

## COMMUNICATION IN A CONNECTED WORLD CHALLENGES AND OPPORTUNITIES

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*We argue that even in the present age of excellent global connectivity, the world remains fragmented as we speak different languages due to historical reasons. This impedes fullest access to scientific and emotional literature of different language groups. We discuss the important role played by human translators in bringing the world together and for transmission of knowledge across frontiers for centuries. We argue that there is an urgent need to develop capabilities for translation from one language to other on a real time basis using modern information processing technologies such as Artificial Intelligence, to derive full benefits of the connectivity offered by modern means of communication and to realize the full intellectual potential of our global village.*

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**T**wentieth century is often referred to as the century of Science and Technology. Path breaking scientific discoveries of the century led not only to a complete understanding of the material universe but also to several new technologies which in turn led to new products and services for the common man. Semiconductor electronics, Computers, and Communications occupy a special place in the slew of technologies of the twentieth century. Today, electronic connectivity has broken all barriers. Information on anything to anyone at any time and in any place has now become a reality. The ubiquitous mobile phone, for example, can not only connect anyone to anyone, anywhere at any time, something that could not have been imagined just a few decades ago but also perform several other tasks. Storage and retrieval of written information have also reached new limits and are still

growing. There is no doubt that we are living in a connected world. Has this unprecedented connectivity led us to new levels of communication amongst us? We believe that we are yet to draw the full benefits of this newfound connectivity and evolve into a communicating world.

### ***The Challenge of Language Multiplicity***

It is well known that all living things communicate; they communicate not only with others of the same species but also across the species. We signal to each other, we talk to each other; we even communicate with other animals like our own cows, oxen, horses, pet dogs, pet cats etc. In the mountains of Northern Turkey, people developed a sophisticated language consisting of trills, chirrups, lilting whistle, called “bird language” over centuries to communicate over large distances. Unfortunately, with the advent of mobile phones, this language is slowly dying. It is hoped that the recognition of this language as an Intangible Cultural Heritage by UNESCO may help keep it alive. It is also known that animals communicate with each other through various means. Dogs communicate with their packs by barking. Mynah is known as the sentry of the

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jungle, as it alerts its flock and others by making loud and distinct calls the moment it spots any predator on the move. Bees have evolved a language of their own to communicate with other members of the beehive to tell them of the location of the source of food through an intricate dance. Glow-worms have perfected a pattern of glow to attract a mate. Even trees and plants are known to communicate among themselves, for example, at the time of attacks by herbivores like locusts, using a unique internal network to warn each other against potential enemies and start releasing repellants or even poisonous chemicals. It is only non-living objects which do not communicate at all, either with each other or with others. It is not surprising that communication has always been an integral part of the evolution of human civilizations over millennia.

It is also known that communication is a learnt skill, at least among the humans. A newborn child can only cry when it is in discomfort or when it is hungry. It slowly picks up how to communicate with its mother through sounds, gestures etc. It then learns a language, the mother tongue. Reading and writing are integral parts of the language learning process. Starting with pictures and paintings, the learning continues into letters, words, sentences, and grammar. Written communication gets over the problems associated with distance and time. It is not surprising that people having the same mother tongue form small cohesive communities. It is also known that there are many mother tongues across the world.

The evolution of written scripts, grammar, and literature are all important milestones in the development of languages. Equally important is the evolution of media to write on. Starting from paintings on rock surfaces and rock edicts, we have come a long way. The discovery of paper and printing press were again important milestones in the evolution of languages. Even though printing was known in China for a long time, the discovery of mechanical printing press by Johannes Guttenberg in 1440 AD, made books available to a large population.

There are about 7100 spoken languages across the world today. A good number of them have no scripts or grammar and have fewer than thousand speakers.

## **Communication Across Generations**

Human beings have always been interested in sharing knowledge and information not only amongst their contemporaries but also with their succeeding generations. How has communication across generations evolved in the past? In the pre-historic era, oral communications were the only mode of communication and were limited to short distances and to a limited number of people. There is no record of what was communicated except in the memory of the persons who were involved in the communication. If this had to be communicated further to somebody else, it had to be only by word of mouth again. It is not surprising that transfer of information and knowledge across generations has always been a challenge. In the famous search for his “Roots”, the author Alex Haley hears about his ancestor Kunta Kinte, who was kidnapped and taken as a slave to America, from the vanishing tribe of singers who memorized the family histories of villages in the form of songs. Indian rulers used to have bards to compose tales of their ancestors and their adventures, victories, and genealogy in poetic form. Understandably, the tales were mostly highly exaggerated.

The preservation of Vedic literature in its pristine form over generations purely through oral traditions is a remarkable example of communication across generations and has been recognized by UNESCO as a Masterpiece of the Oral and Intangible Heritage of Humanity on November 7, 2008. The four Vedas (Rig, Yajur, Sama, and Atharva) are not ‘books’ in the usual sense, though within the past hundred years each Veda has appeared in several printed editions. They comprise rather “tonally accented verses and hypnotic, abstruse melodies whose proper realizations demand oral instead of visual transmission.” A great deal



**Figure 1.** Cave Paintings of Bhim Baithaka (Madhya Pradesh, 10,000 BC)

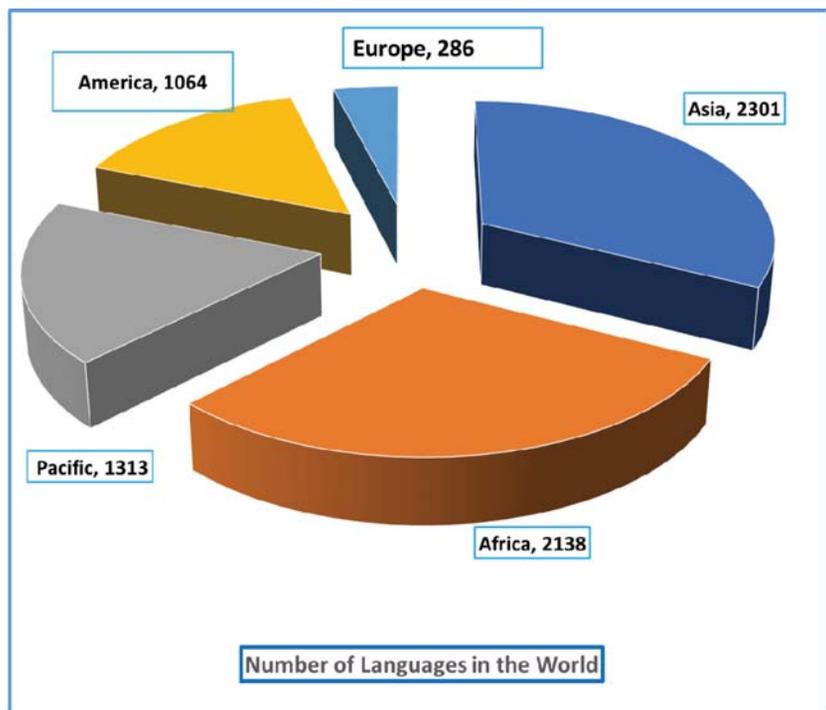
of energy was applied by ancient Indian culture in ensuring that these texts were transmitted from generation to generation with inordinate fidelity. Many elaborate forms of recitation or pathas were designed to aid accuracy in recitation and the transmission of the Vedas. Thus, for example in the Krama-Patha a hymn “word1 word2 word3 word4 ...”, is recited as “word1word2 word2word3 word3word4 ...”. The procedure is so successful that the seven or eight styles of chanting have accurately preserved, for example, the 1,028 hymns with 10,600 verses of the Rigveda.

Probably the first major technological milestone in communication across generations through written communication is through pictures and paintings on stones. The Chinese took this style of logograms to a high degree of sophistication and historical records exist from as early as 1200 BC. In fact, it is so successful that people from different parts of the country can read the writings of each other, though they may not be able to talk to each other easily! With the evolution of writing on rocks, clay tablets, bones, leather pieces (parchment), palm leaves, bark of trees (mostly birch), cloth, metal plates, and finally in recent centuries on paper, languages also evolved in terms of their grammar and literature. Written communication adds permanence to the communication. It conveys information not only between the people who are involved in the first instance in the communication but also it remains as a permanent record and these record exists over a long period of time, may be sometimes several thousands of years. They survive major calamities, natural or man-made but they exist, and they carry the information from one generation to another. But of course, it also leaves some unanswered questions. The early method of conveying information to the next generation through painting it has survived major disasters, natural or man-made. It is very easy to decipher thousands of years later, which we can see in rock painting in caves and other areas. We can easily see what they were trying to communicate what they were trying to say. In fact, their cave paintings of mammoths- which died out around 10,000 years ago, have remained a very valuable historical record. Yes, certainly in some cases not all information may be available and there could be uncertainty arising with the interpretation but basically the records are reasonably easy to decipher.

When the information is conveyed in the form of written texts rather than pictures, it adds some problems because languages and scripts differ from place to place and languages and scripts evolve with time. There have been instances where it has not been easy to decipher what was written. For example, the Indus Valley inscriptions are yet to be deciphered in full. Scripts of Americas, for example developed with no contact with the Old World and have remained difficult to decipher. Often, the required linguistic expertise may not even exist. Some unique traditions of scripts are also dying; for example the Kayasthas (traditional scribes and keepers of revenue records) of Uttar Pradesh, Bihar, and Madhya Pradesh used to have a script, called “Kaithi” of their own, which is no longer in use. Similarly, the Marwari community has a script called “Mundi”, which is also vanishing.

Earlier, towards the end of thirteenth century, ‘Phags-pa’ script was designed by the Tibetan monk and Imperial Preceptor Drogön Chögyal Phagpa, for Kublai Khan- the founder of the Yuan dynasty, as a unified script for the written languages within the Yuan. The actual use of this script was limited to about a hundred years during the Mongol Yuan dynasty, and it fell out of use with the advent of the Ming dynasty.

Some very inspired and painstaking work and lucky finds have helped in deciphering some of the ancient writings. Thus, Jean-François Champollion deciphered the



**Figure 2.** Languages in the World (Source: Ethnologue: Languages of the World, Eighteenth Edition)

Egyptian script in 1822, with the help of the famed Rosetta stone. James Prinsep (1799-1840) deciphered Kharoshti- with the help of bilingual Greek- and Kharoshti, and Brahmi- with the help of Greek-Brahmi coins, and went on to decipher Ashoka's edicts, including those on his famed pillars.

Language multiplicity hampers written communication as much as oral communication. The evolution of languages over time adds to the challenge. There have also been attempts to develop and popularize entirely new languages. For example, a new language called Esperanto was invented in 1887 by a Polish ophthalmologist named L.L. Zamenhof, essentially to bring about world peace but with only up to two million people worldwide speaking Esperanto, it is far from being a global language.

Interestingly, well developed languages are also the ones that go often out of active use because of the difficulties associated with learning these languages by majority of the population, the man on the street. Sanskrit, which has a vast literature on grammar, logic, philosophy, mythology, economics, politics, administration, poetry, drama, various art forms as well as health care etc., was not used for communication among common people and survives as derivatives of Prakrit and Apbhansa as several vernacular languages, like Hindi, Bengali, Gujarati, Assamese, Panjabi, etc. A large body of literature in Pali (Magadhi Prakrit) survives in Buddhist monasteries of India, Sri Lanka, Tibet, and Thailand, etc., as the most important Buddhist literature, Tripitak, is compiled in it. It is no longer in general use.

The written form of Latin, called High Latin, got ossified whereas the spoken form of Latin called Vulgar Latin, morphed into a string of several vernacular languages: Portuguese, Spanish, French, Romanian and of course Italian. Latin remains the *lingua franca* of the Catholic Church. Hebrew was confined to literature and prayers from the time of Bar Kokhaba War in 135 AD, till it was revived as spoken language on October 13, 1881, when Eliezer Ben-Yehuda and his friends decided to exclusively speak Hebrew in their conversations. Now it is the state language of Israel.

India has more than 1500 languages spoken as mother tongues. Only about 10% of these have a sizable speaking population. Some of them do not even have a script of their own. The Indian Constitution recognizes 22 languages, though the Indian States recognize more (thirty-one). The local dialects and accents enhance the richness as well as the complexity. The net result of this enormous language diversity is that when a child goes to school, there is no

guarantee that it will receive education in its mother tongue. The language of the street, the language of the state, the language in the workplace, may all be different. The language learning may continue well after the school days.

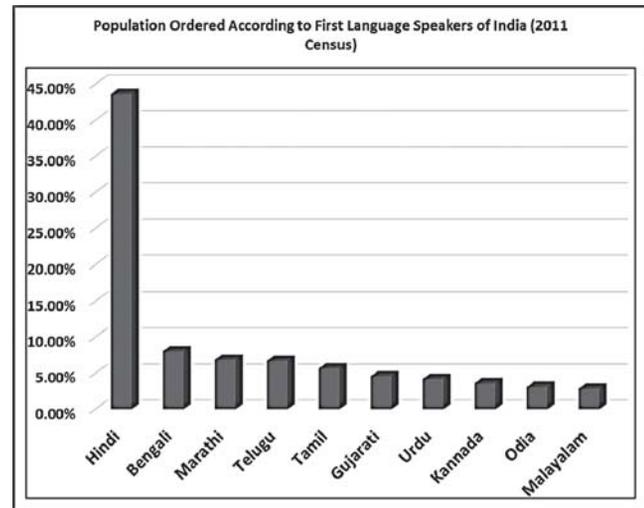


Figure 3. Population of India organized according to first language speakers (only top ten). Hindi includes Rajasthani, Hariyanavi, Braj, Bhojpuri, Bundelkhandi, etc.

When we were young, we thought that once you learn the English language, you are a global citizen. You will be understood everywhere. One visit to an interior village in Maharashtra, one visit to a small town in Europe or Africa or South America will convince anyone that it is not so. It will not be an exaggeration to say that we live in a world fragmented by languages. The unprecedented connectivity of today has only highlighted our inability to communicate beyond well-defined groups.

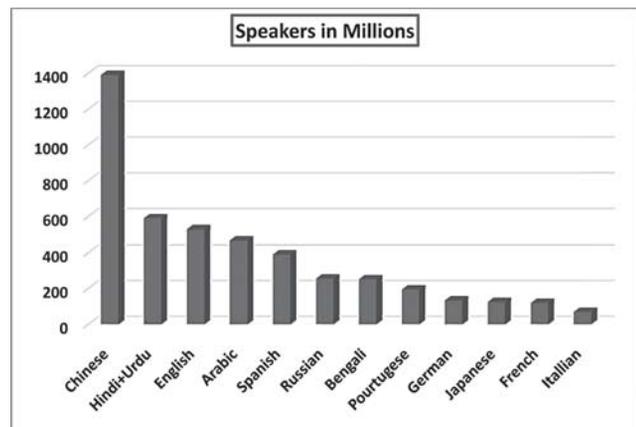
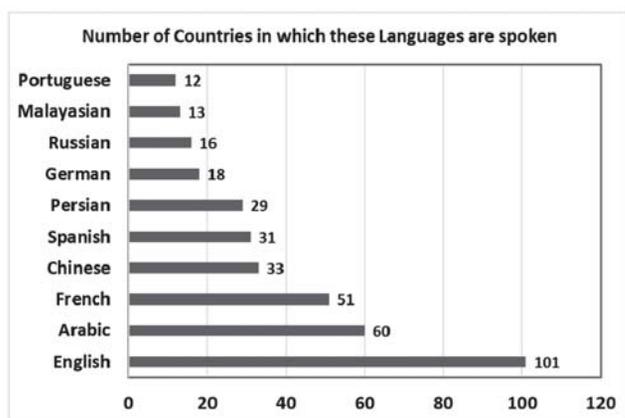


Figure 4. Speakers (in Millions) of Top Twelve Languages in the World (Data from Ulrich Ammon, University of Dusseldorf, Population Reference Bureau)

How have we been handling this language diversity? For historical reasons like colonization, English has



**Figure 5.** Number of countries where some of the major languages are spoken

(Source: *Ethnologue: Languages of the World, Eighteenth Edition*)

emerged as the link language of people across many nations. It is estimated that up to 1.5 billion people across the world learn English today, while those who learn French, Chinese or Spanish are just 82, 32, and 14.5 million. English has also evolved as the main working language of Science and Technology today. Most scientific papers are published today in English. It was not so even a hundred years ago. Newton's *Principia Mathematica* was written in Latin. Leonardo da Vinci left extensive notes on mechanics, flow of rivers, astronomy, optics, architecture, and flight of birds, etc. Even though he wrote in Italian, he used a characteristic 'mirror writing' - left-handed and moving from right to left. Marie Curie's work was published in French. Einstein's first influential papers were written in German.

In India, the educational system and the bureaucracy have been knit together by the English language, again for historical reasons. Even several decades after independence, there is no single language that is understood across the country. The constitution of India provides (clause 3 of Article 348) that in case of any dispute about interpretation of laws and orders, the English version shall prevail!!!. However one should not forget that a majority of the population in India and across the world do not understand English.

### **Role of Translations and Translators**

How have we handled language multiplicities in the past? Learning multiple languages is of course a definite solution but it takes time and effort and is not easy. There is a limit to the number of languages that one could gain mastery over. Professional translators have always been around. Translators and translations have played a major role in communication across populations speaking different languages. Translation is not a matter

of substituting words in one language for words in another. It is important to understand the thoughts expressed in one language and then express it using the resources in another language.

It is interesting to recall that *Panchatantra* (written around 200 BC and attributed to Vishnu Sharma) was translated into Pahlavi during the time of Khusro in sixth century AD and then into Arabic, Hebrew, Latin, Italian, and finally into English by Sir Thomas North in 1570, even before William Jones and others started translating Sanskrit texts into English. The story of *Ramayana* is known across South East Asia, through translations.

The West learnt about India from "Indika", written by Megasthenes (c. 350 BC-250 BC), who was an ambassador at Chandragupta Maurya's court. The original is lost, but its fragments survive in other books and translations, where it is quoted. "The Histories", written earlier by Herodotus (c. 484 BC- c. 425 BC) and its translations, had whetted the appetite of the West about India.

It is important to recall that Arabic translations of the vast Greek literature on philosophy etc. preserved it during the period of Dark Ages of Europe. Its translation back into Latin later led to the Renaissance of the Twelfth Century in Europe. The Western world also learnt of mathematical (including the discovery of zero), algebraic, and astronomical works of Indian scholars, like Aryabhata, Brahmgupta, and Bhaskara II, and others through their Arabic translations. Muhammad ibn Musa al-Khwarizmi (780-850) wrote "Kitab al hisab al Hindi" ("Book of Hindu numericals"), which was translated into Latin as "Algorithmi de Numero Indorum" ("Al-Khwarizmi's Indian numericals") and gave rise to the word "Algorithm". Abu Rayhan al-Biruni (c. 973 – 1050) travelled to India with Mahmud Gazanavi. He translated the works of Patanjali into Arabic. His encyclopedic work on India called "Taḥqīq mā li-l-Hind min maqūlah maqbūlah fī al-'aql aw mardhūlah" (variously translated as "Verifying All That the Indians Recount, the Reasonable and the Unreasonable" or "The book confirming what pertains to India, whether rational or despicable") in which he explored nearly every aspect of Indian life, including religion, history, geography, geology, science, and mathematics; remained a source of information of information about India for centuries.

When the large body of Buddhist and other secular literature accumulated over centuries at the libraries of Nalanda, Udantpuri, and Vikramashila were lost to burning by Bakhtiyar Khilji in 1300 AD, parts of it were recovered from translations available in China.

First English translation of Einstein's papers on relativity were published by M. N. Saha and S. N. Bose in 1920. The famous paper of S. N. Bose on "Planck's Law and Hypothesis of Light Quanta" was translated into German by Einstein and submitted on his behalf for publication in the prestigious *Zeitschrift für Physik* in 1924. An interesting anecdote involves the visit of S. N. Bose to Marie Curie. The story goes that on seeing Bose, Madame Curie gave him a long lecture that Indians do not learn and speak French. Bose is said to have listened to her patiently and then replied in impeccable French that he knew French very well!

It is rightly said that words can now travel worlds, however the driving is done by translation. Language provides us with immense power provided we can cross the communication hurdles by tearing down the barriers of language. This can only be done with the help of translators. Translators have always been necessary when two groups of people who have grown independently come into contact from the times immemorial. They were a very important part of the entourage of conquerors like Alexander the Great and Chinggis Khan. We know about other cultures, their customs, their literature, their philosophy of life, their feelings, and their technology with the help of translators. Without their help, the world will remain fragmented, even with the vast improvements in connectivity and communication.

The weaknesses of professional translators are also well known. History is full of instances, where an incorrect translation led to serious conflicts.

The Hebrew word "karan" (radiance) was incorrectly taken as "keren" (horns) by St. Jerome while translating The Old Testament in 382, and for centuries Moses was depicted in paintings with horns.

During the Second World War, when reporters asked the Japanese Premier Kantara Suzuki how his government felt about the Allies' request that Japan surrender, he replied "Mokusatsu." This one-word answer was translated as "Not worthy of comment," when actually it should have been translated as "No comment" because the Japanese government had not had a chance to consider it till then. Some historians think that this increased the resolve of USA to drop the nuclear bombs on Japan. Many historians believe that the National Security Advisors of USA may have mistranslated and then deliberately distorted critical intelligence, which precipitated the Vietnam War, which resulted in 1,313,000 people dead, countless wounded, and the devastating environmental effects of Agent Orange that continue to this day.

At the height of cold war, a comment of Nikita Khrushchev, "we shall live to see you buried" or "we will outlast you" was translated as "we shall bury you"- which was taken as a threat and led to serious tension.

A mistranslation of "canali" (channels) used by the 1877, Italian astronomer Giovanni Virginio Schiaparelli in the maps of the surface of Mars as "canals" led to a belief that an advanced civilization existed on it, and inspired some great early science fiction, like H G Wells' *War of the Worlds* and Edgar Rice Burroughs' *A Princess of Mars*!

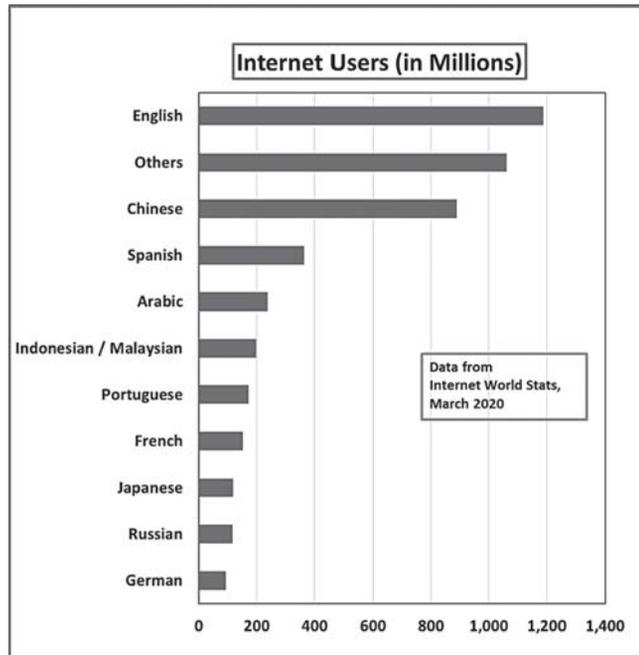


Figure 6. Internet Users (in Millions) by the Language

### ***The Dawn of the Digital Era***

Recent developments in communication, computing, and storage technologies of digital information have brought revolutionary changes in the way one could manage language multiplicities. In the recent years, gadgets that translate on-line from one language to another have become available but are limited to only a few languages. A software to translate written and even spoken language to sign language using animations is available.

However, there is an additional challenge. Spoken languages have many idiosyncrasies associated with regional variations, gestures, intonations etc. Translation of emotional literature and satire can be quite challenging. Evolution of languages over time is also a challenge. We should also remember that none of the languages in vogue evolved in an environment of digital technologies. The literature of science and technology is even more complex.

Each branch has its own unique vocabulary and would need specialized translators. For example, the word "Plasma" has different meanings in different disciplines—ionic plasma, blood plasma, quark-gluon plasma.

The evolution of Artificial Intelligence together with large memory capacities is adding a new dimension to machine translations, the emergence of learning systems. Will it eventually lead to a barrier free communication across the globe?

### ***The Challenge of Fast Changing Technologies on Communication***

The digital world of today depends very strongly on hardware, software, and gadgets. The underlying technologies are also changing very fast. This leads to a very peculiar situation. If there is a break in technology arising from some unnatural event, we may suddenly find that we have a communication break with no access to any stored information.

A real-life example is change from punched paper tapes to computer cards to magnetic tapes to magnetic drums to large size discs to floppy discs to compact discs to pen drives for storage of information, within the last 50 years. Readers for many of the older memory storage devices are no longer available and if the information have not been transferred to newer devices as and when they were available, the information is lost forever. With the advent of cloud memory, we may not even know where

the information we are using is stored and how susceptible they are for technological changes.

What does this lead to? It may lead to a very strange situation. May be a few hundred years down the line, our grand-children may have access to information which are thousands of years old but may not have access to few hundred years old information at all because they do not have the right gadgets to read. Vulnerabilities are also continuously changing. Are we going back in time in communication across generations? We really do not know. But what is important to recognize is that while communication has evolved over a long way with added strengths and new capabilities, it also left some gaping holes which we need to address.

### ***The Way Forward***

What are the challenges in communication that we need to address so that we draw the full benefits of the connected world?

1. We need to ensure that we communicate with each other cutting across language barriers
2. We need to ensure that access to information is not bogged down by language barriers
3. We need to ensure that our communications with future generations are not susceptible to unforeseen breaks, natural or man-made

These are challenges not only to linguists and social scientists but also to the scientists and technologists. □