

The First (70,000 years ago) and Second (30,000 years ago) Cognitive Revolutions

Emergent qualities and quantities as information

Abstract

The aim of this paper is to document the meaning of emergent behaviors and their relation to cognitive revolutions.

In my opinion we have two very distinct cognitive revolutions, one occurring 70,000 years ago and the other one that is more dramatic, occurring 30-23,000 years ago.

The paper analyzes the imaginary constructs, which characterize our civilization, their neuronal origine in the Homo sapiens brain, and their manifestation.

Discussion

I hypothesized that “linearity” developed in human mind at a certain point when several neural anatomical changes occurred in the Homo sapiens brain. Anatomically, such changes developed gradually but in a short time interval 70,000 to 23,000 years ago.

Assumably the rudimentary “**linearity**” (before 90,000 years ago) was generated by area **MT+**, dorsal neural areas **V3A**, **V7**, and **V4D** (Gils Joost Brouwer, and Raymond van Ee-Journal of Neuroscience January 31, 2007), which assured a limited number of predictable choices. During this era the neural bursts of neurogenesis invaded the hominins brains with large amounts of new neurons, and their **connection developed from one synapse**

to another, on short distances, have served nonlinear functions and were responsible for “nonlinear-thinking”; eventually such connections became a chain that served local areas.

However, most “nonlinearity” is produced by the frontal lobe.

A short introduction to human brain neural tracts

Cornelius Weiller, Marco Reisert, Ivo Petro, Jurgen Henning, Nikos Makris, Michael Petrides, Michael Rijntjes, and Karl Egger published in Elsevier on online 21 March 2021 the study *The Ventral Pathway of the human brain: A Continuous Association Tract System*.

The authors concluded:

“Our data showed that the ventral system tracts, traversing through the extreme capsule, form a continuous band of fibers that fan out anteriorly to the prefrontal cortex, and posteriorly in temporal, occipital cortical regions. In all cases a connection between the inferior frontal and middle-to-posterior temporal cortical regions was identified. In the human brain, this tract connects the language domains of Broca area and Wernicke’s area. The differentiation in the three tracts, IEOF, UF, and ECF seem arbitrary, all three pass through the extreme capsule. Our data show that the ventral pathway represents a continuum. The three tracts merge seamlessly, and streamlines showed considerable overlap in their anterior and posterior course. Terminal map identified the prefrontal cortex in the frontal lobe and association cortex in temporal, occipital and parietal lobes as streamline endings. This anatomical substrate potentially facilitates the prefrontal cortex to integrate information across different domains and modalities.”

“In both monkeys and humans, cortical regions comprising the object recognition pathway lie directly adjacent to the primary visual cortex (V1) in the occipital lobe, extending progressively into more anterior and ventral portions of the temporal lobe.” (quoted from Scholarpedia).

“Physiological studies of cell properties also support the functional distinction between ventral and dorsal pathways. Neurons within the ventral stream (V1 and V2 areas, area V4, and inferior areas TEO and TE) respond selectively to visual features relevant to object identification. Neurons within the dorsal stream (within V1 and V2, areas V3, V3A, and middle temporal area MT, and some adjacent area) respond selectively to spatial aspects of stimuli, such as direction and speed of stimulus motion.” (Scholarpedia).

“At all stages, the neural connections are reciprocal (meaning a bidirectional exchange of information) probably the feedback projections play a top-down role in vision” (as in making selections from a unified input).

“Thus, an anatomical substrate exists for interactions between the two processing streams, and these might serve to integrate what an object is with where an object is.” (Scholarpedia).

The quotation from Scholarpedia referred to the processing in the monkeys brain. However, clinical cases suggest that the human visual cortex, like that of the monkey, contains two anatomically distinct and functionally specialized pathways: the ventral and dorsal streams. On the other hand, it suggests **a crucial role of tissue in ventral parts of the temporal cortex for object perception and recognition.**

However, **long-range neural connections in the human brain underpin higher-order cognitive skills (such as planning and emotional regulation) which make humans distinct from the rest of the primate relatives.**

Yan, Yu et al, in an article (*Mapping long-range connections*) published in eLife (May 20, 2022) comments his team's findings during a large study titled *Mapping brain-wide excitatory projectome of primate prefrontal cortex at submicron resolution and comparison with diffusion tractography*, published online 2022 May 20 (doi 10.7554/elife.72534).

The author suggests that **"this long-range neural pathway exists in monkeys, but it connects via multiple synapses instead of a single junction as was previously thought."**

"We found that vIPFC fiber projections passed through external capsule, claustrum, and extreme capsule and anchored to the middle superior temporal region. Although the trajectory of vIPFC between frontal and temporal regions matched well with the diffusion tractography of IFOF, axonal projections of vIPFC never reached the occipital lobe."

This mentioned study shows something that generates a huge distinction between the monkey brain processing and the human brain. It seems that tubular tracts for the transmission of perceptual signal information appeared relatively recently in the section between Temporal lobe and Occipital area. In monkeys, this particular section is created only by multiple synapses.

As it was explained, there exists experimental evidence that synapse-to-synapse transmission of signals generates nonlinear processing and outcomes. Also, the experimental evidence

indicates that the longer the range of transmission in the tubular tracts is, it induces more linearization of processing because of longer section of friction of signals with the tract-wall that causes more top-down processes and slows the signal speed.

Research found that the pre-frontal cortex (PFC) is a top-down dissipative producer, which breaks or disassembles wholes into parts, and actively produces linearization.

Broca area is in the left inferior frontal gyrus and Wernicke's are is in the left posterior superior temporal gyrus.

Cerebellar functions in humans are executed via connectivity with other brain centers, such as thalamus, providing substrate for speech control in association with speech planning, initiation, and coordination of speech. **It is a key structure involved in time perception.**

It forms a cerebello-thalamo-cortical pathway and plays a **significant role in speech acquisition during childhood, and it is involved in maturing the speech production.**

The characteristics provided in the above paragraphs make me postulate that a synaptic-linking-connection between temporal and occipital lobes prevent a more comprehensive signal exchange between these two cortical areas and may cause a huge "latency" for signal transmission.

In my opinion, in the brains of the Last Clade's hominins occurred a significant neuronal enlargement of the cerebellum in the era starting 120,000 years ago that increased the "latency" for its connection to temporal lobe, but on the other hand the exchange of information between these two areas increased by developing more synaptic connection.

However, the multiplication of the synaptic connections increased the nonlinear functional outcome, triggering the nonlinear-thinking.

A study on birds found that, when cerebellar lesions occur, the birds song becomes longer, and this effect possibly results from singing more song elements and more slowly (the study was titled: *The Role of cerebellum in learned vocal communication in adult songbirds*, and it was published in Scientific Reports).

In humans, clinical evidence indicates that in patients with cerebellar lesions, like in birds, have fluent speech, but their words will lack meaning. This cerebellar deterioration is termed Wernicke aphasia and causes auditory incomprehension, while the subjects are unaware of their lack of comprehension.

The mentioned damages/lesions to cerebellar area are equivalent to increasing in “functional latency”, resulting from large increases in the number of neurons in the cerebellar area. The lack of meaning seems to be the equivalent to nonlinear outcomes, which were incomprehensible for those rudimentary linear minds.

The effect does not allow those subjects to recognize time-intervals in the range of 10-150 ms.

A group of archaeological evidence, indicating abstract thinking, was dated around 70,000 years ago. Abstract thinking is nonlinear thinking. Hence, Homo sapiens brain started to switch to nonlinear thinking sometimes 70,000 years ago.

Masazumi Fuji, Saloshi Maesawa, Sumio Ishiai, Kenichiro Iwami, Miyako Futamura, and Kiyoshi Saito made the study *Neural Basis of Language. An Overview on An Evolving Model*, published in

Neurologia medico-chirurgico on2016, April 16
(doi:10.2176/nmc.ra.2016.0014).

The authors concluded: “*In the present model, **language is considered to be processed through two distinct pathways, the dorsal stream, and the ventral stream.** The core of **dorsal stream** is the superior longitudinal fasciculus/AF, which **is mainly associated with phonological processing.** On the other hand, **semantic processing is done mainly with the ventral stream** consisting of the inferior fronto-occipital fasciculus and the intratemporal networks. The frontal aslant tract has recently been named the deep frontal tract connecting the supplementary motor area and the Broca’s area and it plays an important role in driving and initiating speech.”*

Evolution of nonlinear thinking.

However, there is evidence that, **around 90,000 years ago, it occurred a development of “nonlinear-thinking.”** It was an evolutionary process largely supported by unusually strong bursts of neurogenesis (intermediated by powerful geomagnetic excursions). I would postulate that this era may correspond with the epoch 90,000 to 45,000 years ago that followed Blake, post-Blake, and Norwegian Greenland Sea geomagnetic events. As it appears, the culmination of neurogenesis bursts was achieved during Laschamp (43-41,000 years ago) and Mono Lake (around 34,000 years ago) events.

Neuroscience studies indicate that oscillatory synchrony supports top-down signaling from V1/V2 extrastriata cortex that is a decomposition of the perceived images. It develops a top-down

directed beta-frequency synchrony that predicts behavioral context of task-related behavioral information. Contextual-thinking is a fundamental characteristic of nonlinear-thinking. The frequencies involved in this top-down processing were in the range of low-beta 16 HZ.

As it seems, in parallel with visual processing, it occurred an increased processing of the perceived acoustic information within the visual signaling circuits.

Here, the brain was making an energetic choice by selecting for its increased number of neurons more acoustic signals, which required less cerebral/neuronal energy for their transport and processing.

Because of its gradual evolution (90,000 to 23,000 years ago), **in its beginning, such transition was dominated by optical processing, favoring a gradual sliding toward nonlinear thinking.** However, as mentioned, **in parallel but at a lower scale, it occurred a significant increase in acoustic neural processing** intended to compensate the ongoing augmentation in the number of neurons and their respective energetic consumption.

As a consequence of such parallel evolution, many researchers found **a threshold between static and dynamic phases of human language, and it is placed sometimes between 50,000 and 30,000 years ago.** Even then, the temporal lobe, responsible for language, did not seem to have evolved much until 35,000-23,000 years ago.

Characteristics of the evolving nonlinear-thinking

The hominin societies would view time as something that doesn't necessarily flow in a straight line from the past to present and future.

Instead, the events would be interconnected and co-occurring, everything happening at the same time that would be the present.

Obviously, those Late Paleolithic Homo sapiens societies had adjusted their cultural practices and beliefs to the new modality of nonlinear thinking. It became evident to them that most observable phenomena were cyclic and made them adopt a cyclical belief, where a time cyclicity was assumed.

Probably, a more focused view in archaeology may help find evidence about the approximative eras when the mentioned **transitions from simple or primitive linear processing (that was intended for survival and was common to all species) to nonlinear-thinking occurred.**

The archaeologists may find material evidence about **behavioral changes, which altered the understanding of hominins on memory and cause-and-effect changed**, and this novel but confusing change, provided too many probabilities at once. It increased the uncertainty, and rapidly diminishing the surviving capabilities of Homo sapiens and other hominins.

Some of the changes were favorable, like cyclicity of events, contextual and intuitive thinking, Others aspects fall outside the original linear perception that was inherited, and **caused mental conflicts, like the negation of urgency, and a certain confusion about when things must be done.**

No referential points were allowed, and no compartmentalization, division, and multiplication were possible, which all altered the previous linear skills.

In my previous papers I hypothesized that a chain of **geomagnetic events (geomagnetic excursions) favored ROS production in the**

hominin brains that stimulated bursts of significant neurogenesis and biophoton production, which were associated with extra but a significant neuronal production.

Too much neural renewal, after a certain positive accumulation, had caused too many unwanted neural mutations, which generated mental diseases.

Linearization of thinking

In the modern brain (after 70,000 years ago), the increased “linearity” was provided by a significant augmentation in parietal areas and precuneus. It gradually maximized the predictions toward a single choice that occupies a position on a straight line, and all maximized choices became sequentially, while “linearly” arranged. **Those points**, as graphic representation of choices, **fundamental property consists in unlimited additivity or sequentially, which correspond to the process of superposition.**

(The superposition principle states that the net response caused by two or more stimuli is the sum of the responses.)

In my hypothesis, **Home sapiens brain**, when crowded by unwanted mutations, **adapted toward a distinct neural solution** (that gradually developed the **Frontoparietal Synthesis**), where the **anatomical change favored the development of “linear-thinking.”**

The extinction phenomenon, which affected the rest of hominins, is dated **45,000 to 30,000 years ago**, and this threshold may correspond to the mentioned **transition from nonlinear to linear thinking.**

Linearity is something that is perceived by the human senses as a referential point and this process occurs between those points placed along a line and where everything must be only sequential. It allows one to add, subtract, multiply, divide, and do most of all simple operations we currently do in mathematics.

The most significant achievement of linearization turned out to be the process of quantification intimately connected with having linear referential points.

Linear characteristics

Biologically, the nonlinear and linear processing are generated by two distinct neural signal transmission modes:

-when the transmission is on **short-distance (nonlinear signal processing)**

-when the **long-distance neural tracts are developed by the brain (it causes signal linearization processes)**

As the mathematics explain, a system is linear when it follows several principles:

-it obeys superposition (additivity) principle

-homogeneity property (scaling), where a zero input yields a zero output

-the system is time-invariant, when a shift in the input signal generates the same time shift in the output signal

-stability where the output of that system is bounded any bounded input.

Linear systems are a singularity in the infinite set of possible systems; the rest of the systems are nonlinear.

Thus, analyzing nonlinear systems without the need for linearization still implies restricting it to time-invariance, restraining it to only a few classes of nonlinearity, because otherwise it will occur an infinite number of sinusoidal signals.

However, nonlinear in mathematics was considered simultaneously with linear: quadratic equations (nonlinear) have been solved four thousands of years ago, and differential equations (nonlinear) were in use three thousand years ago.

There is mathematical evidence that nonlinear thinking inhabits human mind for a very long time, and in my opinion it occurred long before the linear-thinking.

Quality and quantity as information

The quantities at the conscious level are subjective amounts of information generated by the complexity of elements. The quality of the experience is defined by an informational relationship.

The qualia is the term employed to define the “quality” of experience. However, each sentiment has a particular quantity of information, and each experience produces what we call a sentiment.

Quantity is a principled way of transforming qualitative properties of experience into mathematics by employing a point of reference and making the comparison to that chosen point. We compare such quantities of information even when identical information is produced by very distinct sources.

The qualities represent the amount of information that is generated by a system in a particular state. This state is produced by the interaction that occurs among the elements of that system. By comparing different such states, as they complexly evolve, one hopes to disclose the sense taken by the interactions that is embedded in the emergent result.

Let's take the example of the measurement of a day. It must reflect the spin on which our planet evolves every day around its rotating axis. This cyclic movement is approximately 24 hours per day.

As it seems, this rotation is constant and then, it is considered a physical quantity. In fact, our planet rotation is slowing slightly with time. *“Atomic clocks show that the modern day is longer by about 1.7 milliseconds than a century ago.”* (Wikipedia). *“Over millions of years, Earth's rotation has been slowed significantly by tidal acceleration. Some models suggest that Earth maintained a constant day length of 21 hours throughout much of the Precambrian.”*

“Some recent large-scale effects (like large earthquakes) also contributed to shortening the length of the day by 3 microseconds. The glaciations and post-glacial rebound have their influence in our planetary spin. Large water storage, like the Three Gorges dam, increased the length of the day by 0.006 microseconds.” (Wikipedia)

“Random fluctuations due to core-mantle coupling having an amplitude of 5ms. The sidereal day is shorter than the stellar day by 8.4 ms.” (Wikipedia).

Hence, these variabilities are too small to make a practical difference. Thus, the length of the day remains a physical quantity of practical use.

However, different parts of the cortex influence different qualitative aspects of the perceived consciousness. This makes the case of *integrated information* that is generated by every complexity that causes interaction between its components. *Information is defined as a reduction of uncertainty*. When one sees an image, that image is experienced as an integrated whole and cannot be divided into the images of its components, which may be experienced independently.

Integrated information

The Theory of Information suggests that the quantity of a physical system depends on its existing state. The same theory claims that the **quantity is determined by the amount of integrated information**, while the **quality is determined by the set of informational relationships its mechanism generates that is the emergent.**

David Balduzzi and Giulio Tononi published a study *Qualia: The Geometry of Integrated Information* on PLOS Computational Biology on 2009, Aug 14 (doi: 10.1371/journal.pcbi.1000462).

The authors explain: “*In short, generating a large amount of integrated information entails having a highly structured set of mechanisms that allow us to make many nested discriminations (choices) as a single entity. **Each of the nested choices is an “informational relationship”**. According to IIT, these mechanisms working together generate integrated information that determines the quality of experience.*”

“Qualia space (Q) is a space where each point is a probability distribution on the possible states of the system. Quantity is given by the amount of integrated information a system generates.”

*“Prior to considering its mechanism and current state, the system of two binary elements could have been in any of four possible states with equal probability. This potential repertoire (or apriority repertoire, is the maximum entropy (maxent or uniform) distribution, which entails maximum ignorance. **The mechanism and current state of the system, however, reduce uncertainty, i.e. generate information, about the previous amount of the system. This is because only some previous states could have led to the current system state.**”*

The above concept indicates how compatible the current state is with previous states and allows a comparison between states.

The illusion of reality and its physical background

Cengel, Yanus A. (Department of Mechanical Engineering, University of Nevada, Reno, NV, USA) published a study On Emergent Quantities, Mental Perception and Constructs, and Agencies, subtitled A Holistic View of Existence in The Journal of Neurobehavioral Science on June 12, 2021 (doi: 10.4103/jnbs.jnbs_33_21).

The author explains: *“There is a growing tendency to view all nonphysical quantities as properties of organization and label them emergent quantities which appear out of nothing and disappear into nothingness. In this paper we present plausible arguments that emergent quantities are not limited to large assemblies of matter and that they are encountered even at subatomic level. We also*

make a distinction among different kinds of nonphysical entities such as mental constructs invented by the mind and entities discovered by inference, such as the laws of nature.”

“Science is coding and transposing actual structures of physical realm perceivable by the five senses into representative abstract or nonphysical structures of phenomenological realm perceivable by the mind. The new insights gained by the manipulation of these abstract structures, including mathematical representations, are then decoded back into the physical realm.”

*“The appearance of emergent qualities is contingent upon the existence of the physical entities on which they emerge since, otherwise, we cannot perceive the emergent qualities. This sets the stage **for the perfect illusion that emergent qualities originate from the physical entity.**”*

Let’s see how Yunus A. Cengel defines some nonphysical entities as emergent qualities, mental constructs, and agencies. Most of these abstract structures are mentally manipulated and decoded back into the physical realm.

“We are granting nonphysical entities, including emergent qualities and mental constructs the status of existence though not necessarily external existence but discoverable by the mind.”

“Most physical properties such as shape, color, hardness, conductivity, taste, and sound are also nonphysical. We commonly view them as being physical things and change when the physical thing undergoes a change.”

“Illusions, hallucinations, imaginations, and conceptions are all nonphysical entities by definition since they are not made of matter-

energy. Nonphysical things are not conserved. Nonphysical existence can only be logically reasoned and inferred.”

“The physical and nonphysical realms are intertwined, and they influence and interact with each other. Scientific inquiries may have profound ramifications on the nonphysical realm, each as emergent properties.”

“Many properties or features of physical entities are subjective since they are emergent properties and are not reducible to matter-energy. All physical beings come packed with some intrinsic subjective qualities that cannot be traced back to the properties of their parts.”

“All physical existence is in fact a combination of physical and nonphysical realms, giving rise to the phrase “whole is not only more than but very different from the sum of its parts.”

“Life does not qualify as physical entity, but living beings do since they have physical bodies made of mass-energy.”

“Emergent qualities manifest on physical entities and the mental constructs emanates from a mind as the renderings of the mind. Emergent qualities and agencies are perceived by the mind, but they are not created by the mind. Mental rendering of perceptions should not be confused with mental creations such as imaginations, dreams, plans, thoughts, and designs.”

“Meaning, which is the essence of information and represented by symbols such as words, shapes, and O’s and 1’s is also another form of nonphysical existence.”

“Danish author T. Norretranders said: “The visual world, what we see, is an illusion, but then a very sophisticated one. There are no colors, no tones, no constancy in the real world, it is all something we make up.”

“It is important to note that emergent properties passively qualify physical beings and not actively govern them. They do not exert an influence on physical beings, such as forcing them to act in a certain way. Emergent properties are just qualifiers or qualities and not agencies with causal power.”

“Emergent qualities are not mental creations since they are intimately tied to physical entities they appear on in a certain way, and they are not inventions of the mind. They existed long before the mind did.”

“All properties as shape, dimensions, volumes, temperatures, pressure, density, entropy, enthalpy, amount of matter, amount of energy, taste, smell, hardness, thermal conductivity, electrical resistivity, absorptivity, transparency, molecular structure, and wavelength-everything other than the elemental particles of physics themselves and their assembly-exist as abstract entities in conscious mind. All properties are abstractions or conceptualizations.”

“The characteristic properties of the fundamental particles such as charge, and spin appear to be emergent since they do not originate from the quantized excitations of the underlying elusive fields. Therefore, emergence should be recognized as a fundamental phenomenon, and the nonphysical emergent existence should be regarded as an essential constituent of the realm of existence.”

“We emphasize that emergent quantities are not mental constructs created by the mind. They would still exist out there independent of the mind. The mind only renders a factual description and mental image of emergent qualities during scientific inquiry.”

“It appears that mental constructs or mental rendering constitute a major part of the nonphysical realm of existence. All abstract mental constructs such as mathematics, languages, literature, philosophy, thoughts, beliefs, plans, imaginations, and dreams are part of the nonphysical realm.”

“Some mental constructs as the laws of physics and mathematics are discovered. They already exist out there unnoticed, until a conscious mind become aware of them and express them using physical symbols of representations such as words and numbers.”

Brain entropy

The brain generates consciousness by reducing the entropy of its internal representations below a critical threshold. This is so, because the brain gradually minimizes the entropy of internal representation and as a result, it creates minimum entropy representations termed “qualia.” The QBIT theory indicates that qualia are maximally entangled, and maximally coherent systems with a high amount of information.

The axon-dendrite polarity is required for directional information

The role of new neurons

Newly generated neurons by processes of neurogenesis migrate through the subventricular zone (SVZ) and intermediate zone (Z) to reach the cortical plate (CP). The neurons, which are generated later in brain evolution during life, migrate past neurons generated earlier and occupy more superficial positions.

The cortex is a six-layer structure that is unique for mammals. As explained, neurogenesis places its new neurons on top of the old ones, and a correlation between all these layers always exists.

The connection between neurons occurs via synapses.

A hypothesis on possible anatomical changes in the Homo sapiens brain, which may have triggered a major cognitive revolution.

Archaeological evidence suggests that around 150,000-125,000 years ago occurred a significant enlargement in the skull of all hominins. Such enlargement would indicate an increase in the number of neurons.

Alexander Maier of Vanderbilt Brain Institute published in CellPress on August 17, 2020, an article titled Visual perception: *Human Brain Cells Cause of Change of View* (doi:10.1016/j.cub.2020.06.054).

The

author explains recent findings of De Jong et al. as *Endogenous (illusory) perceptual reversals evoke a reverse hierarchy pattern of cortical responses*.

The article describes De Jong's experiments and their results. It indicates that, during the experiments, it was found that it occurred an inverse temporal lobe response preceding those of the occipital cortex. Such hierarchical inversion was generated by an increase in functional latency of the occipital area.

As a result, the response of the visual signal in the temporal lobe occurred after the occipital lobe response that was in opposition to established hierarchical functioning. Consequently, such inversion created a holistic neural vision.

In my opinion, the mentioned experiments and results are an indication that the hierarchical inversion was an anatomical change that developed as an outcome of a significant increase in the number of neurons in the occipital area in the epoch 125,000-70,000 years ago. The increased number of neurons produced a functional latency in the transmission of perceptual signals compared with temporal lobe response.

In my opinion, **the significant neuronal increase in the occipital area created the posterior cortical hot zone that is associated by Kristof Koch with the minimal neural substrate essential for conscious.**

Hence, the maturation of the posterior hot zone probably occurred around 70,000 years ago and generated a two-fold outcome:

- it introduced a mental holistic processing
- it caused the mentioned development of the minimal neural substrate for conscious.

Wikipedia explains the role played by the posterior hot zone: *“The sensory component (shape, color, texture) of each object stored in memory is physically encoded by neurons of the posterior cortical zone in structures called neuronal ensembles (NEs) or cognits. When one recalls any object, the object-encoding neuronal ensemble activates into synchronous resonant activity, and it is known as the Binding-by-Synchrony hypothesis. It was proposed that synchronization is a general mechanism underlying any novel imaginary experience. **When the synchronization of independent object is driven from the front by the lateral prefrontal cortex, we refer to it as Prefrontal Synthesis; when the synchronization is***

driven from the back, we refer to it as dreaming or hallucinations.”

The above explanation quoted from Wikipedia suggests that De Jong experiments demonstrate **a holistic, while nonlinear reorientation intervening in the Homo sapiens brain, and which started to manifest as abstract-thinking around 70,000 years ago.** In the meantime, **this alteration stimulated an increase in conscious thinking that was an increase in the previously developed simple or primary linearity.**

Thus, the Homo sapiens brain had turned to a dual processing, where the holism (nonlinearity) was the novel one, while the evolving of conscious was additional to the pre-existing occurrence.

Even then, the novel holistic processing influenced the conscious processing, too. *“Holism of systems and processes make them interact with themselves and produce themselves from themselves.”* (A. Gupta, 2008). It is about addressing the properties of the concrete object (physical object) and selecting the relevant ones. It generates a summation of properties or a reduction of them.

Abstract is a summation of details; non-abstract is detailed information. Holistic refers to a process and a representation of the stimulus. The components are integrated to give rise to a global percept. There is neural evidence that faces in high level visual areas are represented holistically in monkeys infero-temporal cortex (Logothetis & Sheinberg, 1996; Tanaka, 1996) and in human fusiform gyrus (Schultz & Rossion, 2006).

This is what Dr. Carhart-Harris calls the primary conscious, and which probably existed from 70,000 to 30,000-23,000 years ago.

First Cognitive Revolution

In my opinion or hypothesis, **the First Cognitive Revolution (70,000-23,000 years ago) overlaps the epoch when the Primary Conscious was developed.** As mentioned above, it implies a holistic approach or nonlinear thinking. It was triggered by an occurring functional latency in the transmission of optically (visual) perceived signals within the occipital cortex area, namely the occipital hot spot.

Prof. Yuval Noah Harrari of the Hebrew University of Jerusalem wrote in Naturalmoney.org an study *A Brief History of Humankind*. The first part that I will quote here refers to The Cognitive Revolutions. In this and other of his work he theorized the First Cognitive Revolution.

“At the time of the Cognitive Revolution planet Earth was home to about 200 genera of large terrestrial mammals weighting more than 50 kilograms. At the time of the Agricultural Revolution, only 100 genera survived.”

“Under identical ecological conditions might have been very different societies, cultures, and beliefs, thanks to novel ability (language, too) to create imagined realities. There has been not a single natural way of life.”

*“Ever since the Cognitive Revolution (First Revolution in my opinion) about 70,000 years ago, **sapiens have been able to change their behavior quickly without any need of genetic or environmental change. Sapiens can change the social structure, the nature of their relations, economic activities within a decade or two, just by telling new stories or changing the previous stories.**”*

Within a new mode of abstract thinking, a primitive while static language still helped in story-telling, making the sapiens overpass the slow genetic evolution.

*“The ability to refer (later has been the a dynamic speech) to things that do not exist, enabled sapiens to cooperate flexibly in large numbers. Since **large scale cooperation between sapiens is based on stories**, the way people cooperate and build their societies can be changed quickly by changing the stories.”* Here the author emphasizes the role of speech in proliferating the story-telling, but this full ability, in my hypothesis, appeared only during the Second Cognitive Revolution that manifested around 30,000-23,000 years ago.

Several linguists from South Africa consider that the static language begins to manifest simultaneously with increased abstract thinking, while both appeared about 70,000 years ago.

Thus, the First Cognitive Revolution was triggered and largely benefited from the development of static language that significantly enlarged social cooperation, from development of the Primary Conscious, and from Holistic Thinking.

All these three factors contributed to an increased brain plasticity, allowing sapiens to move beyond their traditional spaces due to increased adaptability to changing environments.

During this First Cognitive Revolution, sapiens were able to migrate out of Africa populating Eurasia, Australia, and a good part of Oceania just with a static language and a primary Conscious.

“Because of the fastness of cultural evolution, Homo sapiens soon outstripped all the other human species and all the other animal species in its ability to cooperate and to accumulate power.”

“None of these things exist outside the imaginary stories that people invent and tell one another. There are no nations, corporations, and money. There are no such thing as human rights and there are no laws, and there is no justice anywhere outside the common imagination of sapiens and the stories which we tell each other.”

“The truly unique feature of human language is the ability to transmit information about things that do not exist at all. Fictive language is so important because it enables sapiens to imagine things collectively.”

“Beginning 70,000 years ago, there is the first evidence for art and jewelry and the first evidence for trade between different bands. There is also the first evidence for complex societies comprising hundreds of people and not just dozens of people.”

“Cognitive abilities are the abilities to communicate, remember, learn, and think. Such things were very limited 100,000 years ago in Africa.”

About 70,000 years ago appeared the first needle, allowing sapiens to make cloths. Some advances in tool making also occurred at the same time. *“One of the most important technologies that started appearing 70,000 years ago is probably boats and other kinds of sailing craft.”*

Currently, the archaeologists seem shocked by some incomplete evidence that sapiens may have sea fared toward the Americas around 50,000-45,000 years ago, contemporarily with their sea faring from Southeast Asia toward Sahul and New Guinea.

As a result of sapiens migration out of Africa, **it occurred some sexual encounters between Homo sapiens and species of humans and they produced fertile offspring. This is a fact**

genetically proved, and it qualifies for the rising a new species of sapiens, where Neanderthal and Denisovan mixing is quite small (2% to 6%) but probably quite influential.

The genetic impact of Denisovans mixing seems to be larger in East Asia, New Guinea, and Australia; the Neanderthals genetic impact in Europe varies from a region to another and from one individual to another. Last Denisovan disappeared in New Guinea only 15,000 years ago, and the last neanderthal in Eurasia disappeared 30,000 years ago.

Because of the above-mentioned genetic impact, the resulting sapiens-hybrid appears to reflect distinctively this genetic admixture.

Even then, in my hypothesis, the sapiens hybrids gradually homogenized all over Eurasia and Oceania (Australia included) with each other and with sapiens who have not been affected. Also, a similar or at least partial homogenization was caused by African back-migration of sapiens.

The revolution in sapiens cognitive evolution, during the First Cognitive Revolution, has occurred almost entirely outside Africa.

The genetic mixing produced the hybrids who have a sapiens genetic base and genetic dominance.

However, during the Second Cognitive Revolution, it occurred several other neural anatomic changes, which together produced a novel linear thinking.

Second Cognitive Revolution

The threshold between these two cognitive revolutions is drawn by the language revolution archaeologically dated around 30,000 years ago.

In a preliminary stage, around 40,000 years ago, a dynamic language began to replace the static language which existed for 30,000 years.

As it seems, the full dynamic language began to manifest only 30,000-23,000 years ago.

Biologically, during the phase of the static language, it develops a gradual population of the optical (visual) tracts with acoustic signals.

However, the impact was relatively small, because the brain research did not show a significant evolution of the temporal lobe at this time.

As it seems, around 30,000 years ago, the hierarchical inversion that developed 70,000 years ago, producing holism, was reversed again, but this time by the development of the Frontoparietal cortex that attracted much of the additional pulses of neurogenesis and especially those from striatum neurogenesis.

This time the anatomical changes were significantly larger than at any previous time, while the result was radically distinct from holism. It arose **the linearization that radically changed the language and the conscious thinking.**

Biologically, it developed an increased latency in the long-distance tracts, which favored an increased population of acoustic signals, but also because of the speed reduction in the acoustic signal transmission more acoustic details became available and allowed a

much better mental manipulation. The language became exclusively linear because the acoustic characteristics are linear.

The paramount effect in the new cognitive revolution was manifested in language development that increased ad-infinitum abstract outcomes, while turning them into symbolic manifestations. The second paramount effect of linearization was the quantification of qualities that occur in the same abstract realm.

Linearization, because of its fundamental superposition, generates an infinite multiplication of imaginary reality associated with its imaginary quantification.

As mentioned, the **almost radical changes in the Homo sapiens' brain architecture created an outcome of radical nature that, in my opinion, led to a very distinct species that I called as the Speakingman or the Homo loquens.**