

## Research Article

# The Enchanted Staircase - Genesis of the Mind from Animals to Humans

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## Abstract

A beautiful name, appropriate to explain the origin and evolution of the mind, that progressive acquisition of faculties that led to us human beings. The aim of this article is to use increasingly complicated neurostructures to interpret the notions provided by nervous and sensory anatomy, ethology, mental development and psychoanalysis. Five levels are identified, the fourth and fifth with two sublevels each, preceded by the zero or abneural level: the paragraphs are numbered progressively, but each paragraph examines the same evolving arguments. 1. *Neurostructures*, or the typical structures of neurons of each level, acquired gradually, and the areas of the human nervous system in which they are found. 2. *Zoology* with the forms of the N. S. and the animal groups in which they are present. 3. *Perceptiveness*. Already at the beginning of the twentieth century, Jakob von Uexkull, following what was reported by Lorenz, supposed the existence of a specific mental environment in which every animal and every human being moves and lives; today it is common to talk about software that circulates in a computer or in the nervous system, and this beautiful intuition is easy to use. We will see how each subject grasps the universe and the consequent *Mental Universe* that is created in different animals and children, in stages: the mind as a progressive phenomenon from the jellyfish to man, from the newborn to the adult. 4. *Memogenesis* or genesis of the Mind. The Enchanted Ladder is the ascent of intelligence in the animal kingdom from the lowest species to us, through millions of years (phylogenesis), but traveled in development from newborn to adult (ontogenesis). It is an epigenetic scale that situates and clarifies what the *reflex* is, what the *pre-object* is (Ren é Spitz) and what the *permanent object* is (Jean Piaget), *knowledge*, *thought*, *rationality*, *fantasy* and *creativity*. This last faculty distinguishes *Homo sapiens* from all animals and even from Neanderthals and connotes the overwhelming adventure that distinguishes him: creativity is the matrix of history. Main reference is the cognitive psychology of Jean Piaget. 5. *Psychogenesis*. Approach to emotionality and the formation of Psyche. A theme that, necessarily, can only be developed later with much broader treatment. Main reference is the psychoanalysis of Sigmund Freud. In conclusion, from the comparison and synthesis of the different studies, it clearly emerges how the evolution of relational life has occurred.

## Keywords

Epigenetic Scale, Nervous Structures, Psycho-Mental Levels, Mental Universe, Knowledge, Creativity

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## 1. Stimulus - Level 1 - Elementary SM, Element in Single Neuron

### 1.1. Neurostructures

As I have examined in various articles [2], knowledge, thought, rationality, imagination are faculties that every human uses but what they are, when they appear and their importance for the species takes us to a remote past. They are undoubtedly the result of variability and selection but also preceded by much simpler mental facts that lead us to start from nothing, from level zero. The cosmos was born, which is unknown to each of its mineral bodies, life was born and for a long time the world in which it lived was unknown to it. The living multiplied and spread in the ancient oceans from which the waves threw them onto the desert land, they became multicellular but without cells to conduct stimuli. We do not find neurons in Monera, Protists, Fungi, Plants and in animals before the Metazoans; they only had chemical exchanges, some captured light or some cellular movement. Like stones, oceans, mountains, the moon and stars, all were immersed in an UNKNOWN UNIVERSE.

#### *0 m Aneural motor level*

Due to internal stimuli, certain unicellular organisms exhibit movements but are not directed.

#### *0 s Aneural sensory level*

A minimal reception of signals allows for addressing and adapting responses to the environment. Thus, the unicellular flagellated green alga *Euglena viridis* moves toward the aquarium illuminated area. Unicellular protozoa also move, in sponges or Porifera some epidermal cells only receive stimuli while others only respond, forming a first receptor > effector pairs. Cellular interactivity is found in mammals' white blood cells and spermatozoa.

The cell that placed itself between the receptor and effector with the sole task of passing impulses became the first neuron. Subsequently, many parallel S-M lines were formed: *receptor > sensory neuron > motor neuron > effector*. It is the common reflex arc that limits itself to picking up elementary signals and giving reflex actions; in Figure 1 is indicated at the top. The steps are follows:

#### *1m Motor Neuron Level*

The first neuron to appear was the cell between the receptor and effector, hence the minimal SM pathway of stimuli.

#### *1s Sensory Neuron Level*

Increase in neurons lengthens S-M line because the sensory neuron is added, followed by an intercalary connecting neuron, as in spinal cord, shown in Figure 2.

#### *2m Motor Lens Level*

Proximity together favors formation of reciprocal synapses between motor neurons, thus leading to the union of single responses in rudimentary behaviors called taxis. Born from coordinated reflexes, they move toward or away from stimuli (phototaxis, chemotaxis).

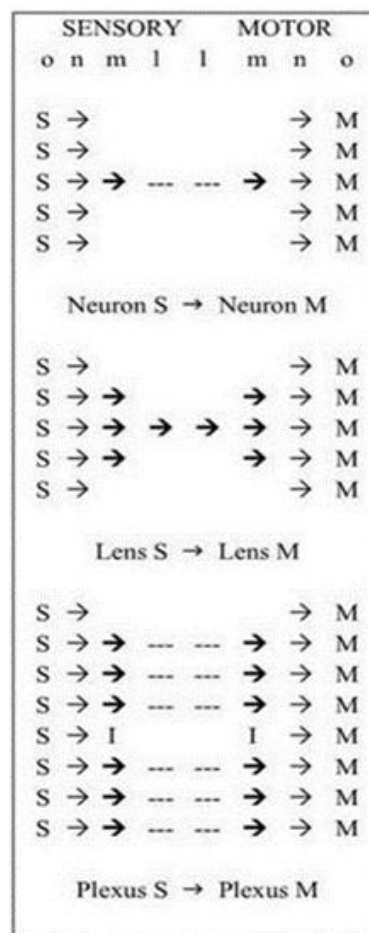


Figure 1. Neurostructures at neuron, lens, plexus.

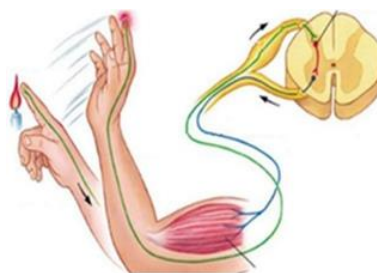


Figure 2. Reflex line.

### 1.2. Zoology

Neurons are initially found in a scattered net in the body of polyps, in a ring in jellyfish, or in cords in Ctenophores; then they are collected in ganglia in flatworms, nematodes, annelids, bryozoans, brachiopods, mollusks, echinoderms and tunicates [4, 9]. With their simple receptors they pick up signals and give rise to reflexes and taxis. There are many reflex arcs in spinal cord, midbrain and medulla oblongata of vertebrates [13, 14].

### 1.3. Perceptivity

We humans know a lot about the cosmos, but everything was dark until the first simple sensors detected Elements or Perceptive Medium, i.e. light/dark, sound/silence, contact/separate, movement/stillness, wet/dry, hot/cold. Thus, the unknown became a VAGUE UNIVERSE where objects could not be distinguished but only diffuse states of light or darkness, heat or cold.

### 1.4. Memogenesis

In the first few days the newborn only has reflexes: he closes his hand and forcefully squeezes the finger or the object with which he touches himself, rotates his head when sensing the nipple, sucking. Mind is an empty department store where for some months the universe enters only forming a generic and syncretic idea of the world given the disorganization of

the few scattered stimuli invested with emotion [17, 20, 22].

### 1.5. Psychogenesis

It begins with primordial sensations of pleasure or discomfort, which indicate favorable states to remain in or undesirable states to retreat from. Both the lower metazoans and the newborn live in a vague universe, with sensations that spread throughout the mental field, filling that very small universe. In the newborn, emotional states, as if they were thin circus tents, fill everything and the sky closes, but then they descend and overlap with each one with the previous, preparing emotionally for subsequent experiences. Therefore, repetition or non-repetition of the pleasure of nutrition and care, as Erik H. Erikson [7] was the first to recognize, and of bodily contact [10], increases trust in the world which is the foundation of future personality.

| Level<br>Progressive                    | SENSORY<br>Stimulus | S   | Neurostructures<br><i>faculty</i> | M                  | MOTORY<br>MENTAL UNIVERSE |
|-----------------------------------------|---------------------|-----|-----------------------------------|--------------------|---------------------------|
| 0 Aneural                               | 0 Nothing           |     |                                   |                    | ▷ U. UNKNOWN              |
| 1 S.M.<br>Elementary                    | 1m Element          | >   | >                                 | M Neuron           | > Reflex Act              |
|                                         | 1s Element          | > S | Neuron                            | M Neuron           | > Reflex Act              |
|                                         | 2m Element          | > S | Neuron                            | M Lens             | > Behaviour               |
|                                         |                     |     | <i>Stimulus</i>                   |                    | ▷ U. VAGUE                |
| 2 S.M.<br>Particularly or<br>Pre-object | 2s Particular       | > S | Lens                              | M Lens             | > Behaviour               |
|                                         | 3m Particular       | > S | Lens                              | M Plexus           | > Activity                |
|                                         |                     |     | <i>Pre-idea</i>                   |                    | ▷ U. CATEGORIAL           |
| 3 S.M.<br>Objectual                     | 3s Object           | > S | Plexus                            | M Plexus           | > Activity                |
|                                         |                     |     | <i>Idea Learned</i>               |                    | ▷ U. OBJECT               |
| 4m Mnemonic<br>Motory                   | 4m Next Plot        | > S | Plexus                            | M Net (Area)       | > Particular Life         |
|                                         |                     |     |                                   | <i>Knowledge</i>   | ▷ U. PLOT                 |
| 4s Mnemonic<br>Sensory                  | 4s Social Plot      | > S | Net (Area)                        | M Net (Area)       | > Particular Life         |
|                                         |                     |     | <i>Thought</i>                    |                    | ▷ U. SOCIAL               |
| 5m Operating<br>Motory                  | 5m Regularity       | S   | Net                               | M Lateral-Net      | > General Waist           |
|                                         |                     |     |                                   | <i>Rationality</i> | ▷ U. REGULAR              |
| 5s Operating<br>Sensory                 | 5s Remote Plot      | S   | Lateral-Net                       | M Lateral-Net      | > General Waist           |
|                                         |                     |     | <i>Fantasy</i>                    |                    | ▷ U. REMOTE               |

|                            |                                                                                                                                                   |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>UNKNOWN UNIVERSE</b>    | No Object and No Perceptive Medium                                                                                                                |
| <b>VAGUS UNIVERSE</b>      | No Object, only the Perceptive Medium                                                                                                             |
|                            | <i>Distinguishes signals of a Simple or Generic or Vague nature such as Light/Dark, Sound/Silence, Damp/Aric, Motion/Stillness, Pleasure/Pain</i> |
| <b>CATEGORIAL UNIVERSE</b> | Categories of Objects or Pre-objects                                                                                                              |
|                            | <i>Distinguishes Category signals such as male, female, puppy, adult, tree, food</i>                                                              |
| <b>OBJECT UNIVERSE</b>     | Specific or Individualized Objects                                                                                                                |
|                            | <i>Distinguishes Object or Specific signals of a specific place or individual</i>                                                                 |
| <b>UNIVERSE PLOT</b>       | Many Objects for Types and Copies                                                                                                                 |
|                            | <i>Proximate Structures and Objects as Specific (Types) and Category (Copies)</i>                                                                 |
| <b>SOCIAL UNIVERSE</b>     | Subjects                                                                                                                                          |
|                            | <i>With language he enters the subjective, social and inner world</i>                                                                             |
| <b>REGULAR UNIVERSE</b>    | Laws (Principles, Criteria, Rules, Theorems)                                                                                                      |
|                            | <i>Explored world looking for regularities</i>                                                                                                    |
| <b>REMOTE UNIVERSE</b>     | Indoor and Remote Objects                                                                                                                         |
|                            | <i>The world explored in every remote horizon, cause, origin, interiority.</i>                                                                    |

Figure 3. Progressive Levels and, down, Mental Universes © R. Bani.

## 2. Pre-idea and Archetype - Level 2 - Particularly SM, Pre-object in Neuronal Lens

### 2.1. Neurostructures

The second level arises from several adjacent neurons with synapses that form the functional unit "lens", in the middle of [Figure 1](#). From a sensory point of view, this allows several receptors to converge their stimuli and to grasp the natural structure, that is, the details that exist around and in objects. Note that each neuron works like a switch, i.e. with a yes/no mechanism, so it can say, for example, that there is light or darkness, sound or silence. However, by receiving the translation of a two-color figure in a group of neurons, some of these will activate while others will not. A pattern of stimuli corresponding to the perceived image is thus reproduced: in their synapses they form a lens that remembers and is activated when the image reappears; that is, he recognizes it. Instead, as described above, an activated motor lens stimulates a group of muscle cells articulating contractions into a spatio-temporal structure, behavior. But synapsing between many nearby sensory neurons required a revolution that made it late: it required the birth of complex sense organs. Sensory lens is useful if it receives from a group of receptors that capture together several elementary stimuli. The complexity of the eye, ear, and lateral line itself tells us how laborious it was to specialize and complement thousands of cells in the global role of a superior sensory level. To gather many simple receptors in a complex organ to have reception no longer of rare stimuli but of their structures: not one or another color but modulated in forms of colors and lines, figures; not a single sound but variations, voices, murmurs, songs.

We have arrived at the anatomy of lobes of fish and reptiles and the sensory and motor cortical areas of lower mammals where the SM flow no longer occurs in single lines but in paths or tunnels that cross a series of successive cellular planes or layers. The first is the interface with outside, nervous area in sense organs such as the eye retina and the organ of Corti in ear: it translates different stimuli into the common *language* used by nervous system, so that from figures, sounds, smells, tastes and touches entered by distinct senses it produces only nerve impulses. The sensorial nerves that from this layer of neurons go to the visual, auditory, olfactory, gustatory and tactile areas. In the flow it must be assumed that the *key stimuli* are distinct and recognized with innate ideas or *archetypes* that alone make the stimuli continue to activate adequate specific instinctive actions. More precisely, there must be a lens for each archetype: from the layer of sensory areas a bundle of axons must converge on this lens and from this successive axon must end on one or a few neurons that are therefore excited at key stimulus appearance: in these nuclei reside emotions of anger, fear, pleasure, pain, desire. From the emotional neuron we pass to an instinctive one of courtship,

attack, escape, rejection, with divergent synapses on the specific motor neuro-lens. From here axons go to the muscles, the last layer of cells in direct contact with the outside; in a nerve only some axons carry stimuli for an action.

By progressive appearance we can distinguish:

*2m Motor Lens Level*, already in the previous level.

*2s Sensory Lens Level*

Synapses in the lens must be specific because only in this way can the stereo-typicality of key stimulus be explained; recognized when it activates its precise neuro-form which thus allows the stimuli to continue. The key stimulus activates the entire path that from the precise sensory lens arouses an emotion and its instinctive center, from here stimuli diverge on the motor lens whose specific synapses give typicality to the present motor module. Remember that only complex sense organs like the eyes and ears allow sensory lenses and then bi-lens pathways with emotion-instinct pairs inserted such as fear-escape and anger-attack; average level of [Figure 1](#). After their invention the growing nervous mass creates more and more lenses that can connect and coordinate in a broader functioning.

*3m Motor Plexus Level*

From a neuron or a sense lens the fibers diverge on several motor lenses articulating the various actions in a higher motility which is the activity. Thus, the key stimulus arouses its typical modules also united in succession, so much so that once the activity is triggered it can be removed, and the motor modules continue to express themselves; the ammonite wasp continues the series of actions even if the triggering stimulus is removed: once the sensory lens is excited the relative motor plexus continues to function. SM Flow: Particular > arc-idea (in the sensory lens) > emotion > instinct > arc-idea (lens or motion plexus) > action or activity.

### 2.2. Zoology

From the common matrix of lower metazoans, by separate lines, evolution leads to this level distinguished by large nervous masses, complex sensory organs and extensive motility. The large cephalic ganglia of Arthropods and Cephalopods [\[4\]](#) and the encephalon of Vertebrates contain neurostructures that capture key stimuli as specific signals and give typical actions of escape, attack, courtship. Human sites are the archaic nuclei of thalamus and striatum [\[13, 14\]](#).

### 2.3. Perceptivity

More elements form a *Particular* or *Pre-object*: the alteration of lights and shadows forms figures, that between motion and stillness events, that of sounds voices and noises. Observing becomes broad and continuous for sensory organs capable of capturing elements no longer single but in visual or auditory structures, however distinct as flat figures or apparent and provisional pictures. Even if the sensorium is ready to capture a lot, only a few signals are important and give an-



swers: the neurons, still few in number, limit themselves to gathering in lenses to recognize only the modest shapes of the key stimuli. In the nervous lens the synapses must give a *shape* corresponding to what activates it, so when it appears the stimuli reaches that shape which recognizes it; that shape is a nervous translation of the key stimulus, passed down innately without learning. It does not allow us to distinguish the specific object but the category of objects, obviously of biological relevance. Repetition of the typical figures of male, female, cub, tree, grass, predator, prey gives the UNIVERSE OF CATEGORIES.



**Figure 4.** Female and Male of the stickleback *Gasterostens aculeatus*.

Thus, in the stickleback *Gasterostens aculeatus* studied by Niko Tinbergen [21], for a male the swollen belly (for eggs) is a sign of female and is common to all females, indistinguishable and equivalent to him, so he courts them all. While the red belly is a sign of male and is common to all males of the species, and he attacks them all because they are antagonists but without distinguishing them. Many similar examples, like in mammals the round and chubby shapes of the cubs unite them in only typical signal to which the adults respond in the same way with gestures of protection and care.

## 2.4. Memogenesis

A fundamental problem clearly arises: there must be something in those heads that, even if translated into nervous language, corresponds to the objects and situations to which they seem to respond. Since it is adequate and appropriate, I will use a common term: idea. Meaning simply the nervous translation of an object or an external situation, or its possible elaboration; without resorting to new definitions or acronyms, I consider sensory forms simply ideas. Which however are not learned and memorized, as we humans do every day, but innate and transmitted between generations, appeared and favored by natural selection given their usefulness in communication and relationship in the life of the species.

From the third month, the second-third S-M stage of Piaget [17, 18], without subsequent mental elaboration, the newborn captures *mobile and inconsistent images*. In particular, René Spitz [20] observed that he can recognize a human mask, that is, the generic features of a *human face* at which he smiles, even if fake or in a photograph; that is why he confuses anyone who comes before him. As in the stickleback, this mask is a particular or pre-object that allows it to recognize humans, but not to distinguish them, and is entirely similar to the key stimulus. It should be noted that now: the neurostructure is the *lens*, with perception of the *pre-object* and memory the

*pre-idea*, which, if innate, is an *archetype*.

*Archetypes* or innate ideas, inherited from ancestral existences, are a very interesting and thorny subject. In asocial animals it is simple: from the egg an individual is born that does not learn from anyone, therefore it will have in its brain, imprinted by DNA, the archetypes with which to interact. In mammals and other animals that learn there must be guides to vital interactions, which direct what is learned. Human archetypes, for Irenaus Eibl-Eibesfeldt [6] are the phallus, the mother, the protective - and punitive totem, exalting gestures such as puffing out the chest and standing straight and stiff, accentuated with puffed clothes, shoulder pads, hats, high shoes; or of submission such as lowering the gaze, head and back, kneeling and prostrating. But also signs of peace such as showing the open hand, shaking hands, relaxing the face and smiling. The beautiful simple expression of the smile, which pleases the sight and relaxes the mind, is wonderfully innate! Of course, it is not learned by being present in those born blind who have never seen a smile. Even show the teeth and fists in anger, or trembling and crying in intense emotions.

## 2.5. Psychogenesis

Archetypes that guide learning. Archetypes with feelings that make certain figures typical, that guide the Ego in its maturation. Carl Gustav Jung [11] believes that we carry them inside us, they are part of the collective unconscious from which they emerge every now and then to express themselves in all cultures: the wise man, the innocent, the explorer, the sovereign, the magician, the hero, the lover, the jester. Vladimir Propp [19] analyzed Russian fairy tales and stories, but today they are stories and films from all over the world, tracing a path where the protagonist is the seeker who goes through a series of episodes and figures, and from being a misunderstood victim he will end up fighting with the bad guy and by winning he will be recognized by the community as a hero, classically marrying the beautiful princess. Along this path the young seeker realizes himself. And it is perhaps the path that every developing Ego, in the green shoot of youth, dreams of taking: passing through a series of archetypal figures, through preordained phases and events, to reach a pre-determined goal: self-realization, social affirmation and marriage. A path between archetypes so recurrent in humanity that it could be innate. But it is not a topic we will deal with here.

## 3. Learned Idea - Level 3 - Objectual SM, Object > Neuronal Plexus

### 3.1. Neurostructures

As the neuromass grows, the lenses increase and can be connected and coordinated in a larger functioning: this union of lenses is a *plexus*, Figure 1 below. It is already evident that the simple increase in the number of neurons allows their in-

tegration and their use at higher levels of perception and/or movement. From the initial physiology of two neurons in reflex lines, we have moved on to groups of coordinated neurons of the second level, the lenses. Although a sensory lens can converge on a single motor neuron or a sensory neuron can diverge on a motor lens, it is natural for the S and M lenses to be correlated in S->M bilenses so that the key stimulus, or pre-object, triggers a certain action.

3m and 3s are now the levels of neurons, lens and plexus, on the motor and sensory doors. Many sensory lenses, which perhaps receive stimuli from different senses, may converge the stimuli so that signals, figures, sounds, smells, touches, of a situation or an object, entered from multiple sensory channels, integrate with each other. This allows many perceived forms to be brought together in a more complete and coherent recognition of the situation or precise object, which will also be recognizable by a detail of it. The chicken emits various typical signals, such as lateral, anterior, posterior figures, sounds, smells and touches of adults and chicks, as does the rooster, with its appearance, aroma, touch, taste. It is, however, still a chicken: a unique object. On motorial door a plexus with its lenses causes stimuli to diverge, implementing multiple actions grouped into activities, resulting in a more complex intervention on the environment. Two plexuses can join together in a biplexus, neuronal structure in which multiple key stimuli, or particulars or pre-objects, are linked to multiple actions, as seen in courtship, fighting, and territorialism. Above all, level three is about specific objects therefore learned ideas that require, and demonstrate, the memory areas existence.

### 3.2. Zoology

Birds and mammals reveal learning [5, 12]. They learn and remember certain places, objects, co-specifics, which they can distinguish and towards which they orient themselves as specific objects, distinct from other similar ones, testifying to the mental synthesis of signals as well as the usefulness of having overcome, at least a little, the limits of the innate. First is the territory, which the subject knows well and takes care to delimit, defend, dig out a den, attract females. Then, for a puppy, the mother remembered in the figure and voice, to whom it is close; reciprocal for the mother who distinguishes, protects, nourishes, defends and plays with her son. Indications of the existence of sensory plexuses that unite different signals, and motor plexuses for diversified behaviors.

### 3.3. Perceptivity

More elements unite in a particular and more of these unite in object. Creating composite and coherent ideas with specific *Objects* overcomes the previous categorical universe and begins the UNIVERSE OF OBJECTS. Which in animal is the set of memories of the territory, of mother and others, in the newborn, following Spitz, is the mother, following Piaget it is the *permanent object*.

Correlation multiple lenses in the plexus cause various details to join in a specific object, which is not possible innately; In addition, the larger the memory areas and more signals will be fixed and structured leading to more ideas and therefore more distinct objects. The typicality of signals with distinction between objects also explains the bond of the animal with its own territory, of the young with its mother, distinct from every other female, of the mother with the son distinct from any other, the bond of a male with a precise female who is separated from others. On the other hand, the dualistic and ambiguous nature of sexual interaction is well known, double because it takes place on two levels. From the place around, for well-known areas of the body, the same signals reach the man as in the Females category, whose members are therefore interchangeable: signals that activate and direct the libido. On the other hand, in the feeling of love, only one person is interested in such bond: one falls in love with a particular woman as a specific object and it is privileged among the others.

### 3.4. Memogenesis

*Object*, memory of specific objects, is what is acquired at the fourth stage SM of Piaget [18]: child distinguishes the *permanent object*, which he remembers even if he no longer sees it. For Spitz [20], the newborn, who only recognized the generic features of the face as a pre-human object, now memorizes and distinguishes the face of the person who frequents him most, combining it with gestures, voice, cuddles: the mother. She too is a *permanent object*, then she will be followed by the father and the others. In evolution, the increase in neurons has made it useful to move from the innate memory of archetypes to initially rudimentary forms of learning, such as imprinting, rigid and definitive, or more malleable conditioning. Both allow us to remember specific facts and individuals and require minimal memory zones between the S and M areas, zones that the impulses pass through first to fix and then to arouse the memory. If an intense emotion traps the signal in the memory neurons, the reappearance of the stimulus is associated with it, so that it is recognized and arouses the emotion, with the coherent response.

Interpretation of Pavlovian [15] conditioning. The innate stimulus activates a genetically predisposed path that goes from the perception of food to the sensory area from which a lens converges at the center of hunger; from here a lens diverges in the motor area, which activates salivation. Appetite sensitizes the memory to fix other signals concomitant with food: some associations between secondary stimuli and food do not recur because they are random, but the recurring stimuli are fixed as conditioning. Once memorized, the conditioner (light, sound, operator) perceived again reaches the sensory area and the memory where it is recognized, activating hunger, salivation and expressions of expectation.

## 4. Knowledge - Level 4m - Mnemonic Motory, Next Plot > Motor Net

### 4.1. Neurostructures

Until reptiles, lenses and plexuses are relegated to separate lobes: olfactory, optical, auditory. But they underwent such an increase that neurons became denser to the point of making that network structure of contiguous neurons (Figure 5) that is the cerebral cortex advantageous, in which it is easy to create synapses and paths. It allows us to unite different objects and activities into even larger and more articulated superior entities, structuring and moving a broader, more elastic and adaptable life. Networks of neurons have another great advantage given by proximity: synapses are more easily guided by experience. Learning is favored by extensive areas of memory and is undoubtedly malleable and adaptable, while innate ideas can only be categorical, rigid and only slowly modifiable. Advantages spread by increasing social communication up to the enormous advantage of culture: certainly, in mammals the evolution, in many orders, towards greater memory and intelligence can be traced back to the great genetic ease of producing networks of neurons. Within and between networks, lenses and plexuses, bi-lenses and bi-plexuses continue to be created. This has been facilitated to such an extent that the emergence of useful SM pathways, hitherto innate, can be guided by sensorium or by motor attempts, as occurs in play and training, where external stimulation of sensory and motor organs induces the development of axons and synapses in neuronal circuits maintained as specific S>M pathways.

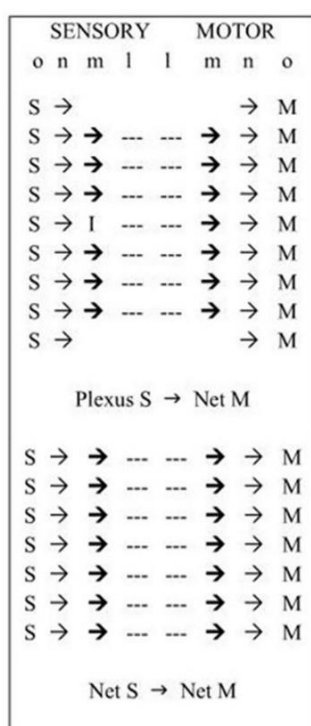


Figure 5. Neurostructures at Plexus and Net, sensory motor.

### 4.2. Zoology

Mammals such as macaques, chimpanzees, elephants, wolves, dogs and others roam the geography and seasons of places they have already frequented, remembering where to find to drink, eat, rest, and spend the winter; thus, they show that they follow *mental maps* [1, 5, 16]. In anatomy, in low mammals the cortex consisted of primary sensory and motor areas, now it has grown areas-nets of neurons suitable for memorizing, thus becoming the seat of many ideas and their structuring into knowledge such as mental maps. Basal functional units are pyramidal neurons, which in billions create the cortex where they receive synapses and send axons throughout the body.

### 4.3. Perceptivity

If the reception of signals is occasional, memory accumulates, associates, moves the construction of ideas as mental objects corresponding to reality: the very fact of rotating, touching and observing repeatedly causes many signals to associate in a single idea of the object. Above all, it is now possible to keep under control not only elements, details and certain objects, but their sensorial globality, the *Next Plot*. Memory extends in the space of the surrounding panoramas and in time as a memory of the season, the cyclicity of events, therefore finding in the new season the conditions remembered from the previous year. Note that for now the mind limits itself to making senses and memory collaborate: it extends into reality a more or less faithful knowledge or idea of UNIVERSE PLOT.

### 4.4. Memogenesis

By Piaget [18] the child in second year does not know how to carry out operations but explores and remembers many permanent objects distributed in space and time, with increasing knowledge of the physical world. Interesting is the fact that he travels through a known place but does not know how to describe it; this corresponds to the mammalian mental maps. Now in the mind, which was a bare room, elements arrive that assemble into structures until they build a theater. Some pieces are physical and form the stage, ceiling, walls and curtains, that is, the stage that is how we globally conceive the world; then we will fill it with objects, chairs and tables, but above all with entities similar to us, human figures with their clothes and masks, images as characters with whom we will have to live and interact on the two stages of the mind and life. Children and Animals have risen in level and reveal a fundamental faculty.

*Knowledge* is the set of notions or ideas that correspond to part of external reality, where such part is proportional to the brain volume in particular to the size of the memory areas. The role of memory is evident: if the senses perceive the immediate surroundings, it is the sum of many immediate surroundings, of many situations and seasons visit, that ac-

cumulates in the mind and extends the knowledge net. Notions are the rare innate archetypes of a stickleback or other vertebrate, the neotypes learned by imprinting, the modest but useful knowledge of many mammals such as monkeys, elephants, wolves and dogs: the mental map or data network relating to its territory and frequented areas. Finally, it is known and evident how the knowledge of a human is enormous compared to the animal thanks to the large cerebral cortex, language and culture, allowing ordinary people to know a lot and experts a great deal.

#### 4.5. Psychogenesis

Having acquired muscular control, the child has motor autonomy and the world opens up before him; he can better explore and manipulate many things that he assimilates into increasingly precise ideas. His mental universe expands and perfects itself, he recognizes many objects, people, environments: a theater with actors, parts and scene changes that he follows, observes, lives. But the main character, the first actor, is missing: it is a theater without an ego. The child is not yet aware of himself and of distinguishing himself from the world. He feels his needs, uses motor autonomy, relates but does not have the idea of being. For a while he will still be convinced that the figure in the mirror is that of a generic child and as such smiles at him.

### 5. Thought - Level 4s - Mnemonic Sensory, Social Plot in Sensory Net

#### 5.1. Neurostructures

Now neurons, lenses and plexuses are part of the memory networks. However, knowledge exists and thought exists, both are located in networks of neurons of the associative areas, which are close to but distinct from the sensory and motor areas. Since in the lower mammals the brain, just derived from the lobes of reptiles, does not have posterior associative areas, those between the sensory areas, but have a minimal knowledge it can be assumed that this is located in the premotor associative area being a motor memory network. While in the average mammals there are associative areas between the sensory areas that by uniting their signals in ideas-objects essentially *think* and are strongly linked to social communication through Wernicke's area. Even in humans, knowledge, motor mnemonic network, can be located in the premotor area while thought, sensory mnemonic network, as an elaboration of assimilated notions, can be located in the post-Rolandic associative areas.

#### 5.2. Zoology

Several mammals, but also insects, have evolved in societies where they tend to acquire a language that spreads

knowledge and culture. Furthermore, dolphins and chimpanzees recognize themselves in the mirror, indicating self-awareness.

#### 5.3. Perceptivity

In usual parallelism between phylogeny and ontogeny: mammals lived solitary but gave rise to species in family and then social groups; thus, starting from the third year of age, having passed the stage of autonomy comparable to the solitary life of lower mammals, the child develops a growing interest in others. Mammals and children overcome the predominantly solitary life to become interested in nearby figures, which they explore more carefully. If acquisitions have so far occurred through solitary research, the spread of sociality is a prerequisite for culture, whose advantages favor the appearance of areas for language and symbolic thought. By privileging individuals and relationships of *Social Plot*, mind creates the SOCIAL UNIVERSE.

#### 5.4. Memogenesis

The child has reached the preoperational symbolic level where *language* allows him to describe known things, and it is the same level as mammals with good sociability and therefore with fairly articulated forms of communication.

*Thought or reflection or meditation* is a new faculty. New areas allow us to rework knowledge, to use it and remodel it according to various needs, among which, primary, that of interacting mentally with others: communicating to agree and collaborate.

#### 5.5. Psychogenesis

In a child's mind, around the third year, a privileged idea begins to emerge. That the image in the mirror, which moves as he moves and smiles when he smiles, is different from the others because it moves and coincides with his intentions. One distinctive relation is born: Ego recognizes itself and begins to form an idea of itself. The permanent object that he repeatedly observes in a mirror and knows exists even if he does not see it, is associated with his own activities, needs and pleasures; the image falls on the pre-existing character like a shell to give form and awareness to what comes from within. It is a further leap notable because in self-consciousness the instinctiveness of character can re-enter a broader and more manageable sense of Self.

Thus, Ego places itself in the mind theater. But also, from that moment on, even the ideas corresponding to other humans will no longer be empty shells; indeed, the child will gradually insert into them the choices, ideas, feelings, and personalities they manifest. Piaget [17, 18] emphasizes the use of thought and language and, therefore, relations between minds. But it is also an emotional relationship: in the same context the Oedipus complex [8] begins as a confrontation between the subjectivities of the Ego and family members,



Mother and Father, that is, between the wills and certainties that move their ideas and words. Thus begins the exploration of the interior of Others and of Self, which helps to discover feelings and common humanity, a basic objective that helps to escape the original narcissism.

## 6. Rationality - Level 5m - Operating Motory, Regularity in Motor Lateral-net

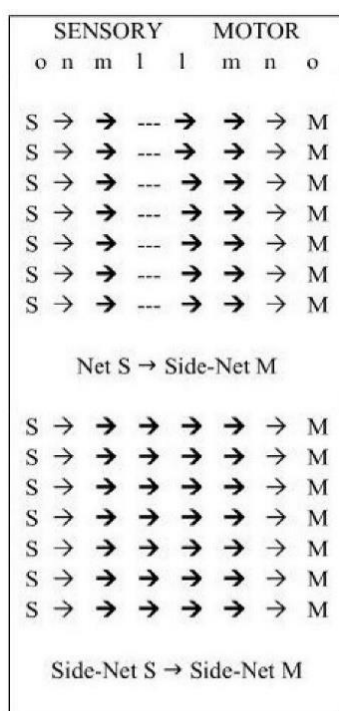


Figure 6. Neurostructures at Net and Side-Net, S M.

### 6.1. Neurostructures

So abundant was the nets production that in part escaped the immediate sensorimotor flow; a growing part originated networks lateral to this flow, *Lato-net*, into frontal cortex. This allows them not to engage in interactive activities but to operate indirectly, acting on the memory located between sensory and motor areas, always immersed in the general flow of stimuli between input and output. Remaining outside of it, at least in the immediate effects, the lateral networks have been able to differentiate into new faculties that did not exist before, with pre-eminent motor activity, *Rationality*, or sensory, imagination and *Fantasy*.

### 6.2. Zoology

Chimpanzees, gorillas, hominids, dolphins and other mammals carry out mental operations similar to reasoning.

### 6.3. Perceptivity

*Regularities* present in the plot, symmetries, rhythms, quantities, rules and natural laws, explain the appearance of a faculty capable of distinguishing and following them, thus better organizing the memory that does not remain only a deposit, albeit large and adaptive, but is arranged and ordered. At this level the mind not only follows the evidence of things but interprets it, develops associations that go beyond what it sees for an endogenous faculty that did not exist before: rationality, reasoning, logic. This takes certain ideas, concepts as a reference, and with them interprets, clarifies and organizes other ideas. Without a doubt, the enormous gift of man to use nature derives from the ability to understand its rules and thus intervene to adapt it to his own desires. Distinguishing symmetries, rhythms and natural laws makes the mind more refined and adaptable to the structure of world, grasping its *Regularities* rises to the UNIVERSE OF LAWS.

### 6.4. Memogenesis

Stage of *Concrete Operations* between 6 and 11 years [18]. Where reasoning does not detach from the sensorium but can follow certain qualities in transformations. Knowing how to recognize and use rules also improves the comparison that at the pre-operational level occurred between two objects at a time while now the child globally orders entire groups of objects based on established criteria.

*Rationality, reasoning, logic*, is the faculty that identifies regularities and can derive rules, criteria and laws from them that are then used to produce new regularities; it orders a certain number of ideas in *reasoning, demonstration, argumentation* in a manner consistent with certain rules or directives or principles. It is evident that, once the amount of memory necessary for the environment and for living in it has been exceeded, the excess nervous networks have moved away from the SM flow to specialize in the use of memory. Dedicating oneself to intervening on the baggage of knowledge to modify and improve it based on certain criteria, identifying and applying certain regularities, allows thought to be rational. If memory cancels the distance of space and time and keeps things present to the subject, rationality compares them by affinity and diversity and orders them into classes and systems that highlight the regularities and allow them to be traced back to the most general rules and universal laws.

Since the left hemisphere of the brain controls the right hand, generally the most used, it seems that the left frontal lobe is the seat of rationality: a lobe more oriented towards the exit as it takes note of the contents of memory and tries to organize them better to better structure motility. I assume that the right lobe is more sensorial and expresses fantasy because it uses notions to modify them into new forms, in a pure, symbolic way and without rapid motor use. *Fantasy* offers *Reason* new possibilities that perceived reality does not show.

## 6.5. Psychogenesis

Knowing how to recognize regularities and rules is also valid for children, hence the importance of acquiring norms of conduct, family rules and establishing the rules of a game to be respected among peers. At this level, social relationships, which begin formal and external, soon become characterized beyond the figures, prevailing the interior and introspective level. We proceed from the outside to the inside because it is in the nature of things that we first grasp the peripheral and most evident part of objects and subjects: we try to imitate but then we mentally enter the personality of others to be like the other, adult or peer. Even the displacement of rules, permissions and prohibitions, from others to us and vice versa involves the displacement of one's own Ego towards the Other. One's own mental figure moves and can coincide with the figure of others to return to itself in an alternation of similarity and diversity, identification and independence. It is certainly the highest emotional drive of the human soul: understanding, permeating the self-awareness of the other and then re-entering one's own self-awareness.

If in the pre-operational phase of Others and Self, appearances and bodily envelopes are grasped: the characters are on stage but are followed and understood only for their external forms and actions. In the phase of concrete operations, the child tries to understand from the evidence what moves these envelopes, and through dialogue tries to acquire and transmit thoughts, feelings, intentions. However, only in the subsequent phase, with abstraction, consciousness becomes completely penetrating into the feelings, character, psychic essence of Others and Self. I believe that this is the core of the Oedipus complex: dynamics between subjects that formally become increasingly profound, first extrospective then introspective. Dynamics that are indisputably useful to the subject to overcome initial autonomy, in the second year of age, and to grow his external identity towards the fifth year, and then internally to the depth of Ego.

## 7. Fantasy - Level 5s - Operating Sensory, Remote Plot in Sensory Lateral-net

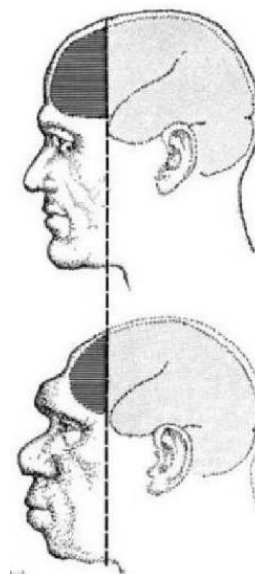
### 7.1. Neurostructures

Numerous and complex are made possible by the great development of the brain, widely discussed, with particularly large frontal lobes, double those of Neanderthals, containing two rich lateral networks that express, among other things, two remarkable qualities. The left lobe contains the lateral motor network, more related to facing and solving problems, which expresses rationality, reasoning, logic; a faculty that appeared first and is shared with anthropomorphs, australopithecines and hominids. The right frontal lobe contains the lateral sensory network because it operates on the post-Rolandic associative area, on the knowledge that it

elaborates in a pure, abstract, essentially sensorial way, with the imagination. However, as [figure 8](#) clearly shows, the human nervous system acts in a unitary way. Latonet is the final conquest of the sapiens that surpasses the other conquests, with the underlying levels and the mental faculties it adds up in epigenesis. But he needs all and uses all.

### 7.2. Zoology

Homo sapiens has spread across the face of the Earth in the most diverse landscapes and climates, showing surprising versatility. Since its origins it has undoubtedly had culture, evident starting from Homo habilis with the transmission of the processing of pebbles to make blades and the use of fire, even if in hominids the cultural changes are imperceptible. Observing the life of Neanderthals in the two hundred thousand years of existence, with their groups skilled in hunting mammoths and controlling the territory, everything remains immersed in a static monotony. While, since dawn, our species has shown great mobility with adaptation to very different conditions, and a rich instrumentation that opposes the Mousterian blades to the javelin, the boomerang, the bow and arrow, the slingshot. It uses boats with which it navigates far away, as far as Australia, Oceania and America where no one had ever arrived. Furthermore, the only hominid, he breeds: first of all, the dog that has accompanied him for thirty thousand years, splendid symbiosis considering its usefulness for guarding and hunting; domestication and use of other species is affirmed with the great changes of the agrarian revolution. Abstraction makes him suppose an afterlife to which he connects through magical rites, funeral and propitiatory rites, of which we have evidence and which show his spirituality. Spirit: absolute entity, the most remote of Being, that sapiens can imagine and that he will pursue throughout history.



**Figure 7.** Frontal lobe of sapiens and Neanderthal.

### 7.3. Perceptivity

The human mind manages a large amount of data. They all arise from perceptive means, light, sounds, molecules, forces, to structure themselves in an enormous and complex way through myriads of Particulars in Objects to give the different Plots: Proximate, Social, Regular, up to the most *Remote Plot* that explains and organizes everything. Thus, the transforming power, undoubtedly practical, of sapiens originates from the ability to understand reality and to extend the net of ideas to the most remote corners of space and time, of matter and energy, where it explores every possible horizon. Such a wealth of ideas constitutes the REMOTE UNIVERSE.

### 7.4. Memogenesis

Still Jean Piaget [18]: the young person from 11 to 15 years old arrives at propositional operations, a phase in which he is able to reason and predict events without having to observe them, thanks to abstraction. And to new faculties.

*Fantasy* distinguishes Sapiens: if reality enters the mind with figures, sounds, smells collected in notions and thoughts, she transforms them into curious and non-existent ideas with which humanity has populated cultures. From horse and man she gets the centaur, from woman and fish the mermaid, so for hippogriffs, pegasus, chimeras, fauns, dragons; all ethnic groups have populated themselves with fantastic beings obtained by splitting-reuniting parts of animals or humans. Creating a world full of fairy tales and legends up to modern cartoons and science fiction films. The great power of sapiens comes from knowing how to detach from the sensorium to daydream. It is known that every mammal dreams during REM sleep: the brain, isolated from reality, wanders in spontaneous associations, producing the most diverse mental forms; the same happens when we are awake in the unconscious. But we have so many frontal cortex that a part is able to follow the other parts in free associations: we daydream; and it is a great source of inspiration. On the other hand, fantasy, with its abstract models far from the SM flow, allows us to penetrate everything and the entire cosmos beyond the evidence to grasp every depth.

*Creativity* is symbiosis between fantasy and rationality: it uses the great freedom of one, combining it with the criteria of coherence of the other; it finds concreteness more than pure imagination because it understands natural laws that are not abstruse. If man has always wanted to fly or go to the Moon and for thousands of years has told so many fantastic stories and inventions, he was satisfied only when his technology was able to respect and use the laws of physics. An ancient dream comes true when the necessary inventions are concrete, that is, they respond to the rules of the world. Creativity, inventiveness, and ingenuity are the source of the overwhelming avalanche of human inventions: they have allowed sapiens to adapt his thinking to situations as many and diverse as the geographical environments and societies scattered throughout history [3].

In short, for a complete picture. Splitting and building ideas is first of all a spontaneous activity of the mind that, in a pure interior form, is expressed in the *Dream*. From the embryo, neurons connect and transmit impulses with an ever-present spontaneous activity, which diverges between groups of impulses by dividing, analyzing, or merging, synthesizing structures of stimuli, that is, ideas. In this basic, spontaneous activity, the guides are then implemented. Thought becomes *Knowledge* if guided by the senses, *Thought* if guided by communication, *Reasoning* if guided by rationality, *Fantasy* if due to imagination. *Creativity* or genius derives, as already said, from the collaboration of imagination and reason. Certainly, it is the balance and integration between the different forms of thought that gives people the best way of thinking in an optimal management of life.

### 7.5. Psychogenesis

Every Subject, Ego or Other, like every object, is structured, and its full acquisition occurs in the times and ways of mental development: first one sees the next, then the regularities, then the remote, first the outside of things and then the inside, this also thanks to abstraction. Thus, in youth, one feels the more or less marked urgency to revisit oneself, to deepen one's subjectivity or identity to draw the maximum conscious extension from it outside and inside. It is an impulse towards universality aimed at achieving maximum harmony between the parties. We go into the depths of impulses, into the abysses of instinct, we search through personal history to soon turn to the stars, to remote entities, to God and to spirituality. But also to the social, in friendship and in the innovative intent of young people we seek the mirror of ourselves.

The growth of Ego will find completion in maturity and love.

## 8. The Staircase

Intelligence, etymology from Latin: *intus* = inside, *legere* = to read.

Entering something to read it, capturing information and understand, tending to go deep even into the most hidden aspects, in its entirety. So it was. The evolution of intelligence has been a long process, since the first living beings and the first metazoans over half a billion years ago, on a progressive scale that has increasingly penetrated nature, along which everything was made to grasp the universe. I have visited this Enchanted Staircase and tried to describe in all its aspects: from sensory, motor and nervous anatomy to the software of the Mind and Psyche systems, using the discoveries of Jean Piaget and Sigmund Freud, summarized by neurostructures, zoology, perception, memoanalysis and psychoanalysis. Driven by needs, life has launched itself into a natural path, because dictated by nature, uphill to want to grasp, and understand, more and more signals, to use them. Progress made possible by peripheral organs as entry/exit doors, but above all

by the internal processing carried out by cells specialized in the conduction of stimuli, neurons as bricks that by multiplying have grown the mind and woven intelligence.

### 8.1. Neurogenesis

The mere increase of neurons, their avalanche multiplication, leads them to articulate themselves into structures that maintain the sensorimotor flow of stimuli but, given the multiplication, forming progressively wider and more penetrating S-M pathways, at increasingly higher levels. An ascent that goes from *single neurons* to *lenses* and *plexuses* of neurons, to *memory networks* up to the *lateral networks* that operate on memory. Epigenetic ladder where each new step requires the previous steps but allows a more precise intervention in the physical plot. The most intelligent control: which can read nature better.

### 8.2. Zoology

The entire animal kingdom has done it, with its species in countless variations, especially in the three major taxa: Mollusks Cephalopods, Arthropods Insects, Vertebrates Mammals. Of the majestic phenomenon we are the pinnacle.

### 8.3. Perceptivity

It has grown enormously, as the synoptic diagrams demonstrate. Figure 8 summarizes the epigenesis of neurostructures and levels with reference to human neuroanatomy. Figure 3 highlights in red the Faculties and Mental Universes, in blue the reality progressively grasped by the Sensory Mind which, through the following phases, rises from nothing to everything.

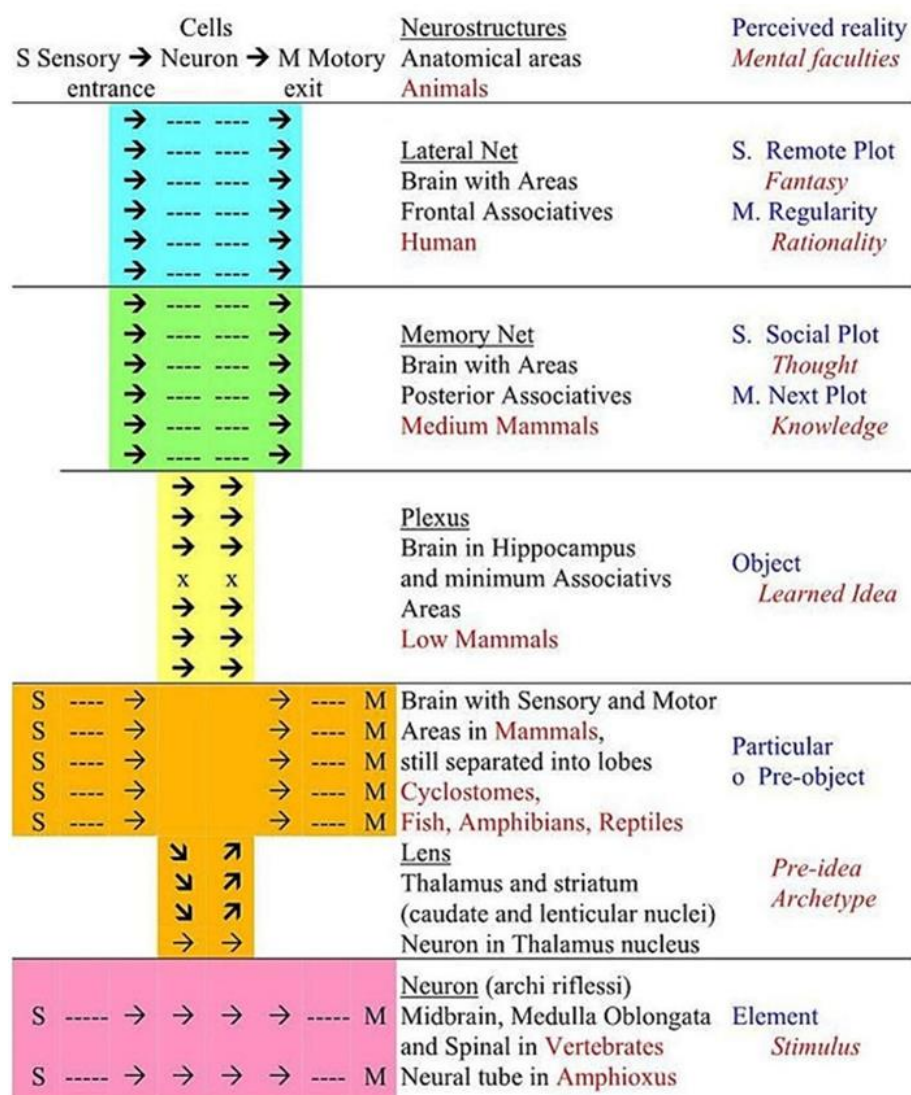


Figure 8. From below, Epigenesis of Neurostructures and Nervous Levels in humans © R. Bani.

Unknown Universe: since the beginning the network of

objects has extended to give the cosmos but the stars, planets, meteors, air, water, stones and even the first living beings



know nothing about it. Follows the *Vague Universe*, of perceptual halos such as hot/cold, sound/silence, light/darkness, just the minimum to grasp the day or night. *Universe of Categories* with pale ideas to recognize certain details or pre-objects or key stimuli with which to distinguish classes of objects such as male or female, food, predator, shelter. Combining more details we arrive at the Objects, collected in a *Universe of mental Objects* as specific ideas, necessarily learned such as the mother, the puppy, the territory. More mental objects, ideas, correlate in the *Plot Universe* that towards the conspecifics differentiates a *Social Universe*, made for us of people and language. The plot that extends reveals the physical and social regularities, therefore *Universe of Laws*. But all these things, everything that a human being and all humanity have in mind, the totality of what they think and wherever it extends, represent the *Remote Universe*.

If the low animals pick up very little of their surroundings: rare points of light in the black night, a few vital fragments in an imperceptible continuum, as they climbed the metazoans picked more and more signals, of category and then of specific objects. Until in mammals the memory areas allow a little knowledge, mental maps, and in primates and some other species even rational and conscientious gifts, as it must have been for australopithecines and hominids. Mental universes from the unknown to the remote, and when I see humans pointing radio telescopes at remote galaxies, discussing bosons and the big bang, I think about how far we have come. Sapiens are immersed in full light.

#### 8.4. Memogenesis

It has grown from elementary stimuli such as the *Perceptive Medium* to the *Pre-idea* or key stimulus, to learned *Idea*. Progress supported by masses of neurons increasingly adequate to grasp reality like the cerebral cortex of mammals with growing nets of neurons and memory. Memory as *Pre-ideas*, and we too have arche-types, such as single *Ideas*, broad memory of reality as *Knowledge*, then memory that elaborates memory and is *Thought*. However, everything is still inserted and forced into sensorimotor flow. Frontal lobe then grows which, lateral, processes the contents of knowledge and thought with the faculties of *Reason* to bring order and of *Fantasy* to vary infinitely. Their osmosis is *Creativity* which has produced an innumerable quantity of artifices with which history is built [3].

Climbing the enchanted staircase, moving from one step to the higher, the neurostructures multiply and integrate, like the faculties that gradually acquire, collaborate, and integrate: the higher ones use the lower ones. Yet, everything happened simply due to the neuron's multiplication which, rising, each time filled a plane with certain units but then, having exceeded the amount of memory necessary to live at that level (lines of neurons, lenses, plexuses, networks) in the environment the excess neurons gave neurostructures of above level until this too was completed. It is a progress quantized in

steps, and it is nature that quantizes it.

#### 8.5. Psychogenesis

Is the structure of Psyche, also progressive and in which Ego proceeds in its formation, maturing from newborn to adult. But, for its completeness, I will have to deal with it in another book.

This is the evolution of intelligence.

#### Author Contributions

Roberto Bani is the sole author. The author read and approved the final manuscript.

#### Ethical Declaration

I declare that this manuscript of mine, my proposals and my commitment comply with the common ethical standards of scholars and men. I declare that no human being and/or animal is involved in the research, I am not the object of my study and there are no collaborators, reviewers or committees of any kind.

#### Declaration of Consent

I have carefully read the Instructions for Authors; I am informed and I give my full consent to publish the manuscript.

#### Funding

The article, the author, does not receive any funding, there is no institution or private body that contributes to the publication.

#### Conflicts of Interest

The author declares no conflicts of interest.

#### Appendix: Glossary

*Nervous-mental-psychic Levels*. Levels or steps in the progress of intelligence.

*Epigenesis*. The ability of each evolving organ to acquire a new structure-function that adds to and superimposes on previous ones, preserved and integrated for their usefulness. Therefore, an evolved organ is a complex stratification of ancient levels, preserved because they are always useful, and recent ones, broader and more visible.

*Nervous Structures*. The combination of the neuron, an anatomical unit, into lines, groups, and networks, constituting the hardware in which the brain's software circulates, whose unity is the stimulus. This article argues for a precise correspondence between the two.

- A single *neuron* conducts a *stimulus*.
- A *lens* is a group of neurons with synapses structured to correspond to and recognize a *pre-idea* (a simple idea), therefore a pre-object (part of an object).

- A *plexus* is a group of lenses connected to each other; therefore, multiple pre-ideas combined into an *idea* corresponding to an object.

- *Nervous Networks*. Groups of neurons that connect, both among themselves and externally, perform a general function, such as the sensory (visual, auditory, olfactory, tactile) and motor areas. Between them lies the post-Rolandic association area, which contains the memory of many pre-ideas and ideas, thus the memory of many objects, i.e., *knowledge*, even minimal knowledge like the mental maps of many mammals. Our mental life largely unfolds between the sensory areas, which create and trigger memories in the association area, which then flow to the motor area: overall, it is a sensorimotor flow network (S->M).

- *Lato-Net* or Networks lateral to the sensorimotor flow. The multiplication of neurons has expanded the frontal lobes, whose nervous networks remain lateral to the S->M flow. They do not participate directly but can process the memory of the association areas. In *Homo sapiens*, they are enormous and process memories with *Rationality* and/or *Imagination*.

*Psycho-Mental Structures* are the software that circulates in the nervous system, just as you run the program (app, file) you're interested in on your computer. Functional units are the *stimuli*, which, however, quickly diverge into the forms/drive's dichotomy. Forms are *ideas*, whose totality and elaboration constitute the *Mind*. Drives are *motivations* (impulses, instincts, feelings), whose totality and elaboration constitute the *Psyche*.

*Perceptivity*. The subject's ability to perceive signals, to which it clearly reacts. It depends on the sense organs, but when they are largely capable of receiving signals, such as the eye and ear, perceptivity comes to depend on the ideas that recognize, or fail to recognize, the signals, and therefore on the subjective Mental Universe.

*Mental Universe*. The set of ideas present in an animal's nervous system, corresponding to a part of external reality, enabling it to recognize and react to it. They are ideas as small as a stimulus or as large as the Remote Universe: distinguishing this progression in the animal kingdom is the privileged object of this study.

*Remote Universe*. The set of phenomena furthest from the subject, in space and time.

*Archetypes*. Innate, inherited ideas that can act alone but also, in humans, in the global mental universe, as guidelines in the maturation of the Ego.

The Evolution of Intelligence is fully covered in the book *Cosmic Thinking* from which this article is extracted.

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