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# Proprioceptive Perception: An Emergence of the Interaction of Body and Language

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## Abstract

This chapter provides a systemic perspective of human behavior, which reformulates the concept of effective behavior and cognition that derive from the classical vision of neuroscience and psychology based on the Cartesian reductionist functionalist paradigm. This systemic perspective, which is based on the theory of autopoiesis, proposes that the act of perceiving proprioception is decisive in the capacity of the human being to differentiate himself from an external space within which he is situated; a phenomenon that we will denominate “proprioceptive perception”. This complex phenomenon of dynamic character emerges from the relationship between the domains of the body and language in the individual’s relationship with their environment. Furthermore, from this systemic perspective, we will present the emotional states as cognitive states necessary for the conservation of the individual’s living identity and the close relationship they have with the sensorimotor patterns and proprioceptive perception. This chapter answers the question of how proprioceptive perception affects the human being’s experience of being different from others and from the environment in which they find themselves, having the possibility of being aware of themselves and of the world they perceive - in a present - within the environment in which they find themselves. And it explains how this phenomenon modulates its modes of emotion in congruence with what occurs in its present.

**Keywords:** autopoiesis, three-dimensionality of behavior, emotions, sensorimotor correlation, posture, sensorimotor pattern, emotional states, proprioception, perception

## 1. Introduction

The proprioceptors are sensory receptors that refer to the qualities of movement in the postural dynamics and displacements of the body in space; sense that for a human being is determinant in the perception of himself in a here and now. We call this phenomenon proprioceptive perception, which modulates the emotional states of the individual given the circumstances of the present.

Proprioceptive perception is a complex phenomenon of dynamic character that results from the modulation of phenomena of different orders such as physiological, relational and interpretative. In this chapter we will address the questions of how, in the epigenesis of a human being, proprioceptive perception affects his capacity to become aware of his corporeal existence within his contextual situation with others

and with the environment in which they exist, moment by moment; and how the proprioceptive experience modulates -in a present- his emotional states in relation to the immediate interactive context maintaining physiological states of the organism congruent to the present circumstances, conserving in adaptation his life in the space in which it exists.

To answer these questions, we will first situate ourselves from a dynamic systemic perspective that reformulates the concept of effective behavior and cognition that derive from the classical vision of neuroscience and psychology based on the Cartesian reductionist functionalist paradigm. This last one understands cognitive phenomena from a representational perspective, where cognition is conceived as an information processing that results in a faithful representation of an external world that operates independently of the organism that perceives it. This has kept science in search of an understanding of the principles and laws of an objective external world, which explains why in the study of perception, there is a prevalence over the exteroceptive senses of an individual (vision, hearing, touch, smell and taste), ignoring the incidence in the sensory integration of the proprioceptive and interoceptive senses. In second place, we will approach how in the origin of the first living organisms are constituted the generative sensorimotor mechanisms of the movements of the effective behaviors that reveal the knowledge of the living beings, to know that it is source and origin of the way of knowing proper of the *Homo sapiens*: the reflection. Next, we will explain how the synchronization between attentional reflexive movements and corporal movements gives origin to the proprioceptive perception that makes possible the differentiation of the external and internal space of the individual. And following with the phenomena of the emotions, we will explain the characteristics of the ways of moving of a human being and how the proprioceptive perception influences the modulation of these in relation to the conservation of the well-being of the organism in its structural coupling with the environment. It explains the concept of emotional plasticity and the type of practices that restore it, showing evidence of its effectiveness.

## 2. The paradigmatic shift

We will begin with the concepts that articulate the reflexive logic of this study that approaches the phenomena of cognition from an evolutionary systemic look that comes from the Theory of Autopoiesis based on the “Theory of the Biology of Knowledge” of Humberto Maturana and Francisco Varela [1], which brings about a radical paradigmatic shift that is produced with the evidence that the internal operation of living beings -in their environment- is of a circular and recursive nature. This implies that the cognitive processes are referred to the changes of the internal states, and not to the changes of the external environment within which it is observed, showing how the world they live in, in a present, is the result of an epigenic process and not of a processing of information captured from the environment. This explains the phylogenetic and ontogenetic origin of the cognitive processes of human beings that - in their relationship with others - give rise to the domain of language, which makes possible their capacity to reflect, and with it, to perceive themselves differentiating proprioceptively from others and from the world of objects that they learn to perceive in their culture.

Both authors define that “knowledge is effective action, that is, operational effectiveness in the domain of existence of the living being” [1], specifying that this domain is constituted, moment by moment, in the physiological operation of the living body in interaction with the environment in which it exists. They show how in organisms with motility this operation of a cognitive nature determines the

changes of state of the individual in relation to the conservation of his living identity in a changing environment, and not to changes in the environment, revealing that effective behaviors do not respond to the perception of an image or representation of the state of an external world.

Therefore, we will address the explanation of how the first unicellular organisms of the planet autonomously maintain effective or adequate behaviors for their conservation within the environment from which they arise and with which they maintain a continuous interactional relationship, a fact that reveals their knowledge of how to live in a changing environment, thus showing how the cognitive capacities that, as we will see, result from the physiological operation of the organism in its interaction with its environment, are constituted in the evolution of the species.

This reflection originates with the study of living beings -including human beings- as dynamic autopoietic systems [1]. That is, as living systems that are self-generating, moment by moment, referring to the dynamic organization of molecular relations that constitutes them. This organization remains invariant in a flow of internal structural changes within a changing environment, with which it maintains a continuous interactive relationship of reciprocal nature, preserving the organization that defines its identity as a species.

Thus, in the operation of this organization, a network of interactive relationships between molecular components that produce the components that constitute the - metabolic network - is constituted, moment by moment, maintaining an operation of a circular and recursive nature that generates autonomy, which determines, moment by moment, the appropriate internal states for the conservation of the molecular organization that constitutes them as living beings within the changing environment in which they exist [2]. In this way, the dynamics of this molecular system constitute a physiological operation of cognitive nature, that maintains the orders of the interactional relations between the molecules, making possible the existence of a living unity that differentiates from the environment that it exists in a permanent reciprocal interaction with it.

Therefore, all living bodies, with or without nervous system, are autonomous self-referential beings, with the ability to determine the appropriate behaviors for their living conservation. So, the changes of states of the organism that trigger internal or external disturbances to themselves, are specified by their internal autopoietic operation and not by the changes of the external environment; environment with which it maintains a continuous of recurrent and recursive interactive relations of reciprocal character, that is, bidirectional.

Thus, the reciprocal character of the mutual interactions between the living body/niche generates in the epigenesis of the individuals a congruence or correspondence between the structures of both spaces constituting a structural coupling, in which both spaces -delimited by the edge of the organism- modulate with each other without there being control of one over the other, since each domain specifies the structural changes triggered by the disturbances produced in their mutual interactions, moment by moment.

In this way, in this study, the living body/niche dynamic interactional system is considered as the unit of study of an individual's behavior; two subsystems that constitute the operational domains of behavior: a) the body domain: constituted in the operation of the physiological dynamics that constitute it, and b) the relational domain: generative of the interactional dynamics that are generated in its operation within the environment in which the individual as a whole exists, an interactional space in which behavior is observed.

“...the phenomena of the structural dynamics of a living system and the phenomena that occur in its interactions in the medium, are phenomena of different kind that occur in phenomenal domains that do not intersect, and cannot be



expressed one in terms of the other”. Thus, “[...] behavior of a living system is the interactional and relational dynamics through which a living system realizes its living as a particular kind of organism in its domain of existence [...] the structural dynamics of the living systems triggers structural changes in the medium, and at the same time the structural changes that take place in the medium as behavior takes place trigger structural changes in the living system. As living takes place in the continuous conservation of autopoiesis and adaptation by the living system through its behavior, the behavior of the living system operates as the guide in the conservation or loss of the living through the coupling of the structural dynamics of the living system and the medium.” [3].

In this way “what we call behavior when observing changes in the states of the organism in its environment corresponds to the description of the movements of the organism in an environment that we point out.” [1]. This means that this environment does not correspond to the world in which the individual lives.

The implication of evidencing the autonomy of living systems, brings a radical epistemological paradigmatic shift by modifying the conception of living beings, since an autonomous system means that it defines itself through mechanisms of self-organization. Therefore, this characterization of living beings modifies fundamental beliefs of the traditional Cartesian, representational and functionalist paradigm that conceives living systems as heteronomous systems, that is, that they are defined - in their conformation and behaviors - through external mechanisms of control (input-output), therefore their world is treated as if it were independent and represented [4]. In this way, classical science defines behavior as responses to external stimuli, being the environment the one that defines the course of structural changes of the living bodies, thus living bodies have no incidence in their evolutionary transformations, for which they would be heteronomous systems. This is exemplified in the following statement by H. Curtis and N. Barnes:

“The characteristics of the behavior of an organism -its sensitivity to particular stimuli and patterns of response to those stimuli- are the product of natural selection, just as much as the shape of the teeth or the feedback loop that regulates blood pressure. Therefore, natural selection is the force or active agent that determines the course of evolution of the identity of living beings, being these mechanical organisms lacking the autonomy to specify their behavior and structural changes in relation to the conservation of the molecular organization that defines their living identity, and actively specify the niche in which they carry out their living through their behavior, conserving themselves in adaptation in a structural coupling with the environment.” [5].

The reformulation of the generative mechanisms of the effective behaviors leads in turn to a reinterpretation of the concept of cognition, which traditionally has been considered as an information processing in which the sensorial surfaces transduce the stimuli of the environment, sending the information to neuronal structures that process it, generating a representation of the state of the world in which the individual is, from which the system selects the effector motor patterns for the appropriate behaviors to the individual's situations, which result from phylogenetic and ontogenetic learning of an adaptive nature.

The autopoietic theory originates a reformulation of the generative mechanisms of effective or adequate behavior of living beings, as well as the evolutionary processes that give rise to the diversity of anatomo-physiological structures that define the identity of living species. The autonomy of living bodies makes them an active agent in the transformation of themselves, as well as of the environment in which they are found; a phenomenon that occurs in the epigenesis of living bodies. The evolution of the history of structural links between organisms and their environment generates reciprocal transformations that lead to the maintenance of a congruence

in the structural changes of both, a fact that makes possible the conservation in adaptation of the organisms. Traditionally, this congruence has been interpreted as the result of effective behaviors in their adaptation to the environment, which result from responses to the stimuli of an external world that operates independently of the operation of the organism, considering them instructive and unidirectional interactions; thus, in the evolution of the organism, the adaptive behaviors would be determining the structure and identity of the species.

### **3. The origin of the autonomous movement and the lived world**

The sequences of movements of an organism in coupling with the environment that are observed in its effective behaviors result from “a very specific correlation coordination between sensory surfaces and motor surfaces, ...sensory-motor correlations that originate from the first living beings through metabolic transformations proper to the cellular unit” [1], which in the recurrence and recursiveness of reciprocal interactions with the environment are constituted in sensory-motor learnings that specify ways of interacting in the regularities of changes in the environment, keeping invariant the molecular relations that define the molecular organization that preserves the living unity in adaptation.

By way of example, the feeding behavior of an amoeba about to ingest a protozoon is described by means of the extension of a pseudopod. Pseudopods are expansions or digitations of protoplasm associated to structural changes in the local physicochemical constitution of the cellular membrane. How does the global and unified movement of the animal occur in its structural coupling with an environment in which it is also structurally coupled to it? “The presence of the protozoon generates a concentration of substance in the environment that is capable of interacting with the amoeba’s membrane, triggering changes in protoplasmic consistencies, resulting in the formation of a pseudopod. The pseudopod in turn produces changes in the position of the moving animal, thus modifying the number of molecules in the medium that interact with its membrane. This cycle is repeated, and the sequence of displacements of the amoeba, therefore, is produced through the maintenance of an internal correlation between the degree of modification of its membrane and those protoplasmic modifications that we see as pseudopods, a recurrent and invariant correlation is established between a disturbed or sensory area of the organism and an area capable of producing motor displacements, which maintains invariant a set of internal relations in the amoeba.” [1].

We can see, on the one hand, how the continuous structural coupling of the organism with the environment generates the congruence between the structural changes of both, and on the other hand, how the movements of the organism generate correlations of specific structural changes between sensory and motor surfaces that establish interactive relations of reciprocity. These relationships are not instructive, they generate a continuous structural change in which the change of one is in relation to the change of the other, moment by moment. Thus, the changes in the motor surfaces generate, in turn, changes in the sensory surfaces, sensorimotor dynamics generating permanent movements that are observed in the proper behavior of an organism in its environment, a process that, as we see, does not consist of a process of capturing and processing information from an external world that operates independently of the organism’s operation.

In this way, in the physiological operation of the organism, the modulation of processes of sensorimotor activity is generated, constituting a synchronic coordination of structural changes between local zones of the organism that modulate with each other, resulting in a distributed modulation mechanism from which a state of

global activity emerges -of a temporary nature. This global state specifies a coherent and unified cognitive state that determines the behavior of the individual in his/her relationship with the environment; a mechanism in which local changes modulate the state of global activity and, vice versa global states modulate the activity of local areas, without the existence of an external or internal agent or force that controls them. Such mechanisms of sensorimotor coordination are constituted in the operation of every living being with or without nervous system -what varies among species are the types of sensorial and effector structures- of a centralized control or product of an external or internal agent that specifies the states of activity of sensorimotor patterns of the organism, as well as dispenses with the idea of a representation of an external world.

Returning to the behavior of the amoeba in its coupling with the environment in which the protozoon is found, they establish a structural coupling, which from an observer's perspective, the protozoon constitutes the prey as a result of a feeding behavior. This fact that a western human being perceives, observes and interprets from the distinctions of the world of his culture, has no relation with the intentional behavior of the amoeba, since by the way, the amoeba does not distinguish the protozoon nor has perspective of the changing environment, therefore it does not intentionally go towards it with the purpose of swallowing it and thus feeding itself. This anthropomorphic interpretation hides what occurs inside the animal in its structural coupling with the environment, that is, it hides the physiological operation of a cognitive nature of the organism that specifies its changes of states triggered by the disturbances of the environment, in relation to its previous states, a fact alluded to when characterizing said operation as circular and recursive.

In summary, from this systemic perspective, the sensation-movement state of a living body in its environment, in a present, results from the dynamic activity of the sensory-motor operations that gives rise to a global cognitive state - of a temporary character - that specifies the coordinated and synchronic dynamic movement sequences that constitute the coherence and uniqueness of an effective or adequate behavior for the conservation of the organism in adaptation in the structural coupling with the environment. This was illustrated with the case of the amoeba's behavior, showing the origins of the generative mechanisms of the effective behavior of living beings with motility, as well as the cognitive processes that result from their co-evolution with the environment in which they exist.

From what has been said before, we can distinguish that the environment in which an observer distinguishes the amoeba, does not correspond to the world that it lives from its sensorimotor dynamics that are referred to its internal operation, which on the one hand means that the environment that it knows is its interiority and on the other hand that these dynamics that specify the movements in their structural coupling with the environment are generative of the lived world, a world without perspective of its changing environment.

We could say that the living of a body arises spontaneously in a generative movement of its knowing, which Maturana expresses strictly by saying: "to live is to know and to know is to live" [1], which from our perspective alludes to a fundamental fact that reveals the mode of existence of every living being, namely, both life and knowledge arise in the same act.

Therefore, the autonomous movement of animals with motility is a key to the understanding of cognition and the phenomenon of perception in human beings, as we will see in the following section the knowledge of the body in its environment is the source and origin of the way of knowing of human beings: reflection. In this regard the biological origin of human knowledge is evidenced by unifying its nature: corporeal-spiritual constitutive of a living unit.



From the world of the biology of knowledge we reach the world of philosophy. The phenomenologist Maurice Merleau-Ponty from his exhaustive studies in the human experience, describes the phenomenology of perception, a study that begins with the conviction that “phenomenology is also a philosophy that re-situates the essences within existence and does not believe that man and the world can be understood only from its factuality” [6]. From his studies of the human perception and behavior, he establishes co-relations between the psychism and physiology that lead him to a reformulation of the classic vision of the body-object, saying: “The union of the soul and the body is not sealed by an arbitrary decree between two external terms; one, the object, the other, the subject. This union is consummated every moment in the movement of existence. It is existence that we find in the body when we approach it through a first way of access, that of philosophy.” [6].

#### **4. The co-evolution of living beings**

Bearing in mind that the world that a living organism feels within its coupling with the environment, it constitutes a continuum of sensation-movement resulting from the cognitive states that emerge from the dynamics of activity of patterns of sensorimotor correlations. These patterns, which are constitutive of the learning process, result from recurrent and recursive movements that are constitutive of the individual's behavior, and determine his anatomo-physiological structure, which specifies his species and his way of knowing and living in his structural coupling with the environment.

In the -recurrent and recursive- structural couplings between living beings that co-exist in the same environment, it is constituted temporary reciprocal interactions between them, generating mutual learning that modify in congruence the anatomo-physiological structures of them. For this reason, in each temporary encounter between them the autonomous operating of the corporal structure of each one determines the specific movements of their behavior, recreating the structural couplings that occur in these temporary encounters. For example, this phenomenon occurs with symbiosis relations between species. This is the case with the structural correspondence between pollinating insects and the flowers of the plants they pollinate. The plant species *Drakeae glyptodon*, an orchid species whose structure takes a similar form to the female *Thynnid* wasp, and in its operation produces pheromones that attract the male wasp which is the only insect vector of its pollination. Thus, in the co-evolution of both species, they constitute a history of structural coupling that constitutes the structural changes that are conserved in their progeny.

This epigenic phenomenon when it occurs between individuals of the same species gives rise to the constitution of social systems. In the recurrent encounters of two or more organisms, specific action dynamics are synchronically triggered, generating a coordination of action between them resulting in a communication that specifies a particular way of interacting and relating, which defines a domain of possible actions between them. Thus, said systems are constituted in dynamics of networks of coordination of action between individuals, that give emergency to a collective of autonomous beings self-organized, which moves like a totality in congruence to the changes of the environment, inside which the individuals generate behaviors that of isolated form they could not acquire. This is the case of the flocks of Franklin gulls that migrate from Cape Horn to Canada, a flight in which individuals increase their speed of flight by 72%, compared to the speed of flight of an isolated individual, and no further in the case of human beings who, in their social



way of life, learn in doing with another to incorporate the mastery of language that makes their capacity for reflection possible.

Thus, in social systems, the learnings that are generated in individuals in the coordination of action among them, constitute the sensorimotor patterns that are the ways of moving and relating that constitute the way of life of the collective, which is transgenerational preserved by maintaining a living knowledge that makes its existence possible within the environment.

This co-evolutionary phenomenon constitutes a communicative process that is not related to an exchange of information, but rather to interactions of a reciprocal nature that generate specific and recurrent structural changes that occur in their encounters; encounters in which the structural changes of the organisms in their reciprocal interactions are modulated - at each instant - generating a coordination of movements that configure a choreography that is repeated in their recurrent interaction within the social system in the environment in which they are found. "We will understand communication as the mutual triggering of coordinated behaviors among the members of a social system" [1].

## 5. Reflexive movement and proprioceptive perception

Following this second order cybernetic perspective [7], which recognizes that the architecture of the neural networks constituting the nervous system that is embedded in the body of the organism, maintains a circular operation that is to say with operational closure, therefore this operation is referred to the states of activity of the network, and not to an external world [8]. This network is self-organized by distributed mechanisms, in which the global states of activity of the network modulates the activity of local zones, and vice versa the activity of local zones modulates the global states of the network. In this way, there is no internal or external agent that controls its operation; on the other hand, this system modulates and is modulated by the physiological operation of the organism. Therefore, the condition of operational closure of the neuronal network would explain that the world perceived by the organism, including the human being, is a world that emerges from the internal operation of the organism in its structural coupling with others and the environment.

Considering this, we will explain the perception of the world lived by a human being and the learnings that originate the proprioceptive perception, from recognizing the type of structural links that occur between the hominid ancestors of *Homo sapiens*, generative of phylogenetic learnings that make possible the emergence of language and its capacity to reflect. These facts give origin to the particular way of life of a social system constituted by networks of coordinated action coordinations from the operational distinctions of the language domain, that is to say, generative action coordinations of the networks of consensual conversations. We are going to see how the first condition for the constitution of the phenomenon of perception in human beings is the origin of the observer. "The observer and the observed, then, emerge in the flow of structural changes that occur in the members of a community of observers when they coordinate their consensual actions through their recurrent structural interactions in the domain of operational coherences in which they carry out their connected practices of living." [9]. Thus, if language is constituted in the domain of the coordinations of the dynamics of action coordinations that occur in the joint action of individuals within the social system in which they carry out their living in coexistence.

The mathematician H. Von Foerster, in his original presentation of the notion of second-order cybernetics, who is a precursor of the same, starts by pointing out

what he calls a theorem, alluding to the statement made by Maturana after explaining the origin and mode of operation of language, which he states in this way:

“I. - All that is said is said by an observer.

A theorem to which Foerster adds a corollary that affirms:

II.- All that is said is said to an observer”.

Concluding that I and II connect two observers through language, with this connection, in turn, a new concept is established, namely that of society, the two observers constitute the fundamental nucleus of a society, thus the three concepts are connected in a triadic way, each one with the other. “In this interaction we cannot say who was first and who was last [...] a closed triad is formed” [7].

Thus, in this circularity, the operation of language within a social system constitutes observers, and observers in turn constitute the language in its operation in the domain of the coordination of the coordination of action among observers, a reflexive dynamic that is recurrent and recursive and generative in turn, of the domain in which it is constituted. This is a dynamic in which perceptual objects that constitute the world of culture in a society of human beings are configured. Thus, the operation of language domain constitutes an operational system constituted by the distinctions of perceptive objects that are associated among them, generating new distinctions that constitute the association network that generates them, a circular and recursive operation.

In the operation of language, the observer and the perceptual objects that constitute him/her are constituted, a circular dynamic that generates the world perceived by individuals, which does not correspond to an objective reality. Therefore, the description that an observer makes of the world of objects or phenomena that he/she perceives is the result of the flow of the experience of his/her consensual behavioral coordination with others. Therefore, these descriptions are not absolute truths, but descriptions agreed upon with others in the coexistence by such “everything said is said by an observer and for an observer” with whom they maintain a generative structural congruence of their coordination of actions in doing together in the coexistence.

“And since perceptual objects arise as behavioral configurations, the world of shared perceptual objects belongs to the sphere of operational concordances between organisms, which constitute them in the course of their coexistence as configurations of their behavioral concordances. In other words, if the perceptual objects remain configured by the behaviors of the organism, the world of perceptual objects that occurs in the coexistence of organisms, including the observer, can only arise from the coexistence as long as the organisms operate generating and conserving their mutual structural correspondence. That this is so is also apparent in everyday life, in which we know that the common world only arises in the community of living” [10].

How does the observer in language generate perceptual objects that are configured in the behavior of the individual? Language occurs in the flow of consensual coordinations of actions of organisms whose actions are coordinated because they have congruent dynamic structures that have emerged or are emerging through their recurrent interactions in a co-ontogenetic structural drift. Because of this, interactions in language are structural interactions that trigger in the organisms interacting contingent structural changes with the course of the coordinations of consensual actions in which they arise. As a result, even though the domain of language is not intercepted with the structural domain of the body of the interacting organisms, the structural changes of the interacting organisms in language are a function of what occurs in their language and vice versa [9].

In this way, the origin of language generates a new operational domain in the behavior of human beings, which generates reflexive operations. Thus, this domain, which

is not intercepted with the corporeal domain (constitutive of the physiological operation), nor with the relational domain (constitutive of the reciprocal interactions that the organism maintains with others and its environment), is constituted as a domain that in its operation generates perturbations both in the state of the organism and in the interactive contexts of the organism. Therefore, it corresponds to a third operational domain, which participates in the modulation of human behavior and experience.

The operation of language generates associations, descriptions and interpretations that originate the beliefs of the world of culture that give meaning to the way of doing and relating to individuals, making them learn to incorporate the recurrent and recursive coordination of action. This operational domain, brings the intentional movements from the reflection, which entails the learning of the reflexive movement of orienting the focuses of attention towards the perceptive objects constitutive of the world that the individuals learn to see in the doing with others, within the culture in which they grow. This reflexive attentional movement brings the possibility of the human being to become aware of himself, of the others and of the environment in which they are, by differentiating himself proprioceptively from the objects that he perceives, which occurs by the ways of relating and interacting that are constituted in the way of life of the hominids.

We will now see what happens in the bodily domain of behavior with the structural couplings in the hominid lineages that give rise to the phylogenetic learnings that make the origin of *Homo sapiens* possible. In the lineages of hominids that give rise to the human being, their way of life was generated learning gave rise to the architecture a nervous system that is characterized by a significant increase in brain mass, which means an increase in interneurons that expands the possibilities of structural plasticity of individuals, and thus the ability to learn, which means greater behavioral plasticity. Today we know that the genomes between *Homo sapiens* and anthropoids are almost identical, and from neuroscience it is observed that the regions of the brain have equivalents in the brains of apes. An interesting difference is the development of the generative auditory capacity of phoneme learning that is related to the origin of language [11]. Therefore, the advances of science support with their data the assumption that the origin of the reflection capacity of human beings is related to their way of life.

Such learning, which modifies the anatomophysiological structure, occurs in a way of life in which the game generates continuous and recurrent coordinations of action, and in this way increases the capacity to manipulate and differentiate objects with which they interact with others. At the same time, they had daily physical encounters in which they groomed themselves, and caressed in sensual and prolonged interlacing of their bodies and continuous sexual games with prolonged physical contact. In this way these dynamics of action generate structural changes in proprioceptive sensorial surfaces that correlate with modifications in motor surfaces, constituting recurrent changes in the sensoriality of the qualities of the movements of dynamics of postural sequences and positions of the different parts of the body, which together with maintaining a frontal vision with the other in the coordination of movement that are accompanied by guttural sounds, establishing in dynamics of action in which they generate movements of joint generative attentions of a perspective of the movement of itself and the other, which entails the reflective learning to sustain a division of centers of attention in movements of visualization of the movement of the other and proprioceptive sensation of the movements that it coordinates with him. Thus, in these dynamics of structural links of character-recurrent and recursive- learning is produced, which are constitutive of sensorimotor patterns that result from the coordination of visual, proprioceptive, tactile and auditory sensations, which constitute the sensation of movement and space of oneself, which occurs simultaneously with the differentiation of others in space.



This pre-reflective process that is observed in the families of hominids is generating the learning that makes possible in the individuals the reflective movement of coordination of the attentional movements and the corporal movements in relation to one another, generative of a perspective that arises from an internal space delimited proprioceptively towards an external space when dividing its attention. "...in effect, their spatiality is not, like that of external objects or like that of spatial sensations, a spatiality of position, but a spatiality of situation. [...] The word here, as it applies to my body, does not designate a certain position with respect to another position or with respect to an external coordinate, but rather the installation of the first coordinates..." [6]. In this way, his corporeality is a spatial reference of his situation in his perspective of the world, moment by moment, which arises in interactions with others and the environment, being the place perceived proprioceptively in which he is and exists in a present.

This reflexive movement constitutive of an observer's perspective, which arises from learning to divide their focus of attention into movements of joint attention with another observer in the manipulation of their bodies and objects, is configuring perceptual objects that constitute the observer that emerges with them. In this way the reflexive movement that arises from motor couplings between individuals, is constitutive of the operational domain of language and of the structural congruence between the objects of perception and the living body in its structural coupling with the environment: "The observer's operation in language consists of a way of living in the recursion of behavioral coordination that arise in the community of living and that configure a world of perceptual objects. [...] The language and the operation of the observer, therefore, do not require or give rise to references to an external reality. The world of the observer's descriptions and explanations is a world of modes of coexistence that generate perceptual objects, in which the observer emerges as one of them when language emerges. Hence the generative and transforming power of the world that language and the explanations given in it have." [12].

## 6. Proprioceptive perception

This composite concept leads us first to consider how perception is understood from this systemic perspective that includes living beings as structurally determined systems. This means that everything that happens to the organism in the interaction with its environment is determined by its structure. Therefore, the interactions of the organism with its environment are not instructive [1, 12]. From this perspective, perception consists of "the configuration that the observer makes of perceptual objects by distinguishing operational cleavages in the behavior of the organism, by describing the interactions of the organism in the flow of its structural correspondence in the environment" [12].

For there to be a perceptive experience, it is the observer who emerges from language as a perceptual object, the one who configures a world of perceptual objects in the recursion of behavioral coordination that arise in the community of living [13].

On the other hand, we will define proprioception as one more sense like vision, smell, taste, hearing; it is the sense of the qualities of the body's movement and its situational disposition in space (that the same movements generate) (see **Table 1**). Proprioception is not in itself a form of perception that gives us the "perception of the body", it is not the image, nor the representation, nor the consciousness of the body as an object [14]. The proprioceptive sensation is produced, moment by moment, by the changes in the activity of the proprioceptors that generate the



Location	Proprioceptor	Quality of sensation
Muscle	Spindle afferents Ia & II	Length, speed, acceleration and deceleration Minimal over-contraction force.
	Golgi tendon organ	Dynamic changes of the contraction force
	Group III y IV	Chemosensitives. Information on metabolic changes and muscle damage/inflammation
Joint	Group I & II	Range, speed and position of the joint. Group I (dynamic and static, low threshold, slow adapting), Group II (dynamic, fast adapting)
	Group IV	Feedback on excessive stress on the joint. Sensitive to joint inflammation
Skin mechanoreceptors	5 types of receptors in the skin: two fast adapting and three slow adapting	Contact and texture of objects. The tension of the skin contributes to the sense of movement of the joint. More sensitive to dynamic than static stimulation

**Table 1.**  
*Proprioceptors and quality of sensation.*

dynamics of the postural sequences of the movement of the individual in structural coupling with the environment. This dynamic phenomenon in which the relations of reciprocity between the changes of the sensorial surfaces and the effector surfaces of the movement, generate that the sensation modulates the movement and the movement in turn, modulates the sensation, a continuous flow of sensation-movement. This flow of sensation-movement is constituted in the operation of sensorimotor patterns that specify qualities of behavioral movement. In the reciprocal interactions of the individual in structural coupling with the environment, the cognitive states specified and that in turn specify, the changes in the dynamics of activity selectivity of the sensorimotor pattern networks that give rise to sensory integration (proprioceptive, visual and vestibular) [15] that define the dynamic body scheme, in a present.

The body schema is defined as an integrated set of sensorimotor processes that organize perception and action in a non-conscious and sub personal way [16]. The body schema is not phenomenologically available to the observer: “the body schema is not the perception of my body, it is not the image, the representation or even the consciousness of the body. Rather, it is precisely the style that organizes the functioning of the body in communion with its environment [17]. On the other hand, body image includes the immediate conscious perception of the body, including the conceptual construction about the body and the emotional attitude and feelings about the body, “being a complex phenomenon that contemplates at least three aspects: perceptual, cognitive and emotional” [17]. However, other definitions have been proposed for this construct: “cognitive representation of the body based on stored knowledge and sensory experience that underlies perceptual judgments” [18], “a representation of the body’s shape” [19], “perception of the body’s spatial dimension, its size, shape and relative configuration of its parts” [20].

What are we talking about when we talk about proprioceptive perception? Proprioceptive perception differs from the concepts of body schema and body image, since it is a reflexive phenomenon that constitutes an attentional movement of the observer towards the corporeal dimension of his behavior, in a here and now. Thus, proprioceptive perception makes present as object of perception the proprioceptive qualities resulting from the dynamics of postural movement and displacements of the individual in his structural coupling with the environment.

These qualities configure the perception of the dynamic corporeal space that is defined in a flow of synchronic coordination of movements of the different parts of the body that configure the coherent and unified global movement constitutive of the proprioceptive qualities that result from the sensorimotor operation of the individual in his structural coupling with the environment.

Thus, proprioceptive perception is the perceptual object of the observer configured with the qualities that make up the internal space that appears sensorially delimited from an external space within which it is situated, generating a perspective of the world of objects from which it differs proprioceptively, perceiving the place in which it exists, in zero time; that is, the living body that constitutes moment to moment, its existence as a living being in a structural coupling with the environment with the capacity to reflect and observe the world that it constitutes in doing with others within its culture.

“If corporeal space and outer space form a practical system, the latter being the background against which it can stand out, or the void before which the object can appear as an objective of our action, it is evidently in the action that the spatiality of the body is carried out, and the analysis of one’s movement has to allow us to understand it better. We understand better, as soon as we consider the body in movement, how it inhabits space (and time, for that matter), because movement is not satisfied with passively supporting space and time, it actively assumes them, it takes them back in their original meaning that is erased in the banality of acquired situations.” [6].

In this way, proprioceptive perception cannot be understood outside of perception-movement. Proprioceptive perception constitutes the reflexive and corporal movements of two dimensions of human behavior constitutive of disjointed operational domains: language and its corporeality. “Reciprocally, every perceptive habit is still a motor habit and here also the capture of a meaning is made by the body.” [6].

So proprioception does not have a dual nature, as proposed by Gallagher [15], since its nature is biological and responds to physicochemical properties. Proprioception corresponds to the body domain; whose operations are the networks of physiological dynamics that constitute the mechanisms of the correlations of the sensory and motor surfaces. While reflection and movements of the focus correspond to the domain of language, whose operations are the networks of semantic distinctions with operational closure. Therefore, when proprioception is a perceptual object of the observer, both the body and language domains are operating simultaneously on proprioceptive perception. In addition, these disjointed domains modulate each other [21], and reflection and attentional movements can trigger changes in proprioception and in turn proprioception generates changes in the language domain, as we will see later.

Consequently, we say that the phenomenon of proprioception is different from the qualities of the perceptual object that the observer configures from his corporeal experience, which results from the modulation of the three operational domains that configure the coherence and uniqueness of his behavior: corporeal, relational and language, moment by moment. Thus, both the proprioception and the proprioceptive perception of the individual in their interactive contexts maintain a structural congruence between both phenomena in their continuous structural changes within their circumstances, thus constituting the effectiveness of their behaviors in relation to both their purposes and the conservation of their well-being.

For this we will first address how muscle physiology is involved in the modulation of body perception. The situational disposition of the individual (his posture and movements, in a present) correlates with a configuration of the afferent activity

of the proprioceptors coming from the skin, the joints and the muscles that are projected towards the primary somatosensory cortex and the primary motor cortex, to then converge in higher order somatosensory regions [20]. The integration and comparison of proprioceptive activity with the activity of other sensory modalities (and the reflective capacity of the human being) triggers the perception of the size of the body parts, which is relative to the perception of other body parts, as well as to the environment in which the individual is coupled in a present. Thus, in situations where the activity of the nervous system presents a change in the relationships that are generative of its structure, as is the case of a vascular accident, epilepsy, anesthesia or migraine, the perception of size and shape of body parts will be modulated by this configuration, which is commonly understood as a perceptual “illusion” of the body. This phenomenon has also been observed by applying an external vibration in specific muscle regions [22]. Since the afferent activity of the muscle is modulating the sensation of the position of the limb, when performing such stimulation, it is possible to generate the “illusion” of the perception of the movement of the limb or the whole body in a desired virtual direction.

In these cases, the perception of the body is modified by unintentional factors on the part of the individual. However, the human being, through his reflective capacity, has the ability to direct his attention to the perception of his body and with it modulate the perception of the relative size and shape of his body parts. The evidence shows how paying attention to proprioceptive sensations (directing attention to movement during the execution of a task) generates a change in the sensitivity of the muscle spindle [23, 24], which would be modulating the perception of movement of the individual in its structural coupling with the environment. In this sense, training the proprioceptive perception we can modulate the muscular physiological activity, which as we will see, modulates in turn the sensorimotor correlations of the basic emotions.

## **7. The modulation of proprioceptive perception and emotions**

In research on emotions, we find a diversity of explanations that involve descriptions of different mechanisms that affect the emotional states of a human being, which respond to different dimensions of the phenomenon: physiological, psychological, relational, behavioral, as well as cultural. Thus, in 1991, Plutchik in his book *Emotions* [25] indicates more than 57 definitions that arise from various authors in the field of physiology and psychology, such as W. James, S. Freud and B. Skinner, to mention a few. This fact shows the multiplicity of non-linear variables that characterize an emotion, so we can conclude that it is a complex phenomenon, which is naturally observed in the behavior of an individual, and that each person perceives in his experience.

Given this last point, we will understand “emotions as specific sequences of movement of an organism in structural coupling with the environment that an observer distinguishes”. We approach emotional phenomena as the distinction of a specific configuration of a coherence in behavior. In this way we distinguish the phenomena that occur in the different operational domains of behavior: body, relation and language, and correspondingly we observe the correlations of the modes of movement, relationship and interpretation of an individual’s experience.

These specific sequences of movement that constitute modes of movement define possible dynamics of action of the individual in his or her present, and with this the type of interactions that are generated in his or her relational contexts, as well as the distinctions of perceptual objects that originate his or her attentional movements in language, generating his or her interpretations.

In the human being two orders of emotional phenomena are observed that respond to the origin of sensorimotor learning, we find the basic emotions of phylogenetic origin, those -fear, rage, joy and sadness, on which the ontogenetic learning constitutive of the secondary or social emotions are interwoven [26], in the present study only the first ones are approached.

In the basic emotions, patterns of movements generate the activation of specific muscular synergies that are triggered from the autonomic nervous system, and therefore correspond to physiological and cognitive states of the organism. Damasio et al. [27], studied the activity of the central nervous system during the evocation of memories of the 4 basic emotions. In this they observed a specific activation pattern at cortical and subcortical level for each one of the emotions. Furthermore, they observed that the emotional states evoked activate the anterior pontine nucleus, which sends projections to the cerebellum and therefore, would possibly be involved in the activation of specific sensorimotor patterns and the quality of movement of each basic emotion. These findings show that each emotion has a physiological configuration of the nervous system and the motor system that is unique to each state, which correlates with a global cognitive operation that gives rise to the “knowing” of the organism in relation to its environment.

The specific movement sequence patterns we are talking about, correlate with specific sensorimotor patterns that come from a phylogenetic learning, that is, they are sensation-movement patterns that we can identify even in primitive unicellular organisms. Thus, the simple expansion and contraction movements of living bodies are indicative of the approach-avoidance behavioral pattern observable from a cell to the human being [28]. Therefore, from the sensory-motor operation of the organism in its structural coupling with the environment, emerges “the knowing” that is evidenced by the autonomy of the body to determine its effective or adequate behaviors to the maintenance of its living and social identity. That is to say, “knowing” emerges with the minimum living unit that moves and feels, feels and moves constituting the basic emotional movements that preserve the way of being of a living being within an environment that it does not know.

Therefore, these emotions that underlie every secondary emotion are related to the conservation of the individual's living identity, so that in continuous flow of the changes of state of the organism in its structural coupling with the environment, an emotional state of a cognitive nature can be identified, through the identification of the movements that generate the muscular synergies that are activated autonomously by the physiological operation of the organism. From here we speak of these emotions as a living knowledge that guides our actions in relation to preserving the essential, life.

These basic emotional movements correspond to fear, anger, joy and sadness, which are differentiated by a set of qualities of the sequence of their movements and the activation of muscular synergies [29]. A recent study by Shafir et al. [30], from the analysis of the movement of each one of these emotional states, identified those crucial motor elements that distinguish each emotion and that in turn, in their repetition are capable of evoking an emotional sensation. The results showed that each emotion is predicted by a single set of motor elements and that each motor element is a predictor of a single emotion, suggesting that the 4 emotions under study are discrete and have a biological substrate (see **Table 2**).

These motor patterns for each emotion delimit the possible movements of the individual, determining specific dynamics of action in its structural coupling with the environment, which in turn determine the individual's modes of relationship. Therefore, in the observation of an individual's mode of movement it is possible to characterize these modes of relationship from the flow of postural movement dynamics generated by each emotion. These dynamics are distinguished in the



Emotion	Quality of emotional movement
Rage / Anger	Advance with sudden, direct effort. Punching movements and leaning forward.
Fear	Locking up and condensing the body, as well as receding into space and retracting into the shape of the body.
Sadness	Passive weight sadness, sinking (letting the ribcage fall), head down, drooping shoulders and arm(s) to upper body, loss of muscle tone
Joy	Jumping and rhythmic movements. Lightness (light) and free flow. Movements that enlarge the body in a horizontal and vertical direction and upward movements in space.

**Table 2.**  
*Emotions and movement qualities (adapted from [30]).*

experience from the proprioceptive perception, because the quality of the movements in which they generate the dynamics of activity of the muscular synergies, – speed and direction of the movement, force and muscular tone- are specific in each emotional disposition, for such in the lived experience patterns of emotional perceptions are evoked registered from proprioceptive perceptions that are correlated with the states of the evoked body.

Thus, the human being with his capacity of reflection, can recognize an emotional state in himself through the proprioceptive perception of the sensation-movement of the body of his emotion, in a present. From the study of the emotional experience, it was shown how the proprioceptive perception plays a central role in the identification of the sensations associated with global states of the body, giving emergence to the emotional experience [31]. The execution of specific body movements evokes emotional states related to those movements [32]. In turn, an emotional state modulates afferent muscular activity, modifying the patterns of sensation-movement. These observations confirm that the continuous modulation of the behavior and experience of a human being is constituted in a joint and disjointed operation of the three operational domains: body, relation and language.

In the study of Shafir et al. [30] they show that the repetition of a movement is capable of evoking an emotion, the attention is directed to the execution of that movement or sequences of movements, therefore, proprioceptive perception is active. In this way, if from the reflective movement of the attention, proprioceptive perception is intended in a present, the emotion is modulated in relation to the immediate environment and not to the flow of evocative associations of a past or future, generating a greater congruence in the structural coupling with the environment in which the living body exists, in a present.

The aforementioned is confirmed by the results of our studies about emotional plasticity in people who practice the cognitive body integration method (CBI), which correspond to a movement-based contemplative practice [33]. CBI practice is constituted from the model of the three-dimensionality of behavior to which we have made reference in this chapter. In the research we measured the autonomic response, through the pupil diameter, during the presentation of images with emotional content in a group of people who had experience in CBI practices and in a control group (CG). Our results showed that the CBI group presented shorter pupil recovery times than the CG group, showing a better emotional adaptation given the context of the individual, in a present [34].

The concept of emotional plasticity alludes to the natural loss of generative behavioral plasticity in the epigenesis of the individual, due to the history of structural links with others and the environment in which they are placed. This generates ways of moving, doing, and interpreting that are proper to the way of life of the

family and culture in which the person lives, configuring in their behaviors modes of emotion that maintain a prevalence of a basic emotion, which over time restricts the domains of action of people, often reaching states of distress and loss of wellbeing within the current way of life. Thus, from the model we call “three-dimensionality of behavior”, correlations between the three operational domains of behavior are distinguished, generating correlations between ways of doing, relating and interpreting of people; from which personalized practices are designed. These practices consist of exercises in which the movement of attention towards the body – in a recursive and frequently manner- is synchronized with dynamic recurrent and recursive movements that involve the master muscles of the muscular synergies of an emotion, with reflections of what occurs in the present. Thus, these practices are intended primarily to restore emotional plasticity in people, and generate learning to modulate their emotional states, from intentional attention to proprioceptive perception, which facilitates placing oneself in the space within the environment in which one exists, maintaining a state of presence in the here and now of the body, which gives an emotional autonomy that modulates the physiological states congruent with the present contingencies, maintaining well-being in the sense of coherence with the present situation and not only of joy or enjoyment.

## 8. Conclusions

The purposes of approaching the paradigm from which the reflexive logic of the explanations of our observations of the phenomena of human behavior and experience is generated are, on the one hand, to show how the explanatory models and their concepts configure the perceptual objects of the world that we perceive, in this case from the doing of science. And on the other hand, to show how the recognition of the autonomy and self-reliance of the body, which reveals the knowledge that results in the continuous structural coupling of the organism with its environment, gives us a look at how the harmonies or orders that are given in the co-evolutionary drift of living species are generated, which allows us to have new references to evaluate the incidences in the individual and collective well-being of the ways of doing and relating of people in the current way of life.

In relation to our study, we can conclude that, in the epigenesis of an individual, a structural congruence is generated -between proprioception as an operation of the body and the configuration of proprioceptive perception in the domain of language- generating a co-determination of both phenomena in the structural coupling of the individual with others and his immediate environment, in a present. This explains that proprioceptive perception is not a dual phenomenon, but emerges from the interaction of the three operational domains of behavior as a coherent and unified experience. Proprioceptive perception - as the perceptual object of the observer in language - modulates and in turn is modulated by the muscular physiology that from its structural changes specifies qualities of movement observed in individual behavior and that in its experience are configured as qualities of movement, volume, relative dispositions of parts of the body and relative to their situation in space.

Proprioceptive perception has great implications for the modulation of an individual's mode of emotion, which are defined by specific physiological states. This occurs because the dynamics of specific movements of each base emotion - which characterizes the way of moving -, are related to the conservation in adaptation of the individual within his changing environment, in a present, and not to the interpretations that he makes of his situation, which is the case of secondary or social emotions, those that do not present defined physiological and cognitive

states and respond to cultural learning. Therefore, proprioceptive perception places the individual in a situation within his present circumstances, which occurs in conjunction with reflexive attentional movements of a generative character of an incorporation in the field of attention of proprioceptive perception. This attentional movement is correlated with changes in the motor surfaces that modulate their way of moving in congruence with the circumstances of the environment. This explains why contemplative practices that intend attentional reflexive movements together with body movements decrease the states of stress, which from our perspective is a generative physiological alteration of the secondary emotions that respond to the associative flow of language.

Consequently, assuming that the cognitive processes of both language and the body maintain an operational closure, we postulate that proprioceptive perception as a perceptual object is configured by spatial and movement qualities that correlate in the body domain with structural changes of the sensory and motor surfaces of the corporeal self in its interaction with the environment. Thus, the self in its history of structural coupling with its environment generates the sensorimotor learnings constitutive of the proprioceptive structure and networks of attentional selectivity that make possible the perception of a delimited internal space that originates its external space, which correspond to a space in which its existence is constituted and in which it exists, bringing to the hand the possibility of taking a perspective of itself, which occurs when differentiating proprioceptively from others and from the changing environment in which they exist. In other words, behavior and the experience of the lived world are co-determined in the interactive operation of the three operational domains of a disjointed character of behavior. And as we see the environment in which an observer distinguishes an individual, it does not correspond to his or her lived world.

From this proposal, new interesting topics are opened to deepen the understanding of these phenomena: the relations that are constituted between the reflexive movement of attention and body movements of the individual in relation to the configuration of the proprioceptive perception.

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