Languages and Disabilities: Is There Anything BME Can Help Out With? Some History, Too

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The Tower of Babel

[1] Now the whole world had one language and a common speech.

[2] As people moved eastward, they found a plain in Shinar and settled there.

[3] They said to each other, "Come, let's make bricks and bake them thoroughly." They used brick instead of stone, and tar for mortar.

[4] Then they said, "Come, let us build ourselves a city, with a tower that reaches to the heavens, so that we may make a name for ourselves; otherwise we will be scattered over the face of the whole earth.

[5] But the Lord came down to see the city and the tower the people were building.

[6] The Lord said, "If as one people speaking the same language they have begun to do this, then nothing they plan to do will be impossible for them.

[7] Come, let us go down and confuse their language so they will not understand each other."

[8] So the Lord scattered them from there over all the earth, and they stopped building the city.

[9] That is why it was called Babel, because there the Lord confused the language of the whole world. From there the LORD scattered them over the face of the whole earth.

Genesis 11:1-9; New International Version (NIV)

All these events took place in Shinar, the country of two rivers, ancient name of the great alluvial tract through which the *Tigris* and *Euphrates* pass before reaching the sea. Later, the given name was Chaldaea or Babylonia, the Asia Minor Mesopotamia.

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Among several cities, there was Babel or Babylon. How beautiful and simple the story … why did linguists have to make things so difficult and complex?

The Indo-European Languages (IELs) are a family of several hundred related tongues and dialects. There are about 445 living IELs with over two-thirds (313) of them belonging to the Indo-Iranian Branch (IIB). The most widely spoken IEL by native speakers are Spanish, English, Hindi, Portuguese, Bengali, Russian, Persian, and Punjabi, each with over 100 million speakers. Today, 46% of the human population speaks an IEL natively, by far the highest of any language family. The Indo-European family includes most of the modern languages of Europe, and parts of Western, Central, and South Asia. All IELs are descendants of a single prehistoric language, reconstructed as ***Proto-Indo-European*** (PIE), spoken in the Neolithic era. Although no written records remain, aspects of the culture and religion of the people who spoke it can be reconstructed from the related cultures of ancient and from some modern speakers who continue to live in areas to where they migrated from their original homeland. However, nothing is absolutely certain, with an unfortunate significant degree of speculation [1], [2].

The objectives set herein are three:

- first, to briefly go over a few linguistic aspects;
- second, to visit that wonderful man-made simple tongue, Esperanto;
- third, to look for BME ways of help.

It sounds as too much, perhaps too far-fetched, implausible, but it would not be the first time to dream and foresee something good and nice setting its feet on an impressive history. Besides, the concept of *disambiguation* will be underlined all over the text, as it refers to the removal of any ambiguity that often tends to confuse the meaning of words or sentences (a typical language common drawback).

Linguistics: What's that?

Long years ago, when both residing in the United States, the author's father, (a linguistics' and tongues' fan who once candidly aimed at learning not less than 50 different languages) [3], gave his son (MV to MEV) a copy of the already above-mentioned book by Mario A. Pei, an internationally recognized linguist. Pei, born in Rome, Italy, came to the United States with his parents in 1908. As a high school teenager, he spoke not only English and his native Italian, but also French and had studied Latin. Over the years, Pei became fluent in several other languages (including Spanish, Portuguese, Russian, and German), and capable of speaking some 30 others, having become acquainted with the structure of at least 100 of the world's languages! As in music and mathematics, some people are endowed with ease or prodigy for languages. How lucky! Languages are the entrance gates to whole cultures.

Language, according to Pei, is the spoken medium, with its written auxiliary, that serves as an overwhelming degree for the communication needs of the human race. We must add here that besides the basic biological drives (feeding, sleeping, and reproduction), communication should also be included as a basic need, followed perhaps by the need of music and art, very special forms of human expression and communication. In other words, the fully isolated man or woman is unthinkable. For a happy ending, Daniel Defoe's (ca. 1660–1731) Robinson Crusoe had to be rescued after 28 long years on a lonely remote tropical island!

Linguists speak in terms of *principles* and *parameters*, as a framework within the so-called *generative linguistics*, in which the syntax of a natural language is described in accordance with general *principles* (i.e., abstract rules or grammars) and specific *parameters* (i.e., *markers* or *switches*) that for particular languages are, say, the position of heads in phrases. A language can be either *head-initial* or *head-final*, where the two latter are parameters acting as *on* or *off* signals (i.e., English is *head-initial*, whereas Japanese is *head-final*). Thus, there is a *Generative Grammar*, or a system of rules intended to produce exactly those combinations of words which form meaningful grammatical sentences in a given language. Principles and parameters were largely formulated by the linguists Noam Chomsky [4] and Howard Lasnik [5]. Many linguists have worked within this framework, and for a period of time, it was considered as the dominant form of this discipline. The theory has also addressed other aspects of a language's structure, that is, phonology, morphology, syntax, and semantics. Chomsky and others have argued that many of the properties of a generative grammar arise from a universal grammar

which would be innate to the human brain, rather than being learned from the environment. It is, no doubt, quite a provoking and attractive hypothesis as the human being is the only species able to speak. The idea would well fit Darwin's and Wallace's nowadays mostly accepted the origin of species theory. However, there are competing versions currently practiced within linguistics. Nothing really fully established yet, making things rather complex, tough, and messy for the uninitiated. The Universe is a huge amazing wonder, but no doubt, the Human Mind is even a greater and more amazing, startling wonder.

Functional magnetic resonance imaging has been applied trying to detect in the cerebral cortex if there are regions where the meaning of language would be represented, that is, to map out a *semantic system*. However, little of this system has been produced, and the semantic selectivity is unknown. Data were collected while subjects listened to hours of narrative stories. It has been shown that such system is organized into intricate patterns that seem to be consistent across individuals. Thereafter, a generative model may create a detailed semantic atlas. Results would suggest that most areas within the semantic system represent information about specific semantic domains, or groups of related concepts. In other words, some kind of neural encoding would exist.

Universal language

Ludwik Lejzer Zamenhof (1859–1917) was a Polish medical doctor, an ophthalmologist, most widely known for creating *Esperanto*, the most successful constructed language in the world. Zamenhof (Figure 1) dreamt of a world without war and believed that this could happen with the help of a new international auxiliary language, which he first developed in 1873. Hence, there is a peace philosophy message fully justifying the Green Star as its symbol. Mario Pei was a defender of Esperanto, a position that he clearly stated in his book *The Story of Language*, previously referred to above.

Zamenhof published the first book detailing Esperanto, *Unua Libro,* on July 26, 1887. The name of Esperanto derives from *Doktoro Esperanto*, his pseudonym (Esperanto translates as *one who hopes*). The language has only 16 grammatical rules. Take a look at a few of them plus some example simple sentences:

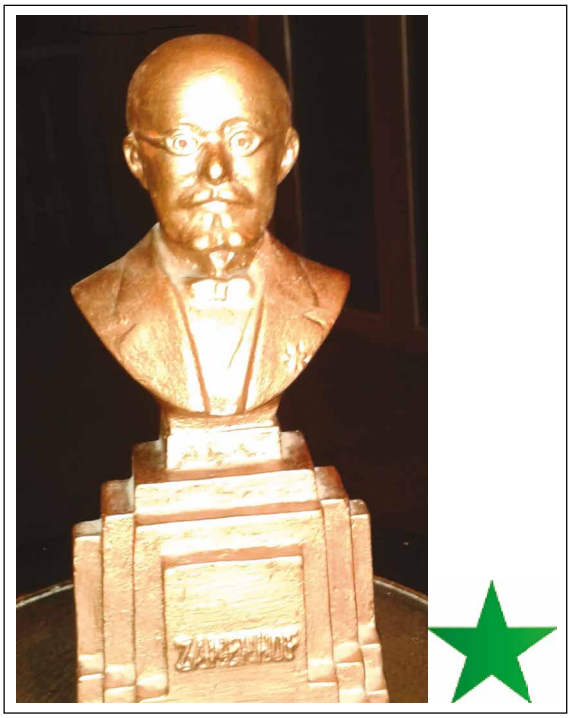

Figure 1. Left: Small bust of Zamenhof, property of the author. Right: Green Star is shown, standing for the Esperanto Hope of World Union.

There is only one definite article, **la**, alike for all genders, cases and numbers; say, **la libro** = the book; **la strato** = the street. **Nouns** have always the ending **-o**. To form the **plural**, add the ending **-j**. Example: **amiko**, and **amikoj**, that is, friend and friends. The verb does not change for person or number. Present time takes the ending **-as**, as **mi amas** = I love; past time, **-is**, as **mi amis** = I loved; future time, **-os**, **vi amos** = you will love; conditional, **-us**; command, **-u**; infinitive, **-i**. Another one: Every word is read as it is written. A final example for now: **Mi ne faris tion** = I did not do that; **Mi neniam faris tion** = I never did that.

For Spanish speakers, the nice little book by Jorge Hess is recommended, first published in the 1950s by the *Liga Argentina de Esperanto* (Argentine Esperanto League); it can now be downloaded from the Web. Besides, there are available several Esperanto u-tubes, even claiming that some are "native speakers" since their parents talked to them in it during their respective kids' growth periods.

BME has some experience in helping disabilities

The well-framed structure of Esperanto suits it for programming, in a way somewhat similar to what has been done to assist the rehabilitation process of autistic children. It might become a complementary means. Let us see a few related examples.

Lopez et al. [6] described a hybrid human–machine interface, based on electrooculogram (EOG) and electromyogram (EMG), which allows the mouse control of a personal computer using eye movement and the voluntary contraction of any facial muscle. The bioelectrical signals are sensed through adhesives electrodes and are acquired by a custom-designed portable and wireless system. The mouse can be moved in any direction, vertical, horizontal, and diagonal; two EOG channels and the EMG signal are used to perform the mouse click action. Blinks are avoided by a decision algorithm and the natural reading of the screen is possible with specially designed software. A virtual keyboard was used for the experiments with healthy people and with a severely disabled patient. The results demonstrate an intuitive and accessible control, evaluated in terms of performance, time for task execution and user's acceptance. Besides, a quantitative index to estimate the training impact was computed with good results.

Perez et al. [7] described the experience obtained at a public hospital following requirements outlined by the attending physicians to a group of children with different autism spectrum disorder degrees, that is, by using a friendly software environment with activities aimed at improving the communication and the interaction of the children with the computer. The proposed interface is an assistive technology, and, as such, it was defined as a Human Activity Assistive Technology model for the purpose of its evaluation. This model considers that the assistive system is composed of:

- the user (a person with a disability);
- the activity (a task carried out by the user);
- the assistive technology (a device to carry out the activity);
- the context (the environment where the user performs the task).

A third paper by essentially the same group presented an assistive home care system specially designed for people with severe brain or spinal injuries and for poststroke survivors who are immobilized or face mobility difficulties. The main objective was to create the easy, low-cost automation of a room or house to provide a friendly environment that enhances the psychological condition of immobilized users [8].

All the three mentioned articles make reference to other similar contributions, meaning that apparently there is a tendency in an automated direction.

Discussion

There are syndromes related to a foreign accent and bilingual aphasia; they are cases with significant language alterations, including understanding changes. Quite interesting is the strange situation that after a blow on the head (it is said), a person may speak a language he or she never knew before (xenoglossy). The word derives from Greek (xenos, foreigner) and (glōssa, tongue or language). It was coined by the French parapsychologist Charles Richet in 1905. However, such a phenomenon is usually considered of paranormal occurrence and, apparently, no well-documented cases have ever been reported, although the latter reference above mentions it. Such paper states verbatim that Foreign Accent Syndrome (FAS) is a little known disorder affecting language which has been described in a few cases after acute strokes or traumatic brain injuries, but until now has not been reported in multiple sclerosis (MS). It is characterized by the appearance of what is perceived to be a foreign accent in the language of the patient. Like aphasia, FAS can occur in MS as a manifestation of a cortical language disorder. It is important to recognize this in order to prevent mistaken diagnoses.

The idea of a universal grammar can be traced back to Roger Bacon (1220–1292), a British philosopher and scientist, who observed that all languages are built upon a common grammar, even though it may undergo incidental variations, and the 13th century speculative grammarians who, following Bacon, postulated universal rules underlying all grammars. The concept of a universal grammar or language was at the core of the 17th-century projects for philosophical languages. During the early 20th century, language was usually understood from a behaviorist perspective, suggesting that language acquisition, like any other kind of learning, could be explained by a succession of trials, errors, and rewards for success. In other words, children learned their mother

tongue by simple imitation, through listening and repeating what adults said.

The term *parameter* is normally reserved for points of narrowly restricted variation. The Principles and Parameters (P&P) framework also acknowledges that languages vary in ways that are relatively unconstrained by a Universal Grammar, such as the exact form of vocabulary items. These latter points of variation are usually treated as arbitrary idiosyncrasies, to be listed in the LEXICON (i.e., the vocabulary of a language, an individual speaker or group of speakers, or a subject). The P&P framework has its origins in the two foundational questions of modern linguistics (Chomsky 1981): "What exactly do you know, when you know your native language? And how did you come to know it?" A satisfactory answer to these questions must address the fact that children are not reliably corrected when they make a grammatical error. Despite the poverty of the stimulus, by the age of about 5 years, we observe "uniformity of success" at language acquisition. Aside from cases of medical abnormality, or isolation from natural language input, every child acquires a grammar that closely resembles the grammar of his or her caregivers. Moreover, even when a child is younger and still engaged in the process of language acquisition, extraordinarily few of the logically possible errors are actually observed in the child's spontaneous speech. Clearly, children do not acquire grammar through simple trial-and-error learning. Linguists have concluded that a great deal of grammatical information must already be present in the child's brain at birth.

Language seems to hold many mysteries as the human species is unique in such magnificent ability. Research faces impenetrable barriers that defy the so far most sophisticated techniques or possible theories. Nonetheless, such obstacles do not mean surrender. The human species is also stubborn and persistent. ■

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