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The Three Stage Digital Evolution of Linguistic Humans

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Abstract

Digital Linguistics (DL) is an interdisciplinary study that identifies human language as a digital evolution of mammal analog vocal sign communications, founded on the vertebrate spinal sign reflex mechanism [Tokumaru 2017 a/b, 2018 a/b/c/d]. Analog signs are unique with their physical sound waveforms but limited in number, whilst human digital word signs are infinite by permutation of their logical property, phonemes. The first digital evolution took place 66,000 years ago with South African Neolithic industries, Howiesons Poort, when linguistic humans acquired a hypertrophied mandibular bone to house a descended larynx for vowel accented syllables containing logical properties of phonemes and morae. Morae made each syllable distinctive in the time axis and enabled grammatical modulation by alternately transmitting conceptual and grammatical syllables. The sign reflex mechanism is an unconscious self-protection and life-support mechanism, operated by immune cell networks inside the ventricle system. DL identified cellular and molecular structures for the sign (=concept) device as a B lymphocyte (or, in other words, Mobile Ad-Hoc Networking Neuron), connects to sensory, conceptual and networking memories, which consist of its meanings [Table 1]. Its antibodies can network with antigens of CSF-Contacting Neurons at the brainstem reticular formation and of Microglia cells at the neocortex [Figure 1]. It is plausible that the 3D structure of the antigen molecule takes the shape of word sound waveform multiplexing intensity and pitch, and that specifically pairing the antibody molecule consists of three CDRs (Complementality Defining Regions) in the Antibody Variable Region network with the logic of dichotomy and dualism. As sign reflex deals with survival issues such as food, safety and reproduction, it is stubborn, passive and inflexible: It does not spontaneously look for something new, and it is not designed to revise itself. These characteristics are not desirable for the development of human intelligence, and thus are to be overcome. All the word, sensory and network memories in the brain must be acquired postnatally through individual learning and thought. The reason and intelligence of humans depend on how correctly and efficiently humans learn new words and acquire appropriate meanings for them.

Keywords: Digital evolution, digital Linguistics, sign reflex mechanisms

Introduction: Laryngeal Descent, Literacy and Group Theory

Digital Linguistics is an interdisciplinary study that identifies human language as a digital evolution of mammal analog vocal sign communications, founded on the vertebrate spinal sign

reflex mechanism. Analog signs are unique with their physical sound waveforms but limited in number, whilst human digital word signs are infinite by permutation of their logical property, phonemes. The author identifies the birth of linguistic humans at the time of the laryngeal descent, which provided vowel accented syllables containing logical properties of phonemes and morae, to 66KA (thousand years ago) on the southern coastline of South Africa at the beginning of the Howiesons Poort industry.

Linguistic humans spent more than 60KY (thousand years) without recording their system and in 5KA, cuneiform was invented in Mesopotamia. In the brain with orthography, written text is automatically translated into speech voice. A character set comprises long lasting syllables which can be shared in a geographic zone and over generations. A civilization is a linguistic phenomenon of linguistic humans. At the end of their biological life, they can write their accumulated knowledge with a character set, so that subsequent generations can share their thoughts and experiences to develop further. This linguistic phenomenon enabled rapid and serial innovations which we call civilization.

In the 21st century, text has become available in electronic form, which is interactive against keyword search. It is time for linguistic humans to be equipped with logic of group theory for conceptual operation to cope with a flood of information of an uncertain quality and reliability.

Stage-1: Laryngeal Descent and Phonemic/Moraic Syllable Production

In Middle Stone Age (MSA) of South Africa, Still Bay (SB) and Howiesons Poort (HP) make up two outstanding Neolithic industries. The starting and ending ages for SB were estimated as 71.9 and 71.0 ka and, for HP 64.8 ka to 59.5 ka. SB and HP emerged along the southern coastline of the African continent. The representative cave for SB is Blombos Cave, and those for HP are the Klasies River Mouth Caves.

Amongst the artefacts unearthed from HP, there were types of tools which were only known from 'advanced' Upper rather than Middle Palaeolithic sites in Europe, and the stratigraphic position (65-59 KA) of Howiesons Poort was highlighted by the excavation of the Klasies River Mouth main site (Wurz 1999). This time-reversal has not been fully discussed and analyzed, as it requires a Copernican turn from a Eurocentric perspective.

The commencement of Still Bay, 71.9 KA, coincides with the Toba volcanic winter. The Still Bay area is on a shallow beach. Klasies River Mouth Caves are located at a few hundred kilometers east of Still Bay, where the waves are high and strong enough to make extremely large caves at the mergence of the Atlantic and Indian Oceans. It is remarkable that the HP artefacts contain engraved ostrich eggshell containers. This sudden augmentation in the precision and sophistication of artefacts at SB/HP indicates that there was a critical technological and cultural breakthroughs at the beginning of SB/HP periods, one of which was probably language. This development of Neolithic industries in SB/HP corresponds with a two-stage development of logical properties in voice, by virtue of phonemes to generate an infinite number of word signs and moraic accents to make individual syllables distinguishable over a time line. Owing to accents, word signs and grammatical syllables can be transmitted alternately without any marks, which enabled dualistic grammatical modulation of adjacent word signs (Tokumaru 2018).

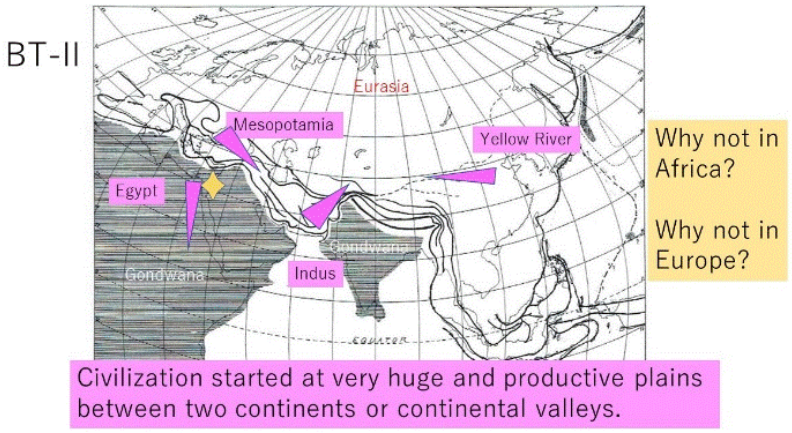
Table 1. Digital Evolution in Physical and Logical Layers

Digital Evolution in Body/Brain and Physical Properties (Reconfiguration)		**Digital Breakthrough**
1.	**Laryngeal descent:**	**Supra-Laryngeal Vocal Tract**
	Phonemic word sign reflex	(PHY) Infinite Word Signs
1)	Mora (monaural audition of mother tongue)	(LOG) Grammatical Processing
2.	**Literacy**	**Orthographic memory**
1)	Character Set for Long Duration	(PHY) Time and Space Sharing to yield Civilization
2)	**(in very low noise environment with repetitive thought operations)**	**(LOG) True Scientific Concepts**
3.	**Group Theory**	**Conceptual Operation**
1)	Electronic Form for Interactive Sylllables	(PHY) keyword Search and Electric Transfer
2)	(Access to multi-disciplinary information to be integrated by true concepts, activating bodily immune system to increase learning ability)	LOG) Forward Error Correction of Linguistic Information and reconfiguration of consciousness by Overcoming vertebrate Sign Reflex Restrictions

Group theory is prerequisite for correct conceptual operations

Stage-2: Literacy and Character Set

If the laryngeal descent had taken place 66 KA, linguistic humans had spent more than 60 thousand years without any external recording system. Then the first character set, cuneiform, was invented 5KA in Mesopotamia, a very vast flat land, where earth and sand sediments filled the sea between the Eurasia and Gondwana continents (Figure-2).



The size of land was beyond the perception of humans, and some form of recording system was needed for taxation. It can be concluded that the character set was not autopoietically invented like grammar. And, it was not the brain mechanism of linguistic humans which required or needed to have an external memory system. It was invented to correspond to the administrative requirements of dynasty to govern unimaginably vast areas, and only those who had gone through special training could read and write. These people probably had not foreseen that a character set should help develop a civilization.

A civilization is a linguistic phenomenon of linguistic humans. At the end of their biological life, they can write their accumulated knowledge with a character set, so that subsequent generations can share their thoughts and experiences. This linguistic phenomenon enabled rapid and serial innovations which we call Civilization. The character set and knowledge of orthography provided linguistic humans with an extended external memory system which could be shared and passed on. Civilization can be defined as the "time and space where members can share linguistic information such as law, literature, science, technology, etc. thanks to a character set and literacy, and can improve on this through the generations," which is a macroscopic definition. Or, another definition can be as follows: "In a civilization, a person is expected to learn what the precedent generations have achieved and go beyond them," as a microscopic definition. In our civilizations, modern humans became immortal by inheriting and improving on common intelligence.

The critical importance of characters, literacy, orthography, education, dictionaries, social equality, social stability (= peace) in civilization has been overlooked: Civilization is not industrial or materialistic, but complex linguistic phenomena. Civilization started around 5 KA in vast river valley regions such as the Tigris-Euphrates, Nile, Indus-Ghanga and Yellow River. To date, it has been universally assumed that such civilizations invented their own character sets. But precisely speaking, it is the opposite: The invention of such characters gave birth to separate civilizations, by enabling the sharing and handing down of knowledge. Thanks to documentation and the dissemination of knowledge through reading, linguistic humans acquired logical immortality in the accumulated knowledge over generations. In this way, civilizations transformed a dugout into a luxury ocean liner and a fire into signal into communication satellites.

Stage-3: Group Theory as Logic for Conceptual Operation

In the 21st century, much linguistic information is available in interactive electronic form. If we put some keywords into Google or other search engines, within seconds they list the relevant linguistic information, which can be immediately accessed, downloaded or converted into speech voice. The Open Public Access Catalog (OPAC) of libraries indicates which libraries hold the books we need (even down to the exact shelf location) and we can find new and secondhand books on the web to be paid with by credit card.

A lot of copyright free books, scientific papers and useful linguistic information provided by public organizations as well as private companies and individuals can be downloaded as PDF files free of charge. We can access them with our smart phone or laptops from anywhere in the world. It is necessary to establish methods to cope with a flood of information of an uncertain quality and reliability.

At the time of receiving information, receivers should identify the reliable information source, and examine if it is authentically presented as the original author desired, and if the author is honest to and responsible for their written words. To become familiar with the author's style, their other books and papers, biography or autobiography, oral history and manuscripts, etc. should also be referred to. Their contemporaries' witness and literature, i.e. the autobiography of the author's spouse, oral history of his colleagues, etc., may also provide useful information. When the authenticity of the text is confirmed, readers can hear the authentic speech voice of the authors (Tokumaru 2018).

Reading a book and understanding it is not an easy task. In general, authors are much more

knowledgeable than readers. Readers tend to feel that authors are geniuses, and to swallow their words without evaluation and understanding. It is necessary for readers to demystify authors, treat them as ordinary people, and trace their step-by-step learning, thinking and speaking process.

Readers are expected to read the author's text repetitively and intensively so that readers can share the prejudice, experiment, experimental results, thoughts, unsolved problems, guessing, surprises, etc. of the author. Readers must identify themselves with authors, as author-self, and must overcome errors in premises, experimental methods, observation and arguments, etc. Readers should verify the reversibility of an author's idea by investigating the authors' deeds and words, back and forward. Without fully understanding the author's knowledge and way of thinking, readers cannot detect the authors' errors and correct them.

Authors are responsible for providing all the necessary information to verify what they claim, and they must be honest and faithful to the fact. Source coding error correction can only be made against the works of honest authors, who respect to the written text. If only authors are honest, contradictions or inconsistency in the text may have meanings to better understand the overall situation.

Readers must carefully read the text word by word and must read between the lines to confirm the author's honesty in their literary style, consistency and careful wording, and clear and ambitious purpose, etc. Text written or transmitted by unreliable and dishonest authors may be set aside without reading.

Piaget noted, ''Logic is the mirror of thought, and not vice versa." (1947). The dynamic level of human intelligence depends on the in-brain logical circuit for conceptual sign processing. And, as we are born innocent or ''tabula rasa," we need to construct this logic for linguistic processing postnatally as efficiently and as precisely as possible. Here, the author proposes to define "word sign" and "concept" rigorously as it features the difference of applied logic: "Word sign" is "an in-brain cellular device equipped with a word sign sound receptor, networking with sensory and other word memories with a logic of 1-to-1."

"Concept" is "a matured and developed word sign device to represent all elements in a group based on 1-to-all logic." It is established through deliberate and thorough thought operations by individual persons. By confirming no exception,the dualistic logic of 1-to-1 evolves into 1-to-all. Concept is a product of intensive thought operations. Only those who maintain intellectual curiosity, enthusiastic desire to learn, and strictness in wording can obtain concept. Concepts are axiomatic and can be put into further thought operation and investigation for deeper consideration.

Logic applied for a sign reflex constitutes a dualism of 1-to-1 connectivity: (i) action, reminiscence: if A then B, (ii) comparison: A+B = ○, ×, △, ◎, ≡, ≠, 〈, etc. Linguistic humans with phonemes can generate a new word to name complex situation: (iii) A+B= C (a new word).

The above dualistic logic cannot satisfy the requirement for a complex concept, where the logic of 1-to-all governs. As 1-to-all logic is not natural, we have to invent and use a special logical circuit to operate concepts and to verify the correctness of conceptual meanings.

Piaget displayed five operations to interpolate between psychology and axiomatic logic, 'psycho-logic' or 'logico-psychology' in accordance with the group theory in mathematics. It is plausible that, by applying these formula as our logic to cope with concept operations, we can rectify conceptual meanings. The author tries to explain how to use each operation in the

following.

(I) Composition (Combinativity): x + x1 = y; y + y1 = z; etc. (Where x * x1 =0; y * y1 = 0; etc.)

The entirety should be divided into two distinctive concepts consisting of a excluded middle so that further conceptual operations should be effective and meaningful. This is the starting point of any concept and conceptualization. Without this rule, discussions should become ambiguous, meaningless and confusing.

Through thorough and repetitive operations, we have to confirm that this rule prevails. If any exception or ambiguity is discovered, we should stop discussion, and must investigate, verify and modify, as necessary, the names and meanings to make sure that the rules of composition (x + x1 = y and x * x1 = 0) should prevail in all concepts.

(II) Inversion (Reversibility): - x - x1 = - y; etc., from which y – x = x1 or y – x1 = x.

Composition must be decomposed by inverse operation, which excludes sophistry such as syllogism. Any complex concept can be composed and dismantled into lower level simple concepts with multiple operations.

In this way, any complex concepts can be defined as mathematical equations of clear, basic and simple concepts. "Definition" is not paraphrasing, but it must be an equivalent logical expression using generic and lower level concepts.

(III) Associativity: (x + x1) + y1 = x + (x1 + y1) = (z).

When a particular concept means different things or phenomena by different scientists, it is necessary to unify the meanings. This associativity can be used in such occasion: Concept A + α = Concept B + β = C

(IV) Identity (General operation of identity): x – x = 0; y – y = 0; etc.

This identity is a versatile tool, as we need to verify the identity of conceptual meaning in different societies, cultures, persons, timing, etc. Meanings of daily concepts cannot be generalized, as they consist of individual sensory episodic memories. Alternatively, meanings of logical and scientific concepts must be shared and must be identical regardless of the users.

In general, a new concept is born to name a newly discovered phenomenon or material. It is useful to know the unique situation where a new concept was invented or conceived by a particular person; what was observed and perceived, when, where, by whom, and why that concept was named as such. It is of no use and very dangerous to seek meaning by recombining memories which readers already possess.

All concepts are born through generalization, and we take then as granted that they have unified and standard meanings. This is true for some concepts, for example in molecular biology, corresponding uniquely to definite molecular structures. But in other cases, the meanings often vary, and their definitions are not shown. How should this be confirmed: X (definition by Dr. A) – X (definition by Dr. B) = 0 (no discrepancy)?

To make conceptual operation meaningful and productive, the definition of a concept must be perfectly identical to the phenomena represented by that concept: X(phenomena, physical) – X(definition, logical) = 0 (zero, no exception). We have to keep the identity between its definitions and its representing phenomena. If any exceptional phenomenon or contradiction

in definition are discovered, we should start discussions and research a remedy.

In interdisciplinary studies, it is necessary to determine the identity of two or more different but similar concepts. Are they the same? How different are they? Can we establish an interdisciplinary concept to unify several disciplinary concepts? For example, to which extent are "vocabulary" in linguistics, "word memories" in brain science, and "consciousness" in psychology identical ($A + \alpha = B + \beta = C$)? When differentials ($\alpha$, β) can be identified, concepts in different disciplines can be integrated.

Can Spencer's words, "instinctive reactions are reflexes (A=B)" be interpreted as instinctive reactions in animal ecology and based on reflex mechanism in brain science? To make such comparison easy, the author proposes, in biochemistry related sciences, to resort to molecular structure, which can serve as a lingua franca for interdisciplinary integration.

(V) Tautology (or special identities): $x + x = x$; $y + y = y$; etc. from which $x + y = y$

While Identity focuses on the identity between two concepts, groups or meanings, Tautology deals with the identity among elements in a group. For example, a dualistic operation of daily concepts can generate concepts of class and relationship, which can be described with this formula: "orange" + "lemon" = "citrus," "son" + "son" = "grandson."

Tautology is also useful when we think of very complex systems. For example, when "computer networks" + "genetic representation of Eukaryote" + "language" = "digital" (they are all digital systems), we can refer to a textbook of computer networks for insights to clarify linguistic communication and genetic representation. DL owes a lot to molecular biology and computer networks as it analyzes invisible mechanisms of linguistic processing in the brain.

Conclusion: To overcome sign reflex restrictions

We must realize that we use the spinal sign reflex mechanism for linguistic processing and intelligence, which is a stubborn, ego-centric, single sign based mechanism (Tokumaru 2018). It is memory based and involuntarily serves the application of fundamental activities such as eating, security, reproduction, etc. We determine what is right or wrong based on what we already know. We do not have self-diagnosis or reconfiguring mechanisms for our consciousness. These are egocentric mechanisms which prioritize a quick response rather than the right answer. Sign reflex is memory based, passive, self-sufficient mechanism, and not open to a new field. We miss hear words we do not know, regardless of their importance. We should pay attention to all words and recognize which are new to us or which are used in unfamiliar contexts. It is envisaged that we have to keep being curious in what we do not know, and must always be open to and take time to conceptualize new situations. Group theory logic becomes thus useful for individuals to differentiate correct from wrong concepts.

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