition of 'Engineering or Technical Education'. It varies from country to country and is sometimes identified by particular type of institutions and their courses of study. In India, Technical Education represents a complex of activities that include post graduate courses and research; under-graduate courses leading to a first degree or equivalent award; diploma courses; certificate courses; junior technical schools level; apprenticeship etc. (Chandrakanth L.S, 1963). Technical education is a sub-system of national education system, which in turn, is an integral part of the total development process. Moreover technical education exists for industry and economic development. Therefore, it has to be dynamic and flexible, keeping pace on the one side with the reform in educational system and on the other technological changes and economy[1].

The engineering education in India started during the British era and focused mainly on civil engineering. The impulse for creation of centers of technical training came from the British rulers of India. It arose out of the necessity for the training of overseers, for the construction and maintenance of public buildings, roads, canals and ports and for the training of artisans and craftsman's for the use of instruments and apparatus needed for the army, the navy and the survey department. The first engineering college established in the Uttar Pradesh in 1847 for the training of civil engineers at Roorkee, which made use of the large workshops and public buildings that were erect for the upper Ganges canal. The Roorkee college (or to give it its official name, the Thomason engineering college) was never affiliated to any university but gave diplomas considered to be equivalent to degrees. In pursuance of the government policy, three engineering colleges were open by about 1856 in the three presidencies. In Bengal, a college called the Calcutta College of civil engineering was open at the writers' buildings in November 1856; the name was changed to Bengal engineering college in 1857, and it was affiliated to the Calcutta University. The overseers' school at Poona eventually became the Poona College of engineering and affiliated to the Bombay University in 1858. For a long time, this was the only college of engineering in the western presidency. In the madras presidency, the industrial school attached to the gun carriage factory became ultimately the Guindy College of engineering and affiliated to the madras university (1858).

After achieving Independence, the national leadership realized the need for the development of human and physical resources. Human resources were to be developed through education and physical resources through the modernization of agriculture and rapid industrialization. "The skilled manpower needed for relevant research and its systematic application to agriculture, industry and other sectors of life could only come from development of scientific and technical education." That was the reason why the advance of technical eduation in India after 1947 was rapid. A chain of five Technical Institutes for higher education were developed between 1951 and 1961. These are known as Indian Institutes of Technology. They are located at Kharagpur (1951), Bombay (1957), Madras (1959), Kanpur (1960), and Delhi (1961)[2]

Imparting technical education in Karnataka as a part of curriculum made its beginning only in the latter half of the 19th century, when the first institute, the school of engineering was established in Bangalore in 1862. This school affiliated to Madras University had two classes and was intended to train men for employment in subordinate engineering services. Thereafter, public work department school was established by Rao Bahdur Arcot, Narayanswamy Mudaliar in Civil and Military station in 1873. As a first step, an industrial school was established at Hassan in 1889 and a similar school was established at Mysore in 1892. There were 14 industrial schools in Old Mysore at the time of integration. Some of them were converted into industrial training institutes and some other closed. The Sri Krishnarajendra Silver Jubilee of the reign of Krishnarajendra Wodeyar in 1938 with textile technology as the subject of study presently offers graduate and post-graduate courses in textile technology and recently it is upgraded as government engineering college.

In view of this technical education in India has travelled a long way. It started as a one tier system, now it has developed into a four-tier structure with a superstructure of research and development keeping close relation with the changing trend in the employment structure. The issue of technical education in India has already been there since ancient days. With the change in time, ideas, circumstances and needs of life its shape has been changing. The paper presents the growth of technical education in India and Karnataka as under Pre-liberalization and Post-liberalization period.

REVIEW OF LITERATURE

The Report of the Committee on India Vision 2020[3] rightly recognized that a large number of the country's engineering colleges need to be up-graded to quality standards close to those of the IIT's, and given similar autonomy. Private sector initiatives and investment, Indian corporate or NRTs or reputed foreign universities, need to be fully encouraged to participate in upgrading technical education in the country. Close links need to be fostered between technical institutions. Besides NPE 1986, a number of policy initiatives have been taken by the government, some of these are: National Technology

Policy Statement (1983), Technology Policy Vision for India 2020 (1996), National Policy Initiative for Technical Education (1998), Information Technology Policy (2000) and India as knowledge superpower, strategy for transformation (2001).

The Government of India's Vision[3] is "To develop and nurture a technical education system in the country which would produce skilled manpower of the highest quality, comparable to the very best in the world and in adequate number to meet the complex technological needs of the economy; and would provide the nation a comparative advantage in the creation and propagation of innovative technological solution and in the development of the technological capacity of the highest order, both for its application in the economic development of the country and for becoming a major supplier of technology and technological services in the world".

The Vision statement has the following six main components:

1. To produce skilled manpower in sufficient numbers to meet the needs of the economy.
2. To ensure the highest quality of output from the technical education system comparable to the very best in the world.
3. To develop a comparative advantage in the creation and propagation of innovative technological solutions.
4. To develop national technological capacity of the highest order.
5. To use innovative technological solutions and technological capacity for economic development and
6. To become a major supplier of technology and technological services in the world.

According to Praveen (2003)[4], there is a real boom in growth and development of engineering education since 1980. Not only is there an addition to the number of institutions with corresponding increase in the intake and out turn, there has been significant additions of new courses to existing ones from time to time. He also describes that employment opportunities for engineers also vary from State to State.

A report of AICTE (2009)[5] has revealed that it has planned to assist financially those engineering institutions which are situated in those areas where the educational institutions lag behind the advanced states. The council has envisaged the following schemes to overcome the problems.

1. Modernization and Removal of Obsolescence (MODROBS).
2. Staff Development Programme (SDP).
3. Emeritus Fellowship (EF).
4. Entrepreneurship Development Cell (EDC).
5. Industry-Institute Partnership Cell (IIPC) especially for initiating skill development programmes and activities.

The council has also stressed the need of establishing engineering education to the underprivileged section of society in which rural, female and backward classes would be especially assisted.

U.R. Rao committee's report "Revitalizing Technical Education" is a review of the performance of the All India Council for Technical Education (AICTE). The five-member committee was set up by the Ministry in November 2002, under the chairmanship of Prof. U.R. Rao, the former chairman of the Indian Space Research Organization (ISRO). The Rao Committee Report is thus a review of the AICTE's performance over the last 15 years. The report, submitted to the government in September 2003, has not been made public yet. The report has also made a number of recommendations that would require numerous actions by the ministry so that the council could ensure optimal growth of

quality technical education consistent with the country's economic development in the present globalized environment.

According to National Policy on Education, 1979, a more balanced technical education system at all stages should be organized, in view of the changed priorities of socio-economic development. The programme of technical education should be on more efficient and meaningful basis. Technical education institutions will form the focal points where problems of rural areas will be studied and solutions found. Programmes will be designed to ensure meaningful interaction and collaboration with industry. Laboratories and workshops should be strengthened and the quality of training should be improved. Technical education courses should be designed also to impart entrepreneurial skills. In view of the fact that the country has already achieved a highly diversified industrial structure, both in public and private sector, industries should plan a large role in maintaining a balanced system of technical education and in the optimum utilization of technical manpower in building up of a research and development base. Emphasis in research will be on industrial and rural development. Institutions will be expected to undertake advanced research in areas of vital importance to the nation, such as energy resources and technology for rural development.

Soner Seker (2013)[6] discusses the role of Computer-Aided Learning (CAL) in engineering education and some descriptions about computer aided learning were explained. He finds that in recent years, the positive results are seen about the use of computer aided learning in engineering education. Computer-Aided Design (CAD), Computer Aided Manufacturing (CAM) and Computer Aided Engineering (CAE) is becoming increasingly popular. Therefore, computers have become very essential for applications in engineering and in engineering education.

OBJECTIVES

The main objectives of the present study are to:

1. To analyze the growth of technical education in Karnataka in the pre-liberalization and post liberalization period.
2. To examine the region wise distribution of technical education institutions in Karnataka
3. To study the structure, composition and management of technical education in Karnataka.

HYPOTHESIS

Based on the review of literature and the objectives laid for the study the following hypothesis has been formulated in this study.

1. There is a uniform growth in technical education across the state of Karnataka
2. Growth of technical education remains constant irrespective of liberalization privatization and globalization

RESEARCH METHODOLOGY

The study is based on secondary source of data. The data is collected from various reports of University grants commission (UGC), All India council for technical education (AICTE), Directorate of technical education (DTE) Karnataka. The main objective of the study is to analyze the growth of technical education in Karnataka and so on. Data relating to number of colleges, admissions, district wise, management wise, engineering and polytechnic colleges etc are collected

All the analysis and calculation are done using percentages, compounded annual growth rate, year on year growth rate, correlation coefficient.

DATA ANALYSIS AND FINDINGS

Table 1. Growth of Engineering Colleges in India

	ENGINEERING DEGREE		ENGINEERING DIPLOMA	
YEAR	NO.OF ADDITION	CAGR	NO.OF ADDITION	CAGR
BEFORE 1991	8.775	4.83	22.75	5.98
AFTER 1991	137.86	5.76	110.27	2.98
correlation before 1991			0.9543156	
correlation before 1991			0.1093363	

Source: Author complication

Engineering Colleges: During 1951 to 2014 following are the changes occurred in Technical Education in India. In the year 1951 there were only 53 engineering colleges which offer Bachelor & Master Degree, increased to 3384 in the year 2014. There is a tremendous growth to the extent of 5.85 CAGR. In the pre liberalization period the CAGR is 4.83%, where as in post liberalization it is 5.76. The CAGR clearly indicate that the post liberalization period has show enormous impact in the growth of technical education in the country. In the pre liberalization period the average number of addition to the existing number of engineering colleges are about 9 colleges per year whereas in the post liberalization period it is 138 colleges per year.

Polytechnic Colleges: In the year 1951 there were only 89 Diploma colleges which increased to 3436 in the year 2014. There is a declining trend to the extent of 5.98 CAGR in the pre liberalization where as it is 2.98% in the post liberalization. The CAGR clearly indicates that the post liberalization period though it has shown enormous impact in the growth of technical education in the country but when it comes to Diploma colleges it is declining due to the growth of engineering colleges. Before 1991 the average number of addition to the existing number of Diploma colleges is about 23 colleges per year whereas after 1991 it is 110 colleges per year. Precisely globalization has created great impact over emergence of engineering education in India.

Correlation – Coefficient: The correlation between the engineering degree colleges and diploma colleges is about 0.95 in pre liberalization whereas in post liberalization it is about 0.10. These values are clearly indicating that people prefer engineering degree rather than engineering Diploma.

Table 2. Growth of Technical Colleges in Karnataka

TIME PERIOD	AVERAGE PER YEAR	CAGR
BEFORE 1991	4.53	8.43
AFTER 1991	9.21	5.02
TOTAL PERIOD	8.88	7.08

Source: Author complication

In the year 1947 there were only 6 technical institutions in Karnataka, which increased to 195 in the year 1990, increased to 588 in the year 2014. There is enormous growth in technical education, over the span of 67 years, average number of institution added is about 9 colleges per year. In the pre liberalization period it is 5 colleges per year which increased to 9 colleges per year in the post liberalization period.

The Compounded annual growth rate before liberalization is 8.43 and it is 5.02 in post liberalization period, whereas the overall compounded annual growth rate is 7.08

Above values clearly infer that globalization has created enormous employment opportunities which in turn gave augmentation in growth of technical education

Table 3. Growth of technical education institutions in India and Karnataka

TIME PERIOD	KARNATAKA		INDIA	
	AVERAGE PER YEAR	CAGR	AVERAGE PER YEAR	CAGR
BEFORE 1991	4.53	8.43	22.4	4.75
AFTER 1991	9.21	5.02	106.08	8.2
TOTAL PERIOD	8.88	7.08	106.66	6.33

Source: Author complication

For the period 1951 to 2014 the average number of technical education institutions grown is about 107 colleges per year in India where as in Karnataka it is about 9 colleges per year. The CAGR for the same period is 6.33 and 7.08 respectively for India and Karnataka.

Before 1991, the average number of colleges added in Karnataka is about 5 colleges per year where as for India it is 22 colleges per year that means 20% of technical education growth in India is contributed by Karnataka. The CAGR of Karnataka is higher than India which 8.43 and 4.75 respectively. Before globalization Karnataka was having substantial number of technical institutions. Whereas after 1991, the average number of colleges added in Karnataka is about 9 colleges per year where as for India it is 107 colleges per year that means 10% of technical education growth in India is contributed by Karnataka. The CAGR of Karnataka is lower than India which 5.02 and 8.2 respectively. Before globalization Karnataka was having substantial number of technical institutions. Therefore maximum sanction of engineering institutions was given to other states of India.

Table 4. Types of Technical Education Institutions in Karnataka

Technical Institutions /Year	1947 – 1991	%	1991-2014	%	Total as on 2014	%
Engineering Degree colleges	50	25.64	156	39.69	206	35.03
Diploma colleges	139	71.28	154	39.19	293	49.83
JITs	6	3.08	6	1.53	12	2.04
Fine Arts colleges	0	0.00	77	19.59	77	13.10
Total	195		393		588	

Source: Directorate of technical education Karnataka 2014

In the pre-liberalization period out of the total 195 technical institutions in Karnataka, 25.64% were engineering degree colleges, 33.33% were engineering diploma colleges and 3.08% were the junior industrial training institutions

In the post liberalization period out of 393 technical institutions in Karnataka 39.69% were engineering degree colleges, 39.19% were engineering diploma colleges, 1.53% were JITs and 19.59% were fine arts colleges.

As on 2014 out of the total 588 technical institutions in Karnataka, 35.03% were engineering degree colleges, 49.83% are engineering diploma colleges, 2.04% are JITs colleges and 13.10% are fine arts colleges.

Table 5. Region wise Distribution of Engineering Colleges in Karnataka as on 2014

Division	Number of Colleges	%
Mysore	50	22.73
Bangalore	121	55.00
Belgaum	31	14.09
Gulbarga	18	8.18
Total	220	100

Source: Author compilation

The analysis reveals that out of the total number of engineering colleges in Karnataka i.e. 220 colleges as on 2014. 55% of the engineering colleges are in Bangalore region, 22% of the engineering colleges are in Mysore region, 14.09% of the engineering colleges are in Belgaum region and 8.18% of the engineering colleges are in Gulbarga region

The region which is having developed infrastructure and concentration of industries like Bangalore and Mysore are having maximum of engineering colleges, where as backward regions like Gulbarga which is having poor infrastructure and lack of industries does not attract the establishment of engineering colleges.

Table 6. Region wise Distribution of Polytechnic Colleges in Karnataka as on 2014

Division	Number of Colleges	%
Mysore	49	16.8
Bangalore	120	41.0
Belgaum	67	22.8
Gulbarga	57	19.4
Total	293	100

Source: Author Compilation

The analysis reveals that out of the total number of polytechnic colleges in Karnataka i.e. 293 colleges as on 2014. 41% of the polytechnic colleges are in Bangalore region, 22.8 % of the polytechnic colleges are in Belgaum region, 19.4 % of the polytechnic colleges are in Gulbarga region and 16.8 % of the polytechnic colleges are in Mysore region

Table 7. Classification of Engineering Colleges 2013-14 – Administration wise

Sl. No	Technical Institutes	Administration – Classification					
		Government	University	Aided	Private	Total	%
1	Engineering Colleges	10	2	9	177	198	96.12
2	Womens Engineering Colleges	0	0	0	3	3	1.46
3	Evening Engineering Colleges	1	1	2	1	5	2.43
	Total	11	3	11	181	206	100
% of category over total		5.34	1.46	5.34	87.86	100.00	

Source: Directorate of technical education Karnataka 2014

The analysis reveals that out of the total 206 engineering colleges in the state as on 2014, 87.86% of the colleges are private colleges, 5.34% of the colleges are private aided, 1.46% of the colleges are University colleges and 5.34% of the colleges are Government colleges. The classification of the engineering institution reveals that 96.12% are engineering colleges, 1.46% is women's engineering colleges and 2.34% are evening engineering colleges.

Table 8. Classification of Polytechnic Colleges 2013-14 – Administration wise

S. N.	Technical Institutes -Diploma	Administration - Classification					%
		Government	University	Aided	Private	Total	
1	Co-eduation Polytechnics	69	0	42	159	270	92.15
2	Women's Polytechnic	9	0	1	5	15	5.12
3	Evening Polytechnic	1	0	1	4	6	2.05
4	Non-Engineering Polytechnic	2	0	44	0	2	0.68
	Total	81	0	44	168	293	
%		27.65	0.00	15.02	57.34	100.00	

Source: Directorate of technical education, Karnataka, 2014

The analysis reveals that out of the total 293 polytechnic colleges in the state as on 2014, 57.34% are private colleges, 15.02% are aided colleges and 27.65% are Government colleges. The classification of the polytechnic institution reveals that 92.15% of the colleges are co-education polytechnic, 5.12% of colleges are women polytechnics, 2.05% are Evening polytechnics and 0.68% is non-engineering polytechnics.

Table 9. Number of Admissions in Engineering Colleges

Sl. No	Years	Engineering					% Year on Year
		Boys	% Year on Year	Girls	% Year on Year	Total	
1	2009-10	34906		21076		55982	
2	2010-11	38101	9.153154	22579	7.131334	60680	8.391983
3	2011-12	40707	6.839715	23907	5.881571	64614	6.483191
4	2012-13	47203	15.95794	25418	6.320325	72621	12.39205
5	2013-14	49612	5.103489	26721	5.126288	76333	5.111469
Total		210529		119701		330230	
%		63.75223		36.24777			

Source: Directorate of technical education, Karnataka, 2014

The analysis reveals the number of students enrolled and % year on year growth in student enrolment in the engineering course for the reference period of 2009-10 to 2013-14. The total number of students enrolled is 330230 out of which 210529 are boys and 119701 are girls. The overall % year on year growth is 8.09%. The boy's % year on year growth is 9.26% where as the % year on year growth for girls is 6.11%

Table 10. Number of Admissions in Polytechnic Colleges

Sl. No	Years	Polytechnics					
		Boys	% Year on Year	Girls	% Year on Year	Total	% Year on Year
1	2009-10	42717		16164		58881	
2	2010-11	40490	-5.21338	15810	-2.19005	56300	-4.38342
3	2011-12	47417	17.10793	20321	28.53257	67738	20.31616
4	2012-13	48100	1.440412	21514	5.870774	69614	2.769494
5	2013-14	47904	-0.40748	23213	7.897183	71114	2.154739
Total		226628		97022		323647	
%		70.0232		29.97772			

Source: Directorate of technical education, Karnataka, 2014

The analysis reveals the number of students enrolled and % year on year growth in student enrolment in the engineering diploma course for the reference period of 2009-10 to 2013-14. The total number of students enrolled is 323647 out of which 226628 are boys and 97022 are girls. The overall % year on year growth is 5.12%. The boy's % year on year growth is 3.23% where as the % year on year growth for girls is 10.2%. The % year on year growth in girls is more than the boys which indicates that there various different course available in polytechnic education which more girls admission.

SUMMARY AND CONCLUSION

There is enormous growth found in technical education in Karnataka, over the span of sixty seven years, average number of institution added is about nine colleges per year. In the pre liberalization period it is five colleges per year which increased to nine colleges per year in the post liberalization period. More than half of the engineering colleges and forty one percent of the polytechnic colleges in Karnataka are located in Bangalore region indicating developed infrastructure and concentration of

industries is one of the factors responsible for establishment of more number of colleges. Almost ninety percent of the engineering colleges in Karnataka are private colleges; whereas only five percent of the engineering colleges are government colleges. In case of polytechnic colleges fifty seven percent are private colleges, and twenty eight percent colleges are government colleges. This means maximum number of technical institutions in Karnataka is in private sector.

The admission in technical education has also shown a tremendous growth. The percentage year on year admission growth in engineering education is eight percent where as in polytechnic it is five percent. The percentage year on year growth in boy's admission is more than girls in engineering education where as in polytechnic the percentage year on year growth in girl's admission is more than the boys which indicates that there are various short term courses available in polytechnic education which attracts the girl's students.

The study clearly gives the picture of growth and development of technical education in Karnataka. It also reveals the region wise distribution, management wise, admission trend, of engineering and polytechnic colleges across the various districts of Karnataka.

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