The Development of Speech and Expression

Speech and language as a means of communication are marvellous qualities. Speech is used between man and man or on occasions, if it is used in, what can be termed, a collective speech in which there is no individual expression. Speech is part and parcel of everyday life and we tend to take it for granted. However, we can safely assume that in primitive man, speech and vocabularies were limited and rather crude. In the long history of man’s development, his progress, though slow, has been remarkable; from a crude ape to an intelligent being in a million years or less, from hunter to agriculturist, from stone to metal user, to citizen in about twenty thousand years or so. That the primitive man who appeared some half-a-million years ago should have had within him the possibilities of civilization with all its achievements in various fields and cultures is an amazing thing.

There are various characteristics which differentiate man from animal. These include the power of thought: thinking that solves problems and difficulties and involves concepts, plans, ideas, reflection and a strong will to survive. We find only the simplest beginnings of any such faculties in animals, but man, from the start, plans and devises to improve his lot and his life. One very significant difference between man and animal is speech and the use of language. Many animals make signs to each other, uttering cries of warning and the like, but they do not use names for things and actions: they do not converse. There is the use of countless sophisticated tools and machinery devised for a purpose. Furthermore man lives in a community.

Over a period of perhaps half a million years or so, there has been an immense development in the brain but this was accompanied with the brain of animals. The difference is not merely quantitative, it is qualitative. There are new specialized structures, not merely more cells. In the cortex, which exercises the central regulation of all actions, consists of a dense network of about 10,000 million nerve cells and their interconnecting processes. No new neurone (nerve cells) are ever added to those with which each human being is born. It is mainly in the new connections and patterns that accumulated knowledge resides. The larger (in comparison with other creatures) efficient brain offers increased possibilities of reacting positively in various ways, a greater capacity for developing talents and improving skills and knowledge. Thinking is the basis of speech and the human being is able to speak because he possesses not only the vocal mechanisms but the cortical accompaniment. If this is missing or injured, speech is impossible. As far as I know, no exact statistics are available, but I am informed that the percentage of those in Malta with serious speech defects is not high, and probably less than 0.4% (less than 1 per 250).

With the development of man, gradual organic changes passed into a new phase of operation - one which is shrouded in mystery, but as striking an innovation as the beginning of life itself. It is difficult to define how this came about, but probably the result of a number of factors acting together. Development no longer proceeded just by the transference of the physical genetic material - the hereditary genes and related matter, but also by the handing on and the development of ideas. Acquired skills and knowledge was passed on, not only by speech, but then in writing, next in printed books and in our age - via the new means of communication. Speech and words were being reinforced by experience and by necessity. There must have gradually emerged in the stream of life a new element: the verbal inheritance of acquired experience and ideas.

To some extent, speech is a reaction to a particular environment as is skin colour or body shape; muscles tend to develop stronger in certain trades where more use is made of them. Speech probably developed further when communities came into existence, as speech was, as it still is, the medium through which human co-operation could be brought about. It also co-ordinates and correlates the diverse activities of men for the attainment of common ends. One may say that language is not always synonymous with race, it may start that way, but the movement there is the less it will stay so.

The nerve is one of the most marvellous of creations in Life. Embodiment of sensitivity and directiveness, it will convey messages both of feeling from the outside world and of command to action in response. It is indeed remarkable how a nerve network evolves into a nerve system, with as its hub a ganglion that is best thought of, although not wholly accurately, comparable to an automatic telephone exchange.

It is impossible to claim full understanding of the extraordinary, intricate process of how Man acquired the unique faculty of expression and speech. Man represents the highest form of organisation of matter and energy that has ever emerged on Earth. Recognition of this kinship with the rest of the Universe is necessary for understanding him, but his unique essential nature is defined by qualities found...
ERRATA

The opening paragraph of the paper titled “The Development of Speech and Expression” by Dr. C.J. Boffa Consultant Dental Surgeon, should read as follows:

Speech and language as a means of communication are marvellous qualities. Speech is used between man and man or on occasions, it is used in, what can be termed as, a collectivised speech. Speech is part and parcel of everyday life and we tend to take it for granted. However, we can safely assume that in primitive man, speech and vocabulary was limited and rather crude. In the long history of man’s development, his progress, though slow, has been remarkable; from a crude man to an intelligent being in a million years or less, from hunter to agriculturist, from stone to metal user, to citizen in about twenty thousand years or so. That the primitive man who appeared some half-a-million years ago should have had within him the potentialities of civilization with all its achievements in various fields and cultures is an amazing thing.
Neurological Aspects of Diving

The nervous system is exposed to many unfamiliar sensations in underwater diving, both from the external environment as well as from the body's internal environment.

The underwater environment of a diver is very different from normal: the individual is surrounded by a low-gravity water environment, and the sense of touch is often dulled by a wet-suit and gloves. Sounds are strange and give little indication of direction or distance. The vestibular apparatus has to deal with continually changing body positions in three dimensions, and little sensation of gravity. Visual input is often distorted, reduced or even absent in low visibility dives.

In addition to these sensations that can largely be anticipated, unexpected sensations can also arise if the function of the nervous system (e.g., the vestibular apparatus) is upset by changes in the surrounding pressure or temperature.

The internal environment of the body is altered in diving because of the effects of breathing gases under pressure. Oxygen, nitrogen and the other gases in air are dissolved in the blood and tissues in larger amounts at increasing depths. The extra nitrogen may disturb normal brain activity. This effect can produce vertigo and other symptoms.

Under pressure, nitrogen takes on the properties of a麻醉欣性 gas. The narcosis it causes is due to its increased fat solubility at high pressures which causes impairment of transmission of impulses at peripheral nerve terminals. The increased pressure may result if the input to the brain from one vestibular apparatus is impaired, which can happen when the pressure drops too rapidly. The dive may also be a symptom of nitrogen narcosis or decompression sickness.

Nitrogen Narcosis

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Nitrogen narcosis is a state of altered consciousness that can occur when a person is exposed to high pressure for a prolonged period of time. It is characterized by dizziness, confusion, and difficulty in performing tasks.

Decompression Sickness

Decompression sickness occurs when the body is subjected to high pressure for a prolonged period of time. It is characterized by dizziness, confusion, and difficulty in performing tasks.

The nervous system is involved in up to 35% of severe cases of decompression sickness, and these are the most serious, as a permanent deficit such as paraplegia may result. Symptoms may develop immediately on decompression or may be delayed for up to 15 hours after a dive. Obvious symptoms of nervous system involvement may be preceded and
who studied this aspect, says that there are about fifty different positions and the stop-step-step process is very rapid. On reflection we realise how highly developed man's neurological system is. Although the main function of teeth is chewing, they are also important in speech and help one speak clearly. The shape of the dental arch and the way the teeth occlude can have an effect on speech sounds. Certain letters of the alphabet need the assistance of teeth to form proper sounds, while some others may not be pronounced fully correctly without the aid of teeth. Of course, teeth also contribute considerably to one's facial shape, form and expression.

The development of articulate speech is not an instinctive process. A child does not arrive in this world with an inborn predisposition to express himself in any particular language. One born of Maltese-speaking parents like us, will gradually learn to speak in a foreign tongue if brought up in an environment where another language is used.

Various anatomical and soft structures play a part in speech. It is interesting to reflect on this aspect. There are no special organs designed primarily for speech; by a process of adaptation and over a period of millions of years, man has learnt to make use of apparatus which perform other functions, such as the respiratory system, jaws, tongue, lips and palate, the masticatory and facial muscles, etc. These are used primarily for breathing, swallowing, and mastication of food. The larynx evolved to act as a safety valve to guard against the entrance of saliva and food into the airways. The lungs and the diaphragm regulate the inward and outward flow of air during respiration. Of course we know that it also plays an important part in speech.

Before a child can express his needs, say of hunger and thirst and, in due course, his thoughts in words, he must pass through various stages, during which he gradually acquires the ability to co-ordinate the movements of the various muscle groups, and eventually to express articulate speech. This period varies between a normal, intelligent child and a less fortunate one. Genetics, health and environment all play their part. The great majority of children, given the right conditions can learn to pronounce nearly all words during childhood. Speech is usually not established until towards the end of the second year of life, but the actual sounds used in speech are acquired much earlier.

The Growth of Speech
Both the sensory impressions received and the neuromuscular control of the speech organs are concerned in the growth of speech. The nervous system of man is a marvellous, highly sophisticated structure by which one is able to react to various types of stimuli of the environment and other factors and which controls the activity of the other systems of the body so that the whole mechanism functions in a coordinated manner.

As this development proceeds, the child is able to make increasing use of the spoken sounds he hears around him. Both the sounds he hears from others and those he makes himself become important in the process of speech development. Impulses arising in the sense organs such as the eyes or ears reach the brain by means of afferent or sensory nerve fibres, the most important being the auditory nerve. Tactual sensations resulting from contacts between various parts of the speech mechanism, tongue teeth, lips and chin, which stimulate the tongue and lips in co-ordination of the movements of the speech mechanism being used in articulation. Through this system of sensory and motor nerve fibres with the association areas of the cerebrum, speech patterns are gradually built up, and co-ordination of the muscles concerned in speech ensues. These patterns form very definite speech habits, and any alteration in such habits or anatomical defects will influence speech adversely. For example in the case of cleft palate patients, faulty speech may develop because of the child's inability to produce sounds normally owing to the cleft palate and is not the result of auditory impairment or lesion in the afferent nervous pathway.

As the child grows, there is gradually a change from mere vowel sounds to the use of sounds which more nearly resemble language. Parallel with the development of speech there is soon a fairly rapid growth in understanding. Adult brains are not merely in constant chemical and physiological action, they are also small generators producing electrical impulses that make the brain thousands of times busier than a switchboard. Brainwave patterns are not fully understood, but they affect speech and expression considerably.

In a normal healthy individual, voice can be regulated. Meanwhile breathing must be kept up. To win better dominance over his environment and organise the community around him, that individual must be a well-integrated whole and capable of teaching or guiding others by means of his voice or his actions. Voice must have played a vital part in the story of every ancient man.

So man has been blessed with Voice. How is it produced? There are several muscle groups in the larynx, voice box or cartilage of the cartilage in the throat that can be felt as the Adam's apple and forming part of the wind-pipe. Two thin bands of tissue are stretched across it, one on each side of the opening. The human voice is regulated by the nervous system and results from air being passed over the vocal cords while breathing out. Muscles contract and relax the vocal cords. When we make sounds, these muscles narrow the opening by pulling on the vocal cords. As air from the lungs passes through the larynx, the cords vibrate. The result is audible sound. (The cricoid, which makes such a strident call which goes on for several hours, has strong cords and tissues in relation to its small size). The volume of the sound in Man depends on the force with which the lungs push up air, however, the pitch of the sound depends on the tension in the cords and their length. The tighter they are pulled, the higher is the frequency of sound.
produced and vice-versa. Generally speaking, women have shorter vocal cords than men; that is why their voices are higher pitched. Men’s voices are generally an octave lower than women’s. Up to the age of puberty, boys and girls have larynges of the same size, and voices of nearly the same pitch. In boys, the larynx grows larger and the voice breaks.

The vocal cords can produce only simple sounds of varying pitch. Different vowel sounds are produced by varying the shape of the mouth cavity through the use of voluntary muscles and related oral tissues, including the tongue and lips. Consonants are formed by changing or interrupting the air flow through the throat and mouth.

**Conclusion**

In the Mediterranean region, Man’s life, including his speech and vocabulary, probably blossomed so to speak, in Neolithic and later times. In this living stream, we can imagine to some extent the emergence, conflict, rejection and survival of various ideas which occurred with the passage of time. Few other factors have effected history more than vocabulary and coordinated efforts among settled communities. However, without the evidence of writing we cannot tell exactly what were the languages of the paleolithic and neolithic peoples. We know little of how languages developed. Limited information can be derived from the fragments of early writings and drawings in ancient caves. During the Early Stone Age, man’s vocabulary must have been rather scanty. He had his mind and his skills to help him, his conscience to contend with and his imagination. The weather must have played an important part in his everyday life. He was also concerned with omens, diseases, life and death, and sacrifices to his gods. Life for Neolithic man was likely to have been a difficult one, one of hard labour in order to survive. Challenges in everyday life must have spurred him on to greater efforts. He probably coined new words for new things and new crafts. With the ups and downs of life, new words and new expressions blossomed.

The development of languages poses many questions. What, for instance, constituted the original vocabulary and coordinated efforts among settled communities. However, without the evidence of writing we cannot tell exactly what were the languages of the paleolithic and neolithic peoples. We know little of how languages developed. Limited information can be derived from the fragments of early writings and drawings in ancient caves. During the Early Stone Age, man’s vocabulary must have been rather scanty. He had his mind and his skills to help him, his conscience to contend with and his imagination. The weather must have played an important part in his everyday life. He was also concerned with omens, diseases, life and death, and sacrifices to his gods. Life for Neolithic man was likely to have been a difficult one, one of hard labour in order to survive. Challenges in everyday life must have spurred him on to greater efforts. He probably coined new words for new things and new crafts. With the ups and downs of life, new words and new expressions blossomed.

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**Mechanical physiological effects**

1. **Micro-massage:** the membranes and particles within the cell vibrate but not the whole cell.
2. **Micro-shaking** by means of the alternate compression and rarefaction the particles and membranes vibrate.
3. **Acoustic streaming** which causes increased membrane permeability. The microstreaming next to a membrane in damaged tissues causes increased absorption and diffusion of the exudate.
4. **Acoustic radiation pressure:** (the pushing force caused by the alternating compression and rarefaction). The positive pressure is followed by a negative pressure which never quite returns to the pre-pressure situation, and hence the idea that one can drive medication through the skin. A process known as Phonomorphosis.

5. **Cavitation:** the alternating waves of high and reduced pressure causes the formation, growth and pulsation of gas or vapour filled voids. It can occur in body fluids, cell suspensions or in tissues. Cavitations can occur in two ways: (a) Stable cavitations which are formed but remain intact for many cycles. (b) Transient cavitation, the bubbles grow suddenly and collapse under the changing pressure of the ultrasonic field, with a resulting huge, local rise in temperature. This will cause gross damage to cells and tissues. This will not occur if the transducer is kept moving.
6. **Heat:** The backwards and forwards movement of particles causes friction and this is converted into heat (probably sub-threshold heat). Using pulsed beam, the heat generated is so minute that this is not sufficient for a therapeutic effect.

**Summary of physiological effects**

- **Thermal**
- **Mechanical**
- **Chemical**

**Summary of therapeutic effects**

- **Absorption of extravasated tissue fluids**
- **Heating**
- **Tissue Repair**
- **Thinning/Softening of fibrotic tissue**
- **Analgesic**
- **Spasmolytic**
- **Phonophoresis**
- **Diagnostically.** (Ultra-sound with a frequency of 1MHz can be used to diagnose certain early fractures. For example the metacarpals; which do not show up on X-Ray. The suspected site is isolated with continuous ultra-sound and should an ache be felt, then a fracture has to be kept in mind).