

HUMAN INTELLIGENCE OPERATED BY INNATE SIGN REFLEX LOGIC OF DICHOTOMY AND DUALISM AND POST-NATALLY ACQUIRED LOGIC OF “GROUP” AND “FORWARD ERROR CORRECTION (FEC)” - DIGITAL LINGUISTICS

Kumon Tokumaru

Digital Linguist, Oita, Japan

Email: tokumaru@pp.ij4u.or.jp

Abstract

It is plausible that language is processed by the innate spinal sign reflex mechanism. Human speech sound contains logical properties of phoneme and mora, which interact with in-brain antigen/antibody molecular structures and networking memories in the postnatally developed logical circuits optimized for signals of syllables, a character set (long lasting syllables) and electronic form (interactive and ubiquitous syllables). For grammatical decoding, sound localization function at the brainstem auditory nuclei is converted to process sound vectors of grammatical syllables. For axiomatic scientific concepts, sign reflex logic of “If A then B” must be upgraded by mathematical group logic to be acquired by learning, so that the results of interdisciplinary conceptual operations should become meaningful and productive. As electronic data is interactive, we can discover as many relevant linguistic information as possible with keyword search on the internet within a few seconds. As a result, we obtain multi-disciplinary and voluminous linguistic information but with uncertain reliability. To inherit collective human intelligence and correct any errors in linguistic information of the past, regenerative reading might be appropriate for individual ontogenesis to repeat intellectual and conceptual phylogeny. Errors cannot be corrected by the original authors posthumously but only by those who are alive now and equipped with error correction techniques for linguistic information.

Keywords: *digital evolution, dichotomy & dualism, group logic, spinal sign reflex, collective human intelligence, forward error corrections (FEC), Homo sapiens*

1. INTRODUCTION: DIGITAL HYPOTHESIS WITH PHONEMES AND MORAE

1.1 Neolithic Industries in Middle Stone Age South Africa

In South African Middle Stone Age (MSA), 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 (thousand years ago) and, for HP 64.8 to 59.5 ka. SB and HP emerged along the southern coastline of the African continent, which is the breakup edge of Gondwanaland 145 ma

(million years ago). The representative cave for SB is Blombos Cave, and those for HP are Klasies River Mouth (KRM) 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 KRM Cave 1. (Wurz 1999) This time-reversal has not been fully discussed and analyzed, as it requires a Copernican turn from a Eurocentric perspective. The author identifies that SB/HP industries correspond to the acquisition of click consonants and vowel accented syllables, and that Linguistic Humans were born 66,000 years ago in South Africa with laryngeal descent for vowel production. (Tokumaru 2020)

1.2 Acquisition of a digital hypothesis

Having visited the oldest modern human site, KRM Caves in South Africa in April 2007, the author hypothesized that quiet and dark environment inside the cave should have triggered and contributed to the linguistic evolution of humans, and expected that the Naked-Mole Rats (*Heterocephalus glaber*), which are naked, eusocial, altruistic, altricial and live underground tunnel in tropical savanna of East Africa, might have more vocal/acoustic signs than non-human primates. But they have just a total of 17 different sound patterns in their communication, and it became clear that the inside cave evolution hypothesis was irrelevant.

What makes the difference of “vocabulary” of more than 100,000 in a human language and 17 in Naked-Mole Rat? From sound spectrogram of their chirps, Naked-Mole Rats produce the same tonal patterns (upsweep, downsweep, “V”, inverted “V”, atonal, etc.) repeatedly, i.e. “at a rate of about 3/s, in bouts lasting 1-3 s.” or “twice per second in repeated bouts separated by pauses of 0.5 - 10s; each bout contained an average of 17 or 18 chirps.” (Pepper, Braude, Lacey, Sherman 1991) On the other hand, human words can be made as many as possible as the permutation of phonemes and can be delivered to listeners without any error by just-once transmission. It was inspired to the author that human communication might be *digital*.

1.3 Microphysical structure in Speech Sound

This development of Neolithic industries in SB/HP seems to correspond with a two-stage development of phonemes, frequency domain logical properties in voice: click consonants, then syllables. Clicks are phonemes without mora, timeline discreteness, while syllables contain mora thanks to vowel accents. It is plausible that the frequent use of the tongue to produce click sounds contributed to the unique mandible of modern humans and provided enough space to house the vocal tract with its descended larynx under oral floor. (Tokumaru 2020)

By virtue of phonemes, an infinite number of word signs can be generated. Moraic accents make individual syllables distinguishable in timeline. Owing to accents, word sign and grammatical syllables can be transmitted alternately without any mark, which enabled dualistic grammatical modulation of adjacent word signs. (Tokumaru 2018a)

2 LOGICAL FOUNDATION FOR LINGUISTIC PROCESSING

2.1 Innate Neural Logic of Dichotomy and Dualism

The Ventricle System (VS) of vertebrates started at the so-called Cambrian Explosion 530MA (million years ago) with the coincidental birth of the Cerebrospinal Fluid (CSF) and mobile neurons, designated as B- and T- lymphocytes. (Kourilsky 2014) B/T lymphocytes are categorized as immune cells in contemporary sciences, because scientists had discovered their immune activities before their mobile neural activities. It is plausible that the mobilization of neurons took place inside CSF/VS earlier than immune activities. Mobile neurons were born inside CSF/VS to work for sign reflexes and then expanded their activity area into blood vessels to work as pathogen patrols. (Tokumaru 2018b)

CSF-Contacting Neurons (CSF-CN) connect the cochlea in the inner ear with Brainstem Reticular Formation (BSRF) and display antigen-like terminals on the ventricle wall. The shapes of antigens should simulate the amplitude envelop fluctuations of word sign waveforms, as “the most important temporal components of the speech signal are the slower, amplitude envelope fluctuations, rather than the waveform’s fine time structure.” (Phillips 2001)

Inside CSF, B-lymphocytes are floating equipped with antibodies specific to antigens of CSF-CN. Neurons. The antigen-antibody networking between CSF-CN and B-lymphocytes can display a logic of dichotomy, i.e. recognition of preliminarily registered shapes. On the neocortex, Glial cells store sensory memories related to the word signs, displaying the same antigens with CSF-CN as indices, which can also network with B-lymphocyte antibodies.

Neurons and immune cells display a logic of dualism, which can integrate two different input stimuli into a single output ($A+B=C$), or indicate a destination (Go To B). (Jerne 1974)

2.2 Combination of logic to process language

The combination of dichotomy and dualism enables (i) spinal sign reflex behavior (If A then do B: A: “Tsunami!” and B: to climb up the hill immediately.), (ii) spinal sign reflex type reminiscence (If A then recall B stored in Glial cells: A: “Apple”, B: the taste of apples), (iii) thought or comparison (A and $B =, \neq, >, \circ, \times$, etc.), (iv) grammatical modulation/demodulation (Word sign + grammatical vector = semantic modulation) and (v) most primitive type of generalization (A and $B = C$, C : concept of class or relationship, primary concepts: “Apple” + “Orange” = “Fruit”, “caterpillar” / “butterfly” = “larva”). (Table-1)

Acquisition of External Logic is necessary for 2nd and 3rd Digital Linguistic Evolution

Physical Layer Evolution	Micro Physical Properties	Logical Layer Evolution	Logic to be Applied
1.Syllables	Phonemes (Frequency) and Mora (Time)	Grammatical Demodulation, Primitive Concepts	Dichotomy and Dualism (innate)
2. Character Set & Literacy	Long lasting syllables	Scientific concepts, Conceptual operations	Group logic (to be acquired)
3. Electronic Information	Interactive and Ubiquitous Syllables	Forward Error Correction (FEC)	Regenerative and Iterative * (to be acquired)

* Iterative thoughts for complex system need to use Schematic and Tabular Reference Models.

Table-1 External Logic Required for Three Stage Digital Linguistic Evolution

3 A CHARACTER SET GAVE BIRTH TO CIVILIZATION

3.1 Linguistic Humans became Immortal

The first character set was invented 5ka in Mesopotamia, a very vast flat land, where earth and sand sediment filled the sea between the Eurasia and Gondwana continents. The size of the flat land was beyond the perception of humans and some form of recording system was needed for taxation purposes. It was invented to support the administrative requirements of a dynasty to govern unimaginably vast areas, and only those who had gone through special training could read and write.

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 provided linguistic humans with an extended external memory system which could be shared and passed on. Text written with a character set is a sequence of long lasting syllables for persons with the knowledge of orthography. Literacy provides persons with an ability to hear voices of spatially and temporarily remote people through text.

The mechanisms to standardize writing and share written information are necessary to maintain and develop civilization: characters, orthography, literacy education, publications, dictionaries,

libraries, social equality, social stability (= peace), etc. 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 with their fertility invented their own character sets. But precisely speaking it was 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.

3.2 Complex Concepts and Mathematical Group Logic Application

When civilization matured, some intelligent people exempted from labor and family lived in very low noise environment such as temples and monasteries to contemplate on the law of the nature. With sincere, repetitive and deliberate thinking, they invented complex concepts.

The author differentiates word signs, primary concepts and complex concepts: (i) Word signs are connected to sensory memories by If A then B logic. (ii) Primary concepts are connected to results of simple dualistic thought operations between word signs: $A \text{ OR } B = C$, $A \text{ AND } B = C$ (A, B: word signs, C: primary concepts.) (iii) Complex Concepts are to designate invisible phenomena. They are operable and consisting of mathematical “group” to be defined by simultaneous equations of dualistic formulae to make mathematical group logic applicable, (a) Combinativity: $x + x^1 = y$; $x * x^1 = 0$, (b) Reversibility: $y - x = x^1$, (c) Associativity: $(x + x^1) + y^1 = x + (x^1 + y^1)$, (d) identity: $x - x = 0$, and (e) tautology: $x + x = x$. (Piaget 1947)

When Combinativity is assured, an entirety can be divided into A and not-A, consisting of an excluded middle. Additive use of combinativity can divide the world binarily, while its multiplicative use enables conceptual operations. When Complex Concepts fulfill the requirements of group, conceptual operations yield meaningful results. Reversibility allows step by step complication and simplification of concepts. Associativity allows to compare similar but different concepts. Identity is versatile comparison, and tautology is a tool for categorization. (Tokumaru 2019)

4 THE THIRD AND FINAL EVOLUTION

4.1 Interactive and ubiquitous syllables in electronic form

Text written with character sets can be transformed into binary electronic form in accordance with coding rules. Maintaining the long lasting nature of written text, electronic form is interactive. If we put some keywords into Google or other internet 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 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 can be downloaded as PDF (ISO 32000-2) files which can be printed universally by any printer. As it is ubiquitous, we can access them with our smartphone or laptops from anywhere in the world. It is necessary to adapt our brain circuit to cope with a flood of information of an uncertain quality and reliability, and let it yield profound effects.

4.2 Forward Error Correction of Collective Human Intelligence by Regenerative Reading and Iterative Thoughts

Complex living organisms reproduce themselves from a single fertilized egg through heterogeneous cell division. In addition, the complexity is increasing in long period of evolution. Can collective human intelligence reproduce itself and increase its complexity? How can?

Forward Error Correction (FEC) is a technology in digital communications to correct errors by exploiting redundancy contained in information without contacting the information sender or original authors. (Tokumaru 2019)

In information theories, errors are divided into two categories, source coding errors (SCE) for which an author is responsible, and channel coding errors (CCE) for which he is not responsible. As these two consist of an excluded middle, when both SCE and CCE are corrected, we can get error-free information.

FEC of collective human intelligence should be (i) identification of the most advanced teacher, (ii) verification of the authenticity of his words, and (iii) step-by-step verification of entire logical structures of his intellectual development through intensive, regenerative and iterative reading.

Introduction of FEC into linguistic communication or information is a new initiative. Traditional reading without FEC has a choice of all-or-nothing. They can believe and accept the author, or reject him entirely. With FEC, readers can partly accept a portion and correct the rest by themselves.

As our intelligence is based on the vertebrates' spinal sign reflex, it is a single-sign based mechanism and not good at contemplating on complex systems. Repetitive and iterative thought operations are necessary to implement FEC. For that purpose, schematic and tabular reference models are effective. Table 1/2 and Figure 1/2 are such examples.

3 Stage Evolution of Human Language : The order of complexity increased. © K. Tokumaru 2019

	530MA	3MA	66KA	5KA	21 st Century
Outside Brain Signal Evolution	Vertebrates were born with the Ventricle System	Early humans with erect-bipedal and opposable thumb were born.	Modern humans were born with the developed mandible and laryngeal descent to vocalize vowel accented syllables.	Character sets are syllables surviving beyond time and space, which were born at Intercontinental huge plain or river delta.	Linguistic data became interactive and searchable.
Complexity			Infinite words, grammar, culture	Civilization, Scientific concepts	① Interdisciplinary integration of sciences, ② Forward Error Correction at channel & source ③ Collective intellect'l genome
In-Brain Adaptation	Sign reflex mechanism consisting of immune cell networks (BSRF, B lymphocytes and Microglia)		At the expense of sound localization function at BSAN to automatically process sound vector of grammatical syllables.	Sign logic of If A then B evolved into Group theory logic, and word signs became concepts.	FEC to treat mass data with uncertain reliability. To go beyond restrictions of sign reflexes.

Table-2 Three Stage Digital Evolution in Physical (outside brain) and Logical (in-brain) Layers

An Overview of Linguistic communication (Schematic Model)

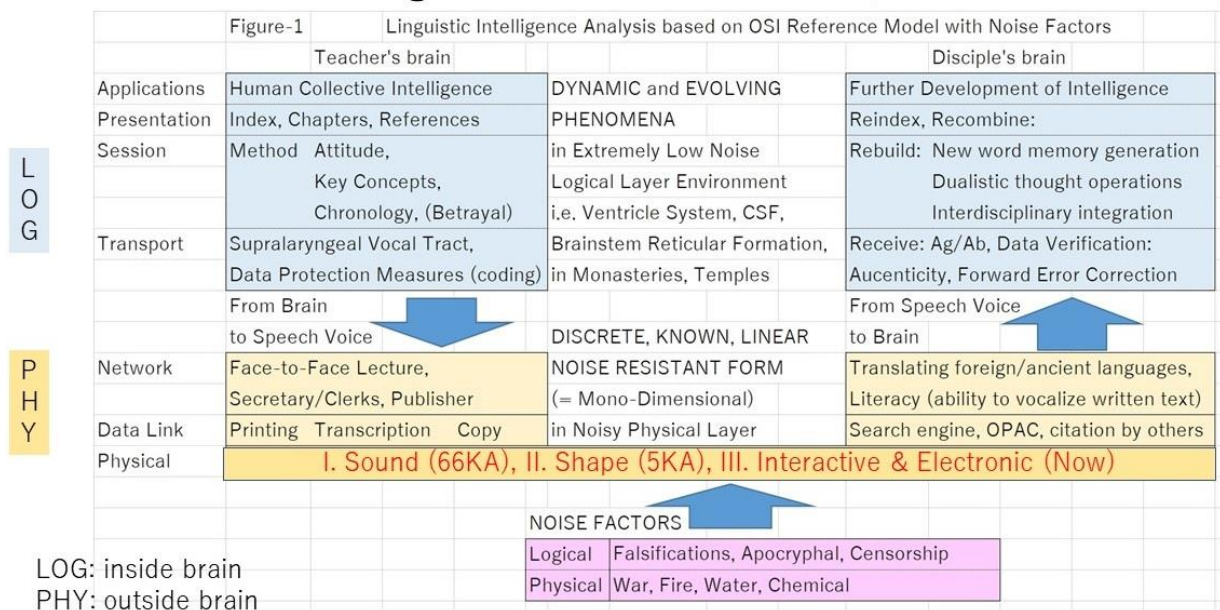


Figure-1 An Overview of Linguistic Communication. This diagram is a hybrid model of Shannon's General Communication Model and OSI Reference Model for Internet.

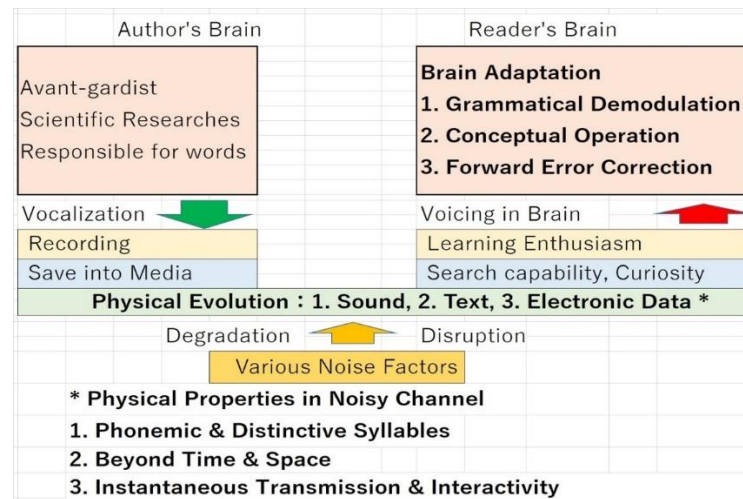


Figure-2 A Simplified version of Linguistic Communication Overview

5 CONCLUSION: TO BECOME HOMO SAPIENS IN TRUE SENSE

We have not established methods to integrate concepts interdisciplinarily or to correct any errors in books after the demise of original authors. Human linguistic communication is still analog method, which has difficulty in eliminating noises or errors, and this is then amplified through multiple handovers. In general, errors in classics are being carried over to contemporary textbooks and contaminate consciousness of scientists very seriously.

To correct any errors in linguistic information of the past and construct collective human intelligence, regenerative and iterative reading might be appropriate for individual ontogenesis of consciousness to repeat intellectual and conceptual phylogeny. When we learn a complex concept, we should go back to the scene where, when and how it was conceived by a particular individual, and trace his way of thinking to discover formerly unconceived phenomenon and to designate it with a new nomenclature of his invention.

It is time to understand the complexity and omni-potency of digital language as well as the logical (innate and acquired) mechanism of linguistic processing and intelligence. (Table-2) It is important to be aware that dichotomy and dualism are innate neuro-immune logic, while we have to embody external logic of mathematical group and FEC through learning and training. We are not *homo sapiens* at the birth. With the acquisition of group and FEC logic for linguistic processing and intelligence, modern humans will become *homo sapiens* in true sense and behave as so.

REFERENCES:

1. Wurz S., the Howiesons Poort Backed Artefacts from Klasies River: An Argument for Symbolic Behaviour, S.Af. Archaeological Bulletin 54(1999) :38-50.
2. Tokumaru, K. (2020) The Digital Linguistics: The Birth of Linguistic Humans 66,000 Years Ago in South Africa with Laryngeal Descent, Linguistics and Literature Studies (in press)
3. Pepper W.J., Braude S.H., Lacey E.A., Sherman P.W. "Vocalization of the Naked Mole-Rat" in Alexander RD et al(1991) The Biology of the Naked Mole-Rat, Princeton Univ.
4. Tokumaru, K. (2018a) Digital Linguistics – The Brain Mechanism for Grammatical Processing, 2018 LAMBERT Academic Publishing, Beau Bassin, Mauritius
5. Kourilsky P., (2014) Les Jeux de hasard et de la complexité – La nouvelle science de l'immunologie, Paris Odile Jacob (Japanese translation by Yakura H. (2018), Tokyo, Misuzu)
6. Phillips, D.P. (2001) Introduction to the Central Auditory Nervous System, in Physiology of the Ear, 2nd Ed. San Diego, CA: Singular, pp613-638
7. Tokumaru, K. (2018b) A Mobile Hypothesis of Neural Networks for Spinal Reflex and Linguistic Processing (Digital Linguistics), Linguistics and Literature Studies 6(6) 267-277
8. Jerne, N.K. Towards a network theory of the immune system, Ann Immunol (Paris). 1974;125C (1-2):373-89
9. Piaget, J., La Psychologie de l'intelligence, Paris, Armand Colin 1947
10. Tokumaru, K. (2019) An Information Theory of Language (Digital Linguistics), Linguistics and Literature Studies 7(5) 206-219