

# Memory from a pragmatic point of view: intersections of Merleau-Ponty and Francisco Varela

*Memória de um ponto de vista pragmático: interseções de Merleau-Ponty e Francisco Varela*

Arthur Araujo\*

*To the memory of my former master,  
Professor Célso Garcia.*

**Abstract:** Based on a pragmatic conception of memory as *doing without representing*, this paper looks into the intersection between Merleau-Ponty and Varela in which the notion of bodily condition assumes a distinctive function. The idea is that memory depends on the bodily condition as a whole and, therefore, has nothing to do with representation. The purpose of the paper can be summarized in the following terms: for an organism, pragmatically, it is vital *to know how* to do things with its memories more than to take them to be internal representations of the world.

**Keywords:** Francisco Varela. Memory. Merleau-Ponty. Pragmatism.

**Resumo:** *Tendo como fundo uma concepção pragmática de memória como fazer sem representar, o artigo explora a interseção entre Merleau-Ponty e Varela na qual a noção de condição corporal assume uma função distintiva. A ideia é que a memória depende da condição corporal como um todo e, por consequência, nada tem a ver com representação. O objetivo do artigo pode ser resumido nos seguintes termos: para um organismo, pragmaticamente, é vital saber como fazer coisas com suas memórias mais do que torná-las representações internas do mundo.*

**Palavras-chave:** Francisco Varela. Memória. Merleau-Ponty. Pragmatismo.

**Data de recebimento:** 21/04/2020

**Data de aceite:** 26/05/2020

**DOI:** 10.23925/2316-5278.2020v21i2p203-230

---

\* Universidade Federal do Espírito Santo – Vitória, ES, Brazil. Professor of Philosophy at UFES. Email: aart037@gmail.com

## 1 Introduction\*\*

With the publication of *Phénoménologie de la perception* (1945), in an original way, Merleau-Ponty introduces the notion of the reversibility of the body. With it, particularly, the philosopher creates an alternative for understanding the relation between mind and body that rivals with Cartesian dualism on an ontological level. Not only as an alternative, the corporeity thesis also anticipates critical topics in the contemporary debates between reductionism and non-reductionism in philosophy of mind. Inspired by Merleau-Ponty's corporeity thesis, Francisco Varela *et al.* (1993) develops the concept of *enaction*. Looking for a methodological alternative to the impasses of the cognitive sciences, in particular, representationalism and the discontinuity between scientific research and experience, Varela advances the concept of enaction in the sense of showing that the cognitive activities of an organism result much more in action and continuity with the environment rather than in representation and discontinuity.

Unfortunately, like Merleau-Ponty, deceased at 53 years old, Varela dies at the relatively young age of 55. In *Le corps évocateur: une relecture de l'immunité*,<sup>1</sup> a paper published in 1989, Varela is inspired by the work of Merleau-Ponty and thematizes the notion of “evocative body”. According to Varela, the body is in a “bipolar condition” that evokes a primordial structure of organism's relation with the world in the form of reversibility. Analyzing the immune system, Varela (1989, p. 195) suggests the deconstruction of the model according to which immunity represents a behavior of defense and response to external actions—what Humberto Maturana (1987) called “military regime”: exteriority imposes itself as strict condition for the functional organization of the immune system, i.e., it is taught or instructed to know the responses (antibodies or commands) that the organism requires in its relation to the external environment. From the idea that the immune system is functionally closed does not follow that it is solipsist: “Varela himself is careful in explaining that, although ‘closed’ in its organization, the system is ‘open’ for interactions” (VAZ, 2011, p. 700). Like Maturana, and very relevant in times of pandemic, Varela deconstructs the military model of explanation of the immune system. He proposes the idea of cooperation between system and world, that suggests the ideas of solidarity and integration between the parts, in the sense that the whole is being built up dynamically and constantly.

As a strategic move in presenting the intersection of intersections between Merleau-Ponty and Francisco Varela, I begin with a question: from a pragmatic point of view, what does memory mean? It means the conduct that memory is *fitted to produce*. In line with Peirce and James's principle of pragmatism, I assume that the meaning of memory consists in its practical effects.<sup>2</sup> *Our conception of such*

\*\* What I am going to present is based on the chapter “A construção da memória” [*The Construction of Memory*] in my book *Da semântica do corpo ao gesto da palavra: interseções entre Merleau-Ponty e Francisco Varela* [*From body's semantics to word's gesture: intersections between Merleau-Ponty and Francisco Varela*] (ARAUJO, 2019).

1 In English: “The evocative body: a rereading of immunity” (*Our translation*).

2 As correctly observed by Professor Winfried Nöth (University of Kassel, Germany; and Pontifical Catholic University of São Paulo, Brazil), one must be careful to not confuse the

*effects, whether immediate or remote, is then the whole of our conception of memory.* In assuming a pragmatic viewpoint, I will dispel the ideas of representation and information storage as they have been so often taken for granted as being the very essence of memory.<sup>3</sup>

Taking into account the pragmatic principle, accordingly, the nature of memory or which of the brain's physical mechanisms and processes engender memory will not be in question. Rather than an ontological concern, most importantly, we will analyze the pragmatic meaning of memory. In my view, memory cannot be abstracted from an organism's actual context and practical interactions with specific environments.<sup>4</sup> In this sense, very shortly, what I intend is to advance a pragmatic view of memory based on the bodily condition and the organism's activity of *doing without representing* (CLARK; TORIBIO, 1994; BROOKS, 1991).

In tracing such a line of thinking, definitively, I will not champion a representationalist (computationalist) view of memory (and of mind) descended from the analytical philosophy of mind and language known as the "first generation of disembodied cognitive science." Alternatively to this view, I embrace a "second

---

respective understandings of Peirce and James on pragmatism. In many instances, Peirce himself insisted that his understanding of pragmatism had been distorted. For Peirce, indeed, James's version of pragmatism is not consistent with the logical and realistic structure of his philosophy. In order to express the original definition, then, Peirce (CP 5.414) proposes to use the word "pragmaticism". Here, as strategy of presenting my pragmatic interpretation of memory, I merely incorporate James's incorporation of Peirce's pragmatic principle: "To develop a thought's meaning we need therefore only determine what conduct it is fitted to produce; that conduct is for us its sole significance; and the tangible fact at the root of all our thought-distinctions is that there is no one of them so fine as to consist in anything but a possible difference of practice. To attain perfect clearness in our thoughts of an object, we need then only consider what sensations, immediate or remote, we are conceivably to expect from it, and what conduct we must prepare in case the object should be true. Our conception of these practical consequences is for us the whole of our conception of the object, so far as that conception has positive significance at all [...] This is the principle of Peirce, the principle of pragmatism" (JAMES, 2000, p. 25). In taking into account the pragmatic principle, accordingly, I have in mind to advance the idea that it provides broad criterion for meaning in the sense of not being restricted to the human experience of the world. In the case of memory, pragmatically, it consists in practical effects on an organism in its transaction with specific environmental contexts.

- 3 In epistemology of memory (<https://iep.utm.edu/epis-mem/#H1>), two different systems can be distinguished: "declarative memory" and "procedural memory". Declarative memory is of information and events while procedural memory is for skills and of how to perform actions. In the case of procedural memory, particularly, it concerns to knowledge-how as a form of practical knowledge. Epistemologically speaking, for instance, the investigation of procedural memory may help to reveal that "knowledge-how" is not reducible to "knowledge-that". In this regard, my approach of memory from a pragmatic viewpoint is line with the procedural meaning of memory.
- 4 Participating at the Conference on "Practical Aspects of Memory" in 1978, later published in the book *Memory Observed: Remembering in Natural Contexts* ([1982] 2000), incidentally, Ulric Neisser endorses an ecological approach to memory in which many pragmatic traces can be identified (NEISSER; WINOGRAD, 1988, p. 2).

generation of embodied cognitive” which is “essentially pragmatist in character” (LAKOFF; JOHNSON, 1999, p. 101; JOHNSON, 2017, p. 18-19). To the extent that the meaning of memory has to do with practical effects, arguably, it is based on an organism’s bodily condition since it engenders an embedding relationship between current experience and future actions. By organism, specifically, I mean forms of life being able to perform *activity of meaning* (*semiosis as meaning-making*) and varying at *different scales* in the world (including plants)—that is to say: “symbolism from sense-presentation to physical bodies is the most natural and widespread of all symbolic modes” (WHITEHEAD, 1927, p. 4). As a consequence, pragmatically, I assume memory (and mind) as being embedded process that emerge from organism’s bodily condition within specific environments. Already in *The principle of psychology*, interestingly, William James paves the way for advancing a form of pluralism with regards to the mind: “My world is but one in a million alike embedded, alike real to those who may abstract them. How different must be the worlds in the consciousness of ant, cuttle-fish, or crab!” (JAMES, 1983, p. 277). Instead of being essentially something inside the head, accordingly, the mind is based on plural processes of signifying the world.<sup>5</sup> For James, additionally, since experience is radically inclusive, the notion of mind/consciousness indicates not to be *conditio humana* and, arguably, varies in grades of experiencing the world (and thus, memory as well).<sup>6</sup>

What I intend is to free memory from a representationalist view and to stress a form of constructivism. I reject radically the methodological individualism and the idea that mental processes consist in computation on symbolic representations as found in the first generation of disembodied cognitive science. In assuming a pragmatic viewpoint, on the contrary, I stress the idea that memory comprises an active process based on an organism’s bodily condition as being “the complex of transactions between embodied minds and the embedding world” (AYDEDE; ROBBINS, 2009, p. 6). In taking into account a conjunction of embedded process in the world and bodily condition, accordingly, I trace the strategy of intersection between Merleau-Ponty and Francisco Varela on memory.

## 2 Mind: an embodied, embedded, enacted, and extended process

I do not have in mind the idea that data storage is worthless for organism’s interaction with the environment. Pragmatically, I think the meaning of memory consists more in practical effects than in representation of data storage—consisting in practical effects

- 
- 5 Taking into account that James uses the term “world”, incidentally, it likens to Uexküll’s notion of Umwelt in that it stands for organism’s specific way of perceiving and acting on the world. Incidentally, for James (2010, p. 6), to the extent that his empiricism consists in a pluralism, “there is no possible point of view from which the world can appear an absolutely single fact” (*pace* Thomas Nagel’s the view from nowhere).
  - 6 Once William James’s pragmatism takes a holistic form, there is no room for dualisms such as fact, value and theory in the sense that they are interpenetrating and interdependent. As such, for me, James’s pragmatism extends the forms of mentality and rationality beyond the *conditio humana*. This idea is not foreign to Darwin’s conception of mind-nature continuity as part of the biological evolution.

on an organism's relation with the environment, once again, such effects (whether immediate or remote) are then all that memory can mean. In embracing a pragmatic viewpoint, accordingly, I will advance a conception of memory according to which it results more in a constructive process than in repertoire of representations and data storage. In methodological terms, then, a pragmatic conception of memory indicates a convergence with non-representationalist approaches in philosophy of mind and cognitive sciences known as embodied, embedded, enacted, and extended approaches (VARELA *et al.*, 1993; ANDERSON, 2003; THOMPSON; STAPLETON, 2009; MENARY, 2010; SUTTON *et al.*, 2010; CLARK, 2011; STEWART *et al.*, 2010).<sup>7</sup>

In order to present a methodological alternative to representationalism in cognitive sciences, Francisco Varela *et al.* (1993; 1999) revisits Merleau-Ponty's notion of mind-world reversibility. Arguing against traditional dualisms in philosophy, for Merleau-Ponty, mind and world are not discrete and separate entities.<sup>8</sup> In his famous example of the left hand touching the right one (in that we have difficulty in identifying which is touching and which is touched), they are not separate orders. In using this image, accordingly, Merleau-Ponty takes the bodily condition to be at once the perceiving object and the subject of perception. The image suggests that mind and world are in a process of oscillation as a sort of experiential field due to the bodily condition's capacity of reversibility. By understanding "body" as an experiential field, interestingly, Merleau-Ponty updates Husserl's distinction between material body (*Körper*) and lived body (*Leib*).<sup>9</sup> Taking into account the

---

7 "The new way of thinking about the mind is inspired by, and organized around, not the brain but some combination of the ideas that mental processes are (1) embodied, (2) embedded, (3) enacted, and (4) extended [...] The idea that mental processes are embodied is, very roughly, the idea that they are partly constituted by, partly made up of, wider (i.e., extraneural) bodily structures and processes. The idea that mental processes are embedded is, again roughly, the idea that mental processes have been designed to function only in tandem with a certain environment that lies outside the brain of the subject. In the absence of the right environmental scaffolding, mental processes cannot do what they are supposed to do, or can only do what they are supposed to so less than optimally. The idea that mental processes are enacted is the idea that they are made up not just of neural processes but also of things that the organism does more generally—that they are constituted in part by the ways in which an organism acts on the world and the ways in which world, as a result, acts back on that organism. The idea that mental processes are extended is the idea that they are not located exclusively inside an organism's head but extend out, in various ways, into the organism's environment" (ROWLANDS, 2010, p. 3).

8 As observed by Johnson (2017, p. 18-19): "[...] mind has reality only as an emergent process of meaning-making, acting, and communicating among creatures capable of certain kinds of complex functions and communicative interactions (Merleau-Ponty, 1962; Varela, Thompson, and Rosch, 1993)".

9 *Körper* and *Leib* can be translated into "physical body" and "own body", respectively. In the second book of *Ideas for pure phenomenology and phenomenological philosophy*, Husserl anticipates an important distinction that significantly influences Merleau-Ponty. In Olivier Gapenne's chapter *Kinesthesia and the Construction of Perceptual Objects*, very opportunely, one reads: "Lived body" is a translation of the German *Leib*, which designates the living body as the seat of phenomenological experience, as contrasted with *Körper*, which designates the body as a physical object (GAPENNE, 2010, p. 210).

bodily condition's capacity of reversibility, the idea is that it incorporates a form of lived experience in the sense of being a dynamic gestalt and intersection of mind and world.

In *La structure du comportement* (1942), not coincidentally, Merleau-Ponty describes the intertwining between perception and action by making explicit the reference to the notion of form (or gestalt). Among recent approaches in philosophy of mind and cognitive sciences, in particular, this intertwining shows that perceptual experience acquires content thanks to the existence of certain motor skills (NOË, 2006). With reference to the work of Kurt Goldstein in *The structure of the organism* (1934), for example, Merleau-Ponty insists that an organism is not simply a passive entity and, therefore, one cannot explain behavior in terms of arch-reflex processes. In *La structure du comportement*, incidentally, Merleau-Ponty advances the analysis of Goldstein's work and stresses the meaning of form (or structure) in which behavior is described as dynamic, non-linear and non-reducible to mechanical causality.

In parallel with William James's conception of experience, being a dynamic form (gestalt) and intersection of mind and world, the bodily condition remains at all times a single process and so it could not be numerically counted twice (as mind or world).<sup>10</sup> Because of the bodily condition's reversibility, which translates itself into dynamic gestalt and intersection of diverse processes, the bodily condition incorporates a form of mind-world continuity: instead of being taken as discrete and separate entities, mind and world merge into the experiential continuum of the bodily condition.<sup>11</sup> As Merleau-Ponty's image of the left hand touching the right suggests, in such an experiential *continuum*, arguably, the boundary of mind and

---

It is equally interesting to note that the distinction of "Körper" and "Leib" finds a similar correspondence in Wolfgang Köhler's differentiation of "body" and "organism": "[...] we have seen, most people have failed to distinguish between the 'body', which is a percept, and the organism, which is a transphenomenal entity [and we look for] an understanding of mental life in its relation to the life of the organism as a transphenomenal, a physical entity" (KÖHLER, 1939, p.187; 190).

- 10 "The puzzle of how the one identical room can be in two places is at bottom just the puzzle of how one identical point can be on two lines. It can, if it be situated at their intersection; and similarly, if the 'pure experience' of the room were a place of intersection of two processes, which connected it with different groups of associates respectively, it could be counted twice over, as belonging to either group, and spoken of loosely as existing in two places, although it would remain all the time a numerically single thing" (JAMES, 1996, p. 10). As also observed by Mark Johnson (2017, p. 126): "James, Dewey, and Merleau-Ponty all shared the fundamental insight that mind and body are not two things or substances somehow yoked together, but rather that what we call 'mind' and 'body' are aspects of an ongoing sequence of organism-environment interactions that are at once both physical and mental."
- 11 Not by chance, for many scholars, Merleau-Ponty is a process philosopher who rejects the Cartesian bifurcation of mind and world: "Whitehead and Merleau-Ponty wanted to break with classical ontology of the object and the subject, with the ontology which sustained scientific thought since Descartes. To describe our primitive experience of the world and to consider nature before the abstract bifurcation between scientific nature and perceptual nature is one and the same thing" (ROBERT, 2008, p. 668-669).

world acquires a fuzzy form. As such, for Merleau-Ponty, mind is not discrete entity and separated from the world and it is more proper to speak of mind as an aspect of the bodily condition's reversibility with world.<sup>12</sup> For Varela, then, Merleau-Ponty's notion of mind-world reversibility is none other than the matrix of the idea that mind consists in embodied processes.<sup>13</sup>

From an old fashioned school named the first generation of (disembodied) cognitive science, however, "mind is based on the idea that whatever else is true of mental processes-perceiving, remembering, thinking, reasoning, and so on [...] exist in brains" (ROWLANDS, 2010, p. 3). Since Francisco Varela *et al.* (1993), however, "enactivism" has assumed that cognition emerges from processes of perception and action on sensorimotor patterns—that is, cognition is an embodied action. In addition, "extended mind" is an expression invented by Andy Clark and David Chalmers in 1998. In the broad sense of being "extended", the idea is that mind is not "in the head" and can extend outside the body in continuity with organism's environment.<sup>14</sup>

In *A world of pure experience* (1904), interestingly, William James insists in characterizing experience (as a whole) as a process in time. Just as the visual field's form, James asserts that the field of experience (or world experienced) is equally fringed and has no definite boundaries or bottom layer. As very well noted by Joel W. Krueger in *James on experience and the extended mind* (2006), once James describes experience as a temporal process, he draws a parallel with the recent conceptions of extended mind, in that mind is taken to be understood as extended beyond the physical body.

Like the very notion of extended mind, accordingly, memory has much more to do with an organism's embodied processes in relation with the environment

---

12 In *L'Individuation – à la lumière des notions de forme et d'information* (2013), a work dedicated to the memory of Merleau-Ponty, the French philosopher Gilbert Simondon exploits the genesis of individuation under the label of "transduction". From the influence of Merleau-Ponty's pre-reflective unity of body and world co-existence, for Simondon, transduction defines the shaping operation explaining the genesis of the individual on a background of pre-individual reality: "a physical, biological, mental, social operation, by which an activity is spread gradually within a domain [...]: each region of constituted structure serves for the following region as a principle of constitution, so that a modification is gradually extended at the same time as this structuring operation" (SIMONDON, 2013, p. 32 – *our translation*). In Simondon's terms, for instance, body and world are transductive in the sense that they exist only in their relation to each other (STEWART, 2010, p. 2).

13 "For Merleau-Ponty, as for us, embodiment has this double sense: it encompasses both the body as a lived, experiential structure and the body as the context or milieu of cognitive mechanisms" (VARELA *et al.*, 1993, p. xvi).

14 "Prima facie, of course, the thesis of the extended mind and the enacted mind seem to have much in common" (ROWLANDS, 2010, p. 72). And: "In contrast to the extended and embedded approaches, the embodied view alone assigns no especially active role to the environment in human cognitive processing. Nevertheless, given that sensory and motor processing themselves involve interaction with the environment, it is no wonder that philosophers and cognitive scientists tend to group the embodied view together with the extended and embedded ones" (RUPPERT, 2009, p. 6).

and less with the traditional notions of mental representation and symbolic computation—here, particularly, I allude to *Memory, embodied cognition and the extended mind* by John Sutton (2006).<sup>15</sup> Insofar as one differentiates levels of embodied functional organizations, one can with justice speak of different levels of cognition and consequently of different types of memory (e.g. iconic, indexical or symbolic memory)—“memory is not, of course, just a structure, but a correspondence (i.e. a relation between structures) that is modified and transported in semiosis” (PATTEE; KULL, 2011, p. 222). In speaking of embodied functional organizations, accordingly, I do not have in mind the idea of identifying the body with functional roles. As I see, it is much more the case of “the body’s capacity to incorporate environmental processes into the operationally closed network of processes” (THOMPSON; STAPLETON, 2009, p. 28). In following this line of thinking, as a constructive process, memory acquires a pragmatic sense insofar as it presupposes an organism’s practice of interaction with the environment: that is to say, memory is an embodied, embedded, enacted, and extended process.

### 3 Memory: a constructive process

In the canonic *MIT Encyclopedia of Cognitive Sciences* (BADDELEY, 1999, p. 514), “memory” is defined as “the capacity to encode, store and retrieve information”. As such, *prima facie*, I agree with this definition. Nevertheless, here, I am not concerned with memory in ontological terms. What I have in mind is rather the meaning of memory (and particularly, the pragmatic meaning of memory). Once memory (as well as mind) extends itself beyond an organism’s inside, it consists in a dynamic process of transaction with specific environments. Along the development of this process, accordingly, many social, historical, and affective contingencies also pragmatically constitute the meaning of memory. As a consequence, memory has to do with a process of constructing an organism’s interaction with the environment more than being a representation of data.

Even in cases of organisms endowed with a brain, the idea here is that memory depends on bodily condition as a whole in transaction with the environment. Instead of being understood as photo frame, memory is taken to be an embodied, embedded, enacted and extended process. In order to interact with the environment, pragmatically, organisms do things with their memories—and this is all that memory can *mean* for an organism as a process of *doing without representing*. In this sense, interestingly, memory incorporates a *sign* of an organism’s existential dimension and being a sign, it may acquire iconic, indexical and symbolic forms in different

---

15 “[...] perhaps we should seek a still more thorough going ecological or everyday approach to memory, which sees constructive processes in remembering [...]. This is the opening for a natural alliance between memory research and the independent set of ideas in theoretical cognitive science variously labelled ‘distributed’ or ‘situated’ or ‘dynamical’ or ‘enactive’ or ‘embodied’ cognition, ‘active externalism,’ or the ‘extended mind’ hypothesis [...]. These views share the constructivist stress on cognitive practices, by which internal representations are incomplete contributors in a context-sensitive system rather than fixed determinants of output” (SUTTON, 2006, p. 282).



levels of organic life.<sup>16</sup> Against the understanding of memory as representation, accordingly, in Merleau-Ponty's own words (1968, p. 72):

[...] the activity and passivity of memory can only be reconciled if we give up the problem in terms of representation. If, to begin with, the present was not 'representation' ('Vorstellung'), but a certain position of the *index* of *being in the world* (our translation; our emphasis).

Irrespective of the notion of representation and paralleling the notion of mind as an embodied, embedded, enacted, and extended process, once more, the main idea to be developed here is that memory capacity depends on an organism's bodily condition in transaction with the environment and it may or may not involve the existence of a brain. In terms of a "pragmatic turn" as new paradigm for cognition to be understood (ENGEL, 2010, p. 222-223), once cognition is taken to be action ("world-making") rather than representation ("world-mirroring"), so too memory will be also understood. Interestingly, as suggested by Ulric Neisser's idea of "ecological approach to memory" (1988), differently from traditional views in psychology, presumably, "practical aspects of memory" have to do with adaptation and purpose. To the extent that everyday life is constituted by natural, social, and historical contingencies, memory cannot be abstracted from an individual's practices of interaction with the environment and acquires a form of a dynamically ecological process. By practical aspects, in pragmatic terms, is meant the conduct that memory is fitted to produce. From a pragmatic point of view, consequently, I assume a non-representationalist understanding of memory in which it translates itself into practical effects on an organism's interaction with the environment.

In contrast with Merleau-Ponty's criticism of memory as representation, as noted by Israel Rosenfield in *The invention of memory* (1994), our scientific tradition and common sense have nourished a myth about memory. According to this myth, our ability to remember depends on images stored in the brain that form the basis of recognition, thought, and action—in accordance with a traditional view, for instance, "recall was a form of search and that storing items in memory was either the construction of mental representations or the construction of associations with representations already existing in memory" (PICKERING, 2016, p. 246). Without this base, we would not be able to recognize family, friends, words, our coats, etc. In a broad sense, however, pragmatism rivals this understanding of memory and suggests that it is instead a building process through which organisms are able to

---

16 "It is important to realize that only in living things and their inanimate extensions undergo semiosis, which thereby becomes uplifted as a necessary, if not sufficient, criterial attribute of life [...] By 'living things' are meant not just the organisms belonging to one of the five kingdoms, consisting of the Monera, Protocista, Animalia, Plantae, and Fungi, but also their hierarchically developed choate component parts, beginning with a cell, the minimal semiotic unit [...] Simple cells, it is thought, fused to form the complex confederations of cells composing each living being. They, in turn, are integrated into organs, organs into organisms, forming social systems of ever-increasing complexity. Thus, physics, biology, psychology, and sociology each embodies its own peculiar level of semiosis" (SEBEEK, 1999, p. 6).

create and recreate their relation with the world. Instead of being representation, as suggested by Merleau-Ponty, the idea is that *memory* is the index of *being in the world* – that is to say, memory acquires an existential dimension.<sup>17</sup>

Instead of having stored images, actually, an organism needs practical procedures to deal with the environmental contingencies. In consequence, memory is not an isolate structure and it is concretely mediated by historical contingencies, affectivity, feeling, or emotion.<sup>18</sup> In a word, memory is pragmatically embodied in the world involving a vast array of natural, social, bodily, affective and (or non-) neural contexts (SUTTON, 2006, p. 282). As I am arguing here, very briefly, memory is an ecologically embodied process that extends beyond an organism's physical body by including environmental contingencies.

Using Bateson's terminology, in fact, there is an ecosystem of mind. Instead of being a linear process and necessarily dependent on organism's interiority, mind consists in ecologically dynamic web of processes in multiple directions as a form of circular causality.<sup>19</sup> Acknowledging this type of causality in which mind is

17 In *Purpose and desire – a new model for understanding life* (2017), J. Scott Turner, biologist and physiologist, endorses the view of “a multiplicity of memory.” In his way of thinking, interestingly, memory is taken to be a form of living experience. Instead of being something static and frozen, for Turner, memory stands for a process of dynamic association in multiple forms: “Memory is never a thing alone; it is always something else [...]. Memory is dynamic, fleeting, always arising in association with something else: a smell, a sight, a rustling of leaves, a photograph that draws out remembered moments from long ago. For that matter, memory is never really a thing at all. We may strew tokens of our memories all around us—trinkets, letters, books—that evoke memories in ourselves and in others, but these tokens are not the memories themselves. Tokens are things we can hold in our hands; memories are living experiences” (TURNER, 2017, p. 49).

18 In many cases in nature, however, one can speak of minimal cognition as indicating types of mind. Paraphrasing Antonio Damásio (1999), one can say that mind is based on organism's capacity for feeling—e.g. organism feels itself as well as it feels the environment. Moreover, taking into account Whitehead's conception of feeling as positive prehension, obviously, it is not an anthropomorphic view of feeling. The idea is that feeling has to do with grades of feeling the world and so it is not *conditio humana*. In *Self comes to mind* (2010), incidentally, Damásio devotes an analysis of *qualia* in which he seeks to understand how the ability to sense of organisms has origin at different scales in nature: [...] there are aspects of cell life that suggest the presence of forerunners of a “feeling” function. Unicellular organisms are “sensitive” to threatening intrusions. Poke an amoeba, and it will shrink away from the poke. Poke a paramecium, and it will swim away from the poke. We can observe such behaviors and are comfortable to describe them as “attitudes,” knowing full well that the cells do not know what they are doing in the sense that we know what we do when we evade a threat. But what about the other side of this behavior, namely, the cell's internal state? The cell does not have a brain, let alone a mind to “feel” the pokes, and yet it responds because something changed in its interior. Transpose the situation to neurons, and therein could reside the physical state whose modulation and amplification, via larger and larger circuits of cells, could yield a protofeeling, the honorable counterpart of the protocognition that arises at the same level (DAMÁSIO, 2010, p. 197).

19 “[...] the idea of an ecology of mind entails three closely related postulates. First, that there is a form of circular causality between the level of the central component,

individually and commonly embodied, arguably, one can claim that it consists in processes emerging from an ecological background. In biology, while ecology has to do with the studies of how organisms interact with their environment (including with other organisms), Bateson's idea of an "ecology of mind" stresses that there is an ecosystem of mind and ideas. As I see, ecosystem of mind points to the understanding of a hierarchy of embodied and extended processes of which one can call individual minds.

[...] we know that within Mind in the widest sense there will be a hierarchy of sub-systems, any one of which we can call an individual mind.

I now localize something which I am calling "Mind" immanent in the large biological system – the ecosystem (BATESON, 1987, p. 325).

In the wake of Bateson, accordingly, I propose the following equation: *ecological mind, ecological memory*. As the very notion of mind, memory has to do with ecologically embodied and extended process between organism and environment. The equation mind *plus* extend process is inspired by Bateson himself (1987, p. 132; note 49) as he advances the idea of memory as "experience of the stream of events".

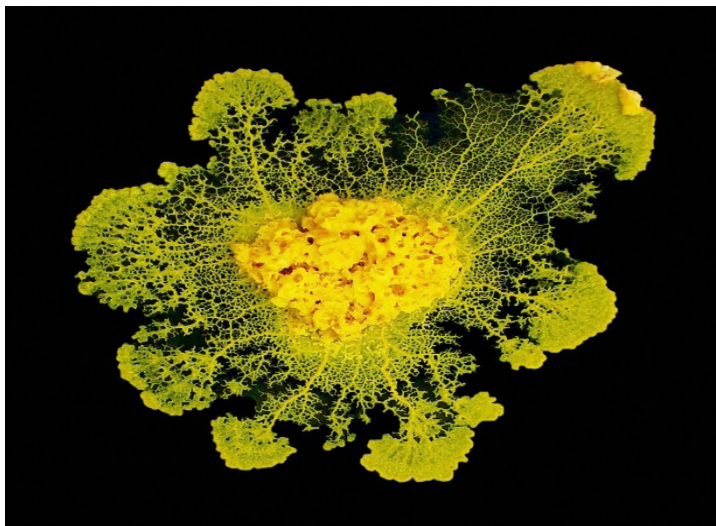
#### **4 Memory and bodily condition**

It is in taking into account the notion of ecological memory, then, that I explore the intersections between Merleau-Ponty and Varela: memory consists largely in an embodied process rather than in storage data in the brain. As the notion of mind as an *embodied, embedded, enacted, and extended process* suggests, it is evident that here it is not a matter of understanding memory as a process enclosed in the brain — in my view, actually, memory is in an organism's body as whole. In Peirce and James's sense, for instance, mind is not a private sphere and separate from the world. In paralleling the notion of *embodied, embedded, enacted, and extended process*, I advance the idea that memory is a dynamic process in the form of what Merleau-Ponty calls body and world reversibility.

In order to illustrate the idea that memory depends on bodily condition (and not necessarily on the existence of a brain), I will analyze slime mould's general characteristics and behavior:

---

individual minds, and the system as a whole, which is responsible for the characteristics of the elements that are indispensable to the maintenance of the system. Second, that the system is 'embodied' through a collection of physically distinct heterogeneous objects (or bodies). Finally, that there is ontological uncertainty between minds at the individual level, as an element of the system, and mind at the level of the system as a whole" (DUMOUCHEL, 2019, p. 4).



**Illustration 1:** slime mould – an incredibly curious type of organism that is on the border between non-living and living. Because of the name, they have long been confused with fungi; however, the slime mold does not belong to the kingdoms of Fungi and Animalia. **Source:** Dussutour (2019).

As a unicellular organism, the slime mould has no neurons or brain. Over the last fifteen years, however, scientists have debated whether the slime mould has the ability to learn and adjust its behavior to the environment. From a traditional point of view, scientists, psychologists and philosophers credit the phenomenon of learning to the existence of the brain and the idea that unicellular organisms can learn and conserve their memory is controversial issue. While not having a central nervous system, interestingly, researchers concluded that the slime mould is able to learn from its experiences and change its behavior accordingly. In laboratory experiments, scientists have observed how the slime mould would adapt along the way to a power source. And, when it merges with another, it can impart knowledge.

In the wake of Whitehead, here, organism is understood as a process that distinguishes itself by performing different forms of functional organization. In the case of the slime mould as an example of the dynamic process in transaction with the environment, it instances a radical form of extended mind by suggesting “a way to distinguish between environmental resources that the cognitive system simply uses instrumentally and resources that come to constitute the cognitive system over some stretch of time” (THOMPSON; STAPLETON, 2009, p. 29). In slime mould’s behavior, particularly, it is clearly an extended process in which cognition consists in embodied action and it indicates a transition from lower levels to the organism’s higher ones in continuity with the environment.

In the case of the slime mould, as an undefined organic form between the kingdoms of *Fungi* and *Animalia* and to the extent that it has no brain, it is the bodily condition that gives it the ability to develop processes of learning and memory.

Echoing the debate on the boundaries of cognition, for instance, the challenge is whether semiotic terms can be extended to all species including unicellular organisms beyond only the five kingdoms (*Monera*, *Protoctista*, *Animalia*, *Plantae* e *Fungi*). The acceptance of primitive processes of semiosis implies hypothetically in accepting forms of “minimal mind”. As put forward by Alexei Sharov (2013), bacteria operate via elementary signaling processes that directly control their actions. For Alexei Sharov, interestingly, such a process means “protosemiosis”. In this particular case of semiosis, there is no reference to any object. In the case of “eusemiosis”, alternatively, it corresponds to “the advanced kind of semiosis [in that] agents associate signs with objects and only then possibly with actions” (SHAROV; VEHKAVAARA, 2015, p. 103). Whereas protosemiosis consists in “primitive ‘mindless’ semiosis” started from the origin of life, in the sense of being a form of minimal mind, eusemiosis “started when evolving agents acquired the ability to track and classify objects” (SHAROV; VEHKAVAARA, 2015, p. 104-105). In the extent that bacteria perform protosemiosis, for instance, they are not capable of referring to objects. The idea contradicts the views that “the Peircean triadic relationship between sign vehicle, object, and interpretant are universal for semiotic processes in all living organisms” (SHAROV; VEHKAVAARA, 2015, p. 113). This idea not only contradicts that the Peircean triadic is universal in all living organisms, but it also appears to be an intellectualist view of mind.

For me, fundamentally, it is an intellectualist view insofar as it opposes mind and object. In this case, one can hardly depart from Cartesian dualism. In order to move beyond Cartesian dualism, accordingly, more than the opposition of mind and object is needed. Taking into account that the functional relations in the reciprocally ongoing interaction of organism and environment, mind becomes an embodied process and *object* can be anything meaningfully differentiated within this process. The idea is not new and it traces back to William James’s pragmatic conception of meaning. For James, indeed, pragmatism is not at all an intellectualist view of meaning. Being a theory of meaning, in particular, James’s pragmatic conception of meaning expresses a form of *meaning-making*. In the sense that meaning has to do with practical effects, the conception of effects, then, is the whole conception of the object so far as that the conception has positive meaning at all—and meaning as being anything which acquires value emerging from the reciprocally ongoing interaction of organism and environment.<sup>20</sup>

Differently from Sharov and Vehkavaara (2015), I think, it is hard to accept the idea that bacteria cannot be capable of apprehending objects meaningfully. It seems more plausible to regard bacteria’s interaction with the environment as an embodied process in which objects can be pragmatically differentiated. As *object* stands for anything that acquires *relevance* and *value* in the reciprocally ongoing interaction of organism and environment, presumably, normativity spreads into multiple forms of life (including bacteria). Differently from Sharov and Vehkavaara (2015, p. 116), once again, it is not sufficient to insist on “the categorization and object tracking as two main criteria that distinguish eusemiosis from protosemiosis”. If eusemiosis

---

20 Akin to the notion of extended mind, as very well suggested by Jordan Zlatev (2002, p. 258), “meaning (M) is the relation between an organism (O) and its physical and cultural environment (E), determined by the value (V) of E for O:  $M = V(O, E)$ .”

and protosemiosis can be concretely differentiated, arguably, this depends on the pragmatic way of organism's interaction with the environment—pragmatically, counting as a form of *meaning-making*, protosemiosis supports a primitive or minimal mind (and of course memory).

From bacteria's behavior, one can identify a form of selective action that contradicts Sharov and Vehkavaara's criteria (2015) for describing organisms endowed with mind. For Jesper Hoffmeyer (2010, p. 194), indeed, "when a bacterium cell finds itself in a gradient of nutrients and swims right instead of left, the cell is making a choice". In this sense, I think, bacteria are performing a selective action as *meaning-making* their relation with the environment that is not absolutely a form of automatism. From a certain point of view, by tracing a direction, bacteria act freely insofar as they "choose" and something becomes an object of meaning: "whether freedom of choice in the coming about of a crossing is an essential requirement of its appearing as an object of meaning" (LEONE, 2012, p. 34). Revisiting James's pragmatic conception of meaning in that it has to do with practical effects, for bacteria, the conception of effects is the whole conception of an object insofar as that the conception acquires a positive significance.

As an illustration that the apprehension of an "object" depends on practical effects, relevance, and the organism's meaning-making, very briefly, I will explore Jakob von Uexküll's analysis on *paramecium's* behavior.<sup>21</sup> Considered the founder of biosemiotics, interestingly, Uexküll (1982, p. 26) draws attention to the relation of relevance and meaning in the organism's behavior.<sup>22</sup> According to Uexküll's

21 I am using "apprehension" as a synonym of Whitehead's "prehension": "The word perceive is, in our common usage, shot through and through with the notion of cognitive apprehension. So it is the word apprehension, even with the adjective cognitive omitted. I will use the word prehension for uncognitive apprehension: by this I mean apprehension which may or may not be cognitive" (WHITEHEAD, 1948, p. 70).

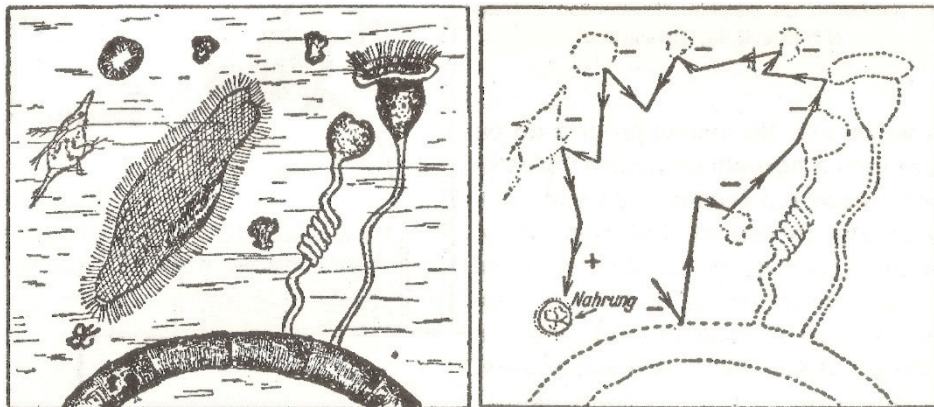
[Leibniz] "employs the terms 'perception' and 'apperception' for the lower and higher ways in which one monad can take account of another, namely for ways of awareness. But these terms are too closely allied to the notion of consciousness [...] Also they are all entangled in the notion of representative perception which I reject [...] Accordingly, on the Leibnizian model, I use the term 'prehension' for the general way in which the occasion of experience can include, as part of its own essence, any other entity" (WHITEHEAD, 1933, p. 233-234). As instantiation of prehensive unit:

"In the genetic theory, the cell is exhibited as appropriating for the foundation of its own existence, the various elements of the universe out of which it arises. Each process of appropriation of a particular element is termed a prehension" (WHITEHEAD, 1978, p. 219).

By using the term prehension, like James, Whitehead spells out an essentially anti-intellectualist and anti-representationalist view of mind and cognition. Not by chance, remarkably, Whitehead illustrates cellular behavior as a type of prehensive activity.

22 On a course at the College de France between 1957-58, later published as *La Nature [The Nature]*, Merleau-Ponty analyses the philosophical consequences of Uexküll's conception of Umwelt: "The Umwelt marks the difference between the world as it exists in itself and the world of such and such living being. It is an intermediate reality between the world as it exists for an absolute observer and a domain purely subjective. It is the aspect of the world in itself to which the animal is addressed, which exists for the behavior

analysis, as it can be seen at the Illustration 2 below, the relation between organism and environment can be abstracted from the actual composition (left side of the figure) and represented by a network of relations made up of significant [+] and non-significant elements [-] (right side of the figure).



**Illustration 2:** *Nahrung* (in German): 'food'.

**Source:** Uexküll ([1934] 2010, p. 73).

For Uexküll, importantly, mechanistic explanations are blind to relevance and meaning in trying to understand an organism's behavior. According to Uexküll, indeed, the process of meaning does not consist in the mechanical effect of environmental inputs onto *paramecium's* sensory capacity. As the *paramecium* selects among the elements available in the environment those that have relevance and meaning, it develops a coordinated pattern of perception and action, in which pragmatically something takes the form of object. As Mark Johnson (2017, p. 18-19) observes, once meaning arises from the interactions between organism and environment, what can be called an 'object' indicates nothing more than significant patterns of perception and action – or what James Gibson (1979) calls '*affordances*' (JOHNSON, 2017, p. 19).<sup>23</sup>

---

of an animal, but not necessarily for its conscience" (Merleau-Ponty, 1995, p. 220 – *our translation*).

- 23 Similar to Uexküll's description of the *paramecium's* behavior, Francisco Varela (*et al.*, 1993, p. 151) introduces the notion of 'Bittorio' in the sense of presenting a model of a relevance system between organism and environment. Described as cellular automaton, insofar as Bittorio is able to distinguish a sequence of disturbances, this indicates a pattern of regularity and constitutes the 'world' of Bittorio – or, in Uexküll's terms, Bittorio's Umwelt. For Varela *et al.* (1993a, p. 156), therefore, what must be observed is that, due to the history of structural coupling with the environment, Bittorio's world consists of *enacting* the world as a system of relevance and meaning. Using the terms 'relevance' and 'meaning', Varela emphasizes the idea of interpretive action (or *enaction*) more than a process of binary representation (0 or 1 as being, respectively, absence or presence of an object). As it can be seen in Illustration 2 above, the '-' and '+' marks do

In *Are we automata?* (1879), which later constitutes the chapter “The Automaton-Theory” in *The principles of psychology* (1890), interestingly, William James expresses not only an alternative understanding of consciousness as a functionally selective process, but also anticipates many topics of discussion in philosophy of mind, cognitive sciences and neuroscience, namely, the “chasm” between mind and brain that materialistic views seem to suppose. In recent specialized studies, in particular, when used by James, the term “chasm” points to the “explanatory gap” problem of epistemological discontinuity between mind/consciousness and brain. Being a functionally selective process, for James, mind/consciousness cannot be ontologically or epistemologically reduced to mere collateral products of our nervous processes and, consequentially, we cannot be understood to be purely material machines. In a way very similar to Bateson (1979), incidentally, James insists that mind functions selectively on differences.<sup>24</sup>

Even though being an inquiry of the human mind/consciousness, in *Are We Automata?*, James presents a quite suggestive picture of mind (as a functionally selective process) that echoes many points converging with Uexküll’s analysis on the *paramecium*’s behavior:

Good involves the notion of less good [and it] necessitates comparison [that] would involve a process not commonly thought of as physical. Comparison requires a *tertium quid*, a *locus* [...] in which the two outward existences may meet on equal terms. This forum is what is known as a consciousness [...] Where we suppose it to exist we have mind; where mind exists we have it (JAMES, 1879, p. 6).

Whoever studies consciousness, from any point of view whatever, is ultimately brought up against the mystery of interest and selective attention. There are a great many things which consciousness is in a passive and receptive way by its cognitive and registrative powers (JAMES, 1879, p. 8-9).

[...] it might be shown that perception involves nothing beyond association and selection [...] between sensations on the one hand as signs and original intellectual products, materially

---

not represent binary representations and indicate a system of relevance and meaning for Bittorio to apprehend the world. Given Bittorio’s ability to interpret, the meaningful apprehension of the world is not performed upon internal representations. The idea is that interpretation generates a domain of distinctions from which a system of relevance and meaning emerges. In comparison with Uexküll’s notorious example, the description of Bittorio’s behavior shows features converging with the tick’s Umwelt. Like *paramecium* and Bittorio, for instance, the tick builds a world as system of relevance and meaning in no way consisting in a mechanical automatism. For an organism, accordingly, it is fundamental the ability (or *know-how*) of organizing a system of relevance and meaning in its relationship with the environment. It is an understanding of relevance and meaning that suggests a parallel with Merleau-Ponty’s notion of bodily condition as a matrix of a semantic domain of organism-world relation.

24 “[...] perception operates only upon difference. All receipt of information is necessarily the receipt of news of difference, and all perception of difference is limited by threshold [...] The difference [...] becomes information by making a difference” (BATESON, 1979, p. 29; 68).



different from sensations on the other, as Objects (JAMES, 1879, p. 10-11).

Taking into account a bacteria's behavior, one can claim with fairness that they perform a process of selection by comparison and classification between good and less good from a gradient of nutrients in the environment. In this sense, arguably, bacteria seem to be actively endowed with interest and selective attention. Using James's own word, as perception involves nothing beyond association and selection, for bacteria, such processes indicate the presence of minimal mind as a relation of signs (sensations) and objects. The idea here is, in short, that the apprehension of an "object" depends on the organism's bodily condition in pragmatically *meaning-making* the interaction with the environment.

As the behavior of bacteria do not seem to correspond to mechanical apprehensions of objects, supposedly, they must be endowed with a (albeit, very rudimentary) form of memory (LEONE, 2012, p. 33)—memory based on associations and selection between sensations. In *Symbolism, Its Meaning and Effect*, incidentally, Whitehead develops a theory of perception by arguing that there is a more fundamental form of symbolism found in sense-presentation experiences:

Symbolism from sense-presentation to physical bodies is the most natural and widespread of all symbolic modes. It is not a mere tropism, or automatic turning towards [when] a tulip which turns to the light shows probably the very minimum of sense-presentation. [So] all organisms have experience of causal efficacy whereby their functioning is conditioned by their environment (WHITEHEAD, 1927, p. 4-5).

What is striking in this passage from Whitehead is that tulip's move illustrates a pragmatic form of minimal symbolism. In line with Uexküll's analysis of the *paramecium's* behavior, more than being a case of mere automatism, the tulip's move is meaningfully organized on selection, comparison and classification between good and less good in the environmental aspects.<sup>25</sup>

As a case of a minimum of sense-presentation, the tulip turning to the light differentiates something symbolically as being good: in such a process, no doubt, "light" stands for a sign of good and one can fairly well speak of vegetative semiosis. In this sense, moreover, one can speak of memory. In comparison with the bacteria's motility dynamics, the idea is that the tulip's move reveals a (rudimentary) form of memory based on presentational immediacy. Used by Whitehead as a reference to perception, "presentational immediacy" instances the fact that "whatever is perceived belongs to the same duration of simultaneity as the perceiver" (FORD, 1984, p. 30-31).<sup>26</sup> For Whitehead (in comparison with Merleau-Ponty), taking into

---

25 "Behaviors are not mere movements or tropisms, but they consist of perception (Merken) and operation (Wirken), they are not mechanically regulated, but meaningfully organized" (UEXKÜLL, [1934] 1982, p. 26).

26 In *Process and reality* ([1929] 1978, p. 61; 81), Whitehead notes that [in] "ordinary perception through the senses [this] mode of perception is here termed 'presentational immediacy'. In this 'mode' the contemporary world is consciously prehended as a continuum of

account the notion of “duration” in sense-presentation, *memory* is a resultant process of *prebending the past* grounded in an actual body.<sup>27</sup> Depending on an experience’s duration, it incorporates a process of appropriating (or prehending) the past in order to make it presently and pragmatically meaningful. Being cases of sense-presentation, I think, one can endorse the thesis that bacteria and tulips are emblematic illustrations of minimal symbolism, mind and memory based on the organism’s bodily condition.

As a reputed neuroscientist, interestingly, Antonio Damásio has advanced the idea that the body is the foundation of mind. Differently from the traditional mainstream in cognitive science and neuroscience, for Damásio (2010, p. 26), even though mind is linked to the brain, it is not separated from the body and it is part of a complex living organism—that is to say, not being limited to the brain, mind is in the body as a whole and this is the reason by which the notion of organism is so crucial here. In line with Damásio’s understanding of body as a foundation of mind, I think, one can likewise understand the meaning of memory as being dependent on the organism’s bodily condition (with or without a brain).

In an intriguing book entitled *The revolutionary genius of plants: a new understanding of plant intelligence and behavior*, interestingly, Stefano Mancuso, professor of botany, presents the hypothesis of *memory without brain*. For Mancuso, a function which is performed by specific organs in animals, in the case of plants, spreads along the whole body. Even though lacking in organs similar to a brain, Mancuso advocates that plants can perceive the surrounding environment and perform appropriate actions.

What calls attention in Mancuso’s hypothesis is that “intelligence” supposes a form of memory and for plants it is no different. In his view, organisms are capable of learning from experience, and plants are no exception to this rule. They can respond appropriately in order to solve problems through their lives. In this process, of course, memory is crucial so that plants can survive. For Mancuso, if any plant, such as an olive tree, is subjected to drought or salinity, it will respond by implementing necessary modifications in its anatomy and metabolism to ensure survival. So, of course, the plant learned a lesson and got the best possible answers from memory. In this case, semiotically, one can speak of indexical memory in the plant’s behavior.

As one of the conceptual building blocks of biosemiotics, incidentally, Peirce extends the use of semiotic terms including slime mould’s behavior:

Consider a gob of protoplasm, say an amoeba or a slime-mould. It does not differ in any radical way from the contents of a nerve-cell, though its *functions* may be less specialized. There is no

---

extensive relations [...] For the organic theory, the most primitive perception is ‘feeling the body as functioning’. This is a feeling of the world in the past; it is the inheritance of the world as a complex of feeling; namely, it is the feeling of derived feelings. The later, sophisticated perception is ‘feeling the contemporary world’. Even this presentational immediacy begins with sense-presentation of the contemporary body.”

27 In Whitehead’s *Symbolism, Its Meaning and Effect* (1927, p. 15), very opportunely, one can identify traces of embodied cognition when he argues that perceiving color and extensiveness is an embodied process.

doubt that this slime-mould, or this amoeba, or at any rate some similar mass of protoplasm, feels. That is to say, *it feels* when it is in its excited condition. But note how *it behaves*. When the whole is quiescent and rigid, a place upon it is irritated. Just at this point, an active motion is set up, and this gradually spreads to other parts. In this action, no unity nor relation to a nucleus, or other unitary organ can be discerned. It is a mere amorphous continuum of protoplasm, with *feeling passing* from one part to another (CP 6.133; *our emphasis*).

In general terms, arguably, Peirce anticipates the debate scenario on the boundaries of cognitive abilities. Using terms such as “function”, “feeling” or “behavior”, Peirce describes the slime mould as an entity capable of cognition by comparing it with nerve cell’s functions. For Peirce, indeed, the slime mould and the nerve cell perform analogous cognitive functions in different degrees. Like Peirce, many scientists (SAIGUSA; TERO; NAKAGAKI; KURMOTO, 2008) believe that the study of slime mould may shed light on how cognitive processes have developed in the form of a *continuum* in nature at varying scales.

As an empirical postulate, additionally, the case of the slime mould can support a cosmology beyond human life: “the mental must not necessarily correlate to a nervous system; it could also be realized in other material systems” (HEIDELBERGER, 2004, p. 173)—this idea traces back to Gustav Fechner’s psychophysical worldview. Differently from the current functionalism in philosophy of mind and cognitive sciences, Fechner provides a broad explanation of the functional dependence between mental and physical as two different aspects of one and the same process:

[...] the properties [...] are considered mental when they are perceived inwardly, meaning from the perspective of the entity itself; and [...] the entity is considered something physical, when it is viewed from the outside, meaning from a perspective that is not the perspective of the entity itself (HEIDELBERGER, 2004, p. 170).

In the sense that physical and mental are functionally differentiated, therefore, Fechner’s functional cosmology favors an understanding of mind as a process varying at different levels and distinguishing itself from an entitative point of view.<sup>28</sup> It is the understanding of mind that I assume here regarding the meaning of memory.

## **5 Bodily condition, memory and semiosis**

If memory were taken simply to refer to information storage, it would not be able to establish a pragmatic relation between organism and environment. In the case of the slime mould, for instance, it adjusts direction and speed of movement implying a comparison of past and present which is based on its bodily condition. When

---

28 In parallel with Fecher, incidentally, James strives “to resolve certain entitative differences of traditional thought into relational or functional differences” [of the states of mind] (PERRY, 1976, p. 367).

considering the slime mould, the notion of bodily condition transcends the image of organism as a rigid entity occupying a simple location in space and time. Since the slime mould's form suggests much more an indefinite process of transition between organism and environment, the image is not but that of extended mind. In addition, it is not only the slime mould's form that lies on the indefinite boundary between non-living and living. Regarding the slime mould's structural organization, it is also on the boundary between organism and environment: where do the organism and the environment begin and end? In connection with the idea of indefinite boundary, Merleau-Ponty's conception of body reversibility suggests the understanding of a transactional process between organism and world from which meaning processes, cognition and memory emerge. Arguing for the reversibility of the body and its property of being both sentient and sensible, Merleau-Ponty advocates an anti-representationalist view based on the basic contention that mind is an embodied and extended process.

The idea here is that the dynamics of body and world reversibility suggests a pragmatic understanding of memory. As recent studies report, the slime mould (cellular and plasmodial) develops the ability to learn to predict unfavorable and periodic conditions created in laboratory experiments (REID; LATTY; DUSSUTOUR; BEEKMAN, 2012). Depending on the species, they are attracted to caffeine, salt or strong light and are even able to learn by "habituation". In parallel with Peirce's analogy between nerve cell content and the slime mould's behavior, the studies show that the mechanisms of learning of this organism perform cognitive functions analogous to organisms with a brain. The results also show that learning ability is identified with non-neural bases and reinforce the relevance of the organism's bodily condition in developing cognitive capacities. Unlike Heidegger who believed that the ability of representing the world in concepts would make us existing beings apart from *Animalia*, the studies of slime mould show that the capacity of signifying the world is performed at different scales and consequently it is not *conditio humana*.

If the slime mould's behavior is generalized, one may show that the capacity of memory depends on an organism's bodily condition in the form of reversibility with the world. The idea is that memory essentially stands for a relational structure and sensitivity to environmental contingencies. To the extent that the body reversibility is in the form of a *continuum* of experience, it is fair to say that memory results in a pragmatic process of constructing and reconstructing the relation with the world rather than in a fixed repertoire of stored data. For the slime mould, pragmatically, memory consists in practical effects. If immediate or remote, practical effects means everything that slime mould's memory can mean. Although it is an elementary case, the slime mould's behavior exemplifies how memory consists of a building process in the sense of guaranteeing the organisms a capacity of interpreting the world that goes far beyond simple repetition and behavioral automatism. As the case of the slime mould illustrates, the degree of functional organization of different processes in nature indicates different levels of cognitive ability and, consequently, different levels of memory. Following Peirce and James's pragmatic principle, accordingly, to conceive the meaning of memory is to trace what sensations are to be expected from it and what conduct it is fitted

to produce. For the slime mould, particularly, that is all that memory means for it.

For many (KULL, 2009), while vegetative semiosis is based on iconic signs, animal and cultural semiosis are respectively based on indexes and symbols. In primitive organic forms such as the slime mold, the use of indexical signs is presumably found whereas, in the tulips behavior, it hardly uses icons.<sup>29</sup> But, it is still an open question whether iconic and symbolic memories are also to be found in this type of organism. As the notion of semiosis itself, however, the capacity for memory is supposedly found in different forms of life. In addition, the slime mould's behavior typifies a radical form of engendering semiosis based essentially on the organism's bodily condition that may be associated with the emergence of mentality (SHAROV, 2012, p. 63). Despite the fact that vegetative semiosis is presumably iconic (KULL, 2009, p. 21), moreover, natural indexes are found across species (SEBEOK; DANESI, 2000, p. 95). As a consequence, it is fair to say that the logical differences between iconic, indexical and symbolic semiosis suppose different types of memory (KULL, 2009, p. 23). Even though the boundaries of semiosis is a controversial issue, insofar as one recognizes a non-linguistic sphere of semiosis, different types of memory can be identified in nature—that is to say, “any semiotic system has its own memory” (KULL, 2011, p. 182).

In order to draw a parallel between semiosis and memory, one needs to make clear in what sense meaning is to be understood. I totally agree with Floyd Merrell (1997, p. xi) that “meaning is not in the signs, the things, or the head.” For him, indeed, meaning is in the “processual rush of semiosis.” In assuming such a conception of meaning, the door is opened to understand semiosis based on a process-thought. As the principle of Peirce's and James's pragmatism asserts that there is no such thing as non-relational thought, accordingly, one is entitled to claim that meaning is a dynamically relational process. In this sense, considering the pragmatic meaning of memory, presumably, it also incorporates a form of a dynamically relational process: memory does not teach the organism what it must do on the world; with memory, organisms make sense of world in performing a dynamic relation with it (EDELMAN, 1992; ROSENFELD, 1994). For the slime mould, for instance, it is evident that memory is in a dynamic process since it is embodiedly interacting with the environment. Rather than relying on internal structures of representation, memory capacity is the organism's *praxis* of interacting with the world. Depending on the type of praxis that can be semiotically described, one can speak of iconic, indexical or symbolic memory. And *value* is the term that characterizes the meaning of memory for an organism *here* and *now* having nothing to do with eventual internal constraints.

---

29 Our approach [...] makes the general application of Peirce's term “icon” to vegetative semiosis questionable. In particular, the distinction between icon, index, and symbol is based on the type of the relation between a sign and its object, and the result of such association creates an interpretant-sign of the object in the interpreting mind. But molecular signals (that are in the domain of Kull's vegetative semiosis) appear to control actions of specific cell components directly without any internal reference to either an object or mental interpretant. Most cellular components seem to have no capacity to handle and classify objects (SHAROV; VEHKAVAARA, 2015, p. 104).

## 6 Final move: memory without representation

In parallel with Merleau-Ponty, Varela asserts that cognitive abilities do not depend on internal representations and result much more from the structural coupling between organism and world. In a paper dedicated to Merleau-Ponty (*Le corps évocateur: une relecture de l'immunité*),<sup>30</sup> Varela (1989) shows that the organization of a system is defined as an emergent function. For him, the idea is to deconstruct exteriority as the condition for the immune system's organization. Although Varela acknowledges the need for interaction with the external environment, he describes the organization of the immune system as the result of structural coupling with the environment. For the immune system, that is reason that it does not need stored memory in order to interact with the environment and so its memory consist much more in embodied process.

Nobel Prize Laureate in 1972, interestingly, Gerald Edelman showed that the presence of bacteria does not determine the nature of the antibody to be produced by the immune system. Insofar as the immune system is not taught to know the antibodies in advance, the invading virus selects the appropriate antibodies. In consequence, the immune system performs cognitive capacities and memory in form of selection and variation regardless of previous representations. In elaborating the *Theory of neural Darwinism* (1987; 1989; 992; 2004), Edelman draws methodological consequences from the study of the immune system and shows that the brain consists in a system of variation and selection in dynamic interaction with the environment, regardless of internal representations previously stored.

As Edelman, interestingly, Varela also draws methodological consequences from the study of the immune system. If we consider the immune system's memory capacity, it consists much more in an embodied process of constructive interaction with the environment than of representing stored data. Thus, for instance, one can explain the creative capacity of the immune system in the face of the diversity of viral attacks that goes beyond the repetition of data stored in a memory structure supposedly fixed. If memory indicates some significance on the immune system's behavior, it is because it engenders a dynamically embodied structure and sensitivity to the environment's contextual and historical contingencies—such as, for example, the case of the slime mould's behavior. It represents a radical form of cognition in which the organism's bodily condition performs a rudimentary cognitive function though nevertheless similar to those of the brain.

As described by Varela in parallel with Merleau-Ponty's body reversibility, just as the immune system's behavior depends on a structural process of incorporating the environment, memory capacity is also rooted in the bodily condition of the system itself in a process of construction and reconstruction in interacting with the environment. The idea is that organisms have symbolic experience—and including memory—whose functioning is conditioned by their embodied processes in the world. Given the environment's contingencies and variations, accordingly, the process of construction or reconstruction of memory indicates in what sense the immune system is creative and produces novelty more than being a merely repetitive structure. Since the immune system does not have prior cognition or

30 In English: "The evocative body: a review of immunity", *our translation*.

anticipated representations of the environment's future contingencies, it is senseless to claim that it must always be in a sentinel state, waiting for the enemy. As a process of construction or reconstruction, the immune system's memory capacity depends much more on the system's bodily condition than on the existence of an internal structure of representation and data storage. Once again, in what concerns the relevance of the organism's bodily condition, it is evident the parallel with the slime mould's behavior.

When an organism switches on its memory in order to perform decision-making, this does not mean that it consists of stored representation. To the extent that organisms *make sense* of memory, it is dynamically constructed in embodied transactions with the environment and it acquires a pragmatic meaning. Taking into account that the meaning of memory is in the practical effects based on the organism's bodily condition, additionally, memory consists of construction more than representation. For an organism, indeed, it is pragmatically vital *to know how* to do things with its memories more than to take them to be internal representations of the world—that is, memory is a process of *doing without representing* (CLARK; TORIBIO, 1994).

Identifying the pragmatic meaning of memory is perhaps one of the most intricate challenges in recent philosophical and scientific contexts: demystify the view that the ability to remember depends on stored representations. To insist on the importance of minimizing the load on stored memory and maximizing the sense of construction and pragmatic meaning of memory.

## References

- ANDERSON, Michael L. Embodied Cognition: A field guide. *Artificial Intelligence*, [S. l.], v. 149, issue 1, p. 91-130, Sep. 2003. DOI: [https://doi.org/10.1016/S0004-3702\(03\)00054-7](https://doi.org/10.1016/S0004-3702(03)00054-7). Available at: <https://www.sciencedirect.com/science/article/pii/S0004370203000547>. Accessed on: 15 Dec. 2019.
- ARAUJO, Arthur. *Da semântica do corpo ao gesto da palavra: interseções entre Merleau-Ponty e Francisco Varela*. São Paulo: FiloCzar, 2019.
- AYDEDE, Murat; ROBBINS, Philip. Short Primer on Situated Cognition. In: AYDEDE, Murat; ROBBINS, Philip (Eds.). *The Cambridge handbook of situated cognition*. Cambridge: Cambridge University Press, 2009. p. 3-10.
- BADDELEY, Alan. Memory. In: WILSON, Robert A.; KEIL, Frank C. (Eds.). *The MIT encyclopedia of the cognitive sciences*. Cambridge, MA; London: MIT Press, 2001. p. 514-517.
- BATESON, Gregory. *Mind and nature: a necessary unity*. New York: E. P. Dutton, 1979.
- BATESON, Gregory. *Steps to an ecology of mind: collected essays in anthropology, psychiatry, evolution, and epistemology*. New Jersey: Jason Aronson, 1987.
- BROOKS, R. A. Intelligence without Representation. *Artificial Intelligence*, [S. l.], v. 47, issues 1-3, p. 139-159, Jan. 1991. DOI: [Cognitio, São Paulo, v. 21, n. 2, p. 203-230, jul./dez. 2020](https://doi.org/10.1016/0004-</a></p></div><div data-bbox=)

3702(91)90053-M. Available at: <https://www.sciencedirect.com/science/article/abs/pii/000437029190053M>. Accessed on: 15 Dec. 2019.

CLARK, Andy. *Supersizing the mind: embodiment, action and cognitive extension*. Oxford: Oxford University Press, 2011.

CLARK, Andy; CHALMERS, David. The Extended Mind. *Analysis*, [S. l.], v. 58, n. 1, p. 7-19, 1998. DOI: <https://www.jstor.org/stable/3328150>. Available at: <https://www.jstor.org/stable/3328150?seq=1>. Accessed on: 10 Feb. 2020.

CLARK, Andy; TORIBIO, Josefa. Doing without representing? *Synthese*, [S. l.], v. 101, p.401-431, 1994. DOI: <https://doi.org/10.1007/BF01063896>. Available at: <https://link.springer.com/article/10.1007/BF01063896#citeas>. Accessed on: 10 Feb. 2020.

COBLEY, Paul; DEELY, John; KULL, Kalevi; PETRILLI, Susan. *Semiotics continues to astonish: Thomas A. Sebeok and the doctrine of sign*. Berlin; Boston: Walter de Gruyter GmbH & Co. KG, 2011.

DAMASIO, Antonio. *The feeling of what happens: body and emotion in the making of consciousness*. New York: Harcourt, Brace, and Co., 1999.

DAMASIO, Antonio. *Self comes to mind: constructing the conscious brain*. New York: Pantheon Books, 2010.

DUMOUCHEL, Paul. Embodiment: The Ecology of Mind. *Philosophies*, [S. l.], v. 4, n. 12, p. 1-9, Mar. 2019. DOI: <https://doi.org/10.3390/philosophies4020012>. Available at: <https://www.mdpi.com/2409-9287/4/2/12#cite>. Accessed on: 20 Feb. 2020.

DUSSUTOUR, Andrey. Slime Mold can learn. *National Geographic*, 8 Apr. 2019. Available at: <https://www.nationalgeographic.com/magazine/2019/02/slime-mold-can-learn-animal-milk-bank-strawberry-sex-breakthroughs/>. Accessed on: 28 Dec. 2020.

EDELMAN, Gerald M. *Bright air, brilliant fire: on the matter of the mind*. New York: Basic Books, 1992.

EDELMAN, Gerald M. *Neural Darwinism: the theory of neuronal group selection*. New York: Basic Books, 1987.

EDELMAN, Gerald M. *The remembered present: a biological theory of consciousness*. New York: Basic Books, 1989.

ENGEL, Andreas. Directive Minds: How Dynamics Shapes Cognition. In: STEWART, John; GAPENNE, Olivier; DI PAOLO, Ezequiel A. *Enaction: toward a new paradigm for cognitive science*. Cambridge, MA: The MIT Press, 2010. p. 219-244.

FORD, Lewis S. *The emergence of Whitehead's metaphysics, 1925-1929*. Albany: State University of New York Press, 1984.

GAPENNE, Olivier. Kinesthesia and the Construction of Perceptual Objects. In: STEWART, John; GAPENNE, Olivier; DI PAOLO, Ezequiel A. *Enaction: toward a new paradigm for cognitive science*. Cambridge, MA: The MIT Press, 2010. p. 183-218.



- HEIDELBERGER, Michael. *Nature from within: Gustav Theodor Fechner and his psychophysical worldview*. Translated by Cynthia Klohr. Pittsburgh; University of Pittsburgh Press, 2004.
- HOFFMEYER, Jesper. Semiotic freedom: an emerging force. In: DAVIES, Paul; GREGERSEN, Niels Henrik (Eds.). *Information and the nature of reality: from physics to metaphysics*. Cambridge: Cambridge University Press, 2010. p. 185-204.
- JAMES, William. Are We Automata? *Mind*, [S. l.], v. 4, issue 13, p. 1-22, Jan. 1879. DOI: <https://doi.org/10.1093/mind/os-4.13.1>. Available at: <https://academic.oup.com/mind/article-abstract/os-4/13/1/2870747>. Accessed on: 19 Feb. 2020.
- JAMES, William. *Essays in radical empiricism*. Nebraska: University of Nebraska Press, 1996.
- JAMES, William. *Pragmatism and other essays*. London: Penguin Books, 2000.
- JAMES, William. *The principle of psychology*. Harvard: Harvard University Press, 1983.
- JAMES, William. *The will to believe and other essays in popular philosophy and human immortality*. Boston: A Digireads Book, 2010.
- JOHNSON, Mark. *Embodied mind, meaning, and reason: how our bodies give rise to understanding*. Chicago: The University of Chicago Press, 2017.
- KÖHLER, Wolfgang. *The place of value in a world of facts*. London: Kegan Paul, Trench, Trubner & Co., Ltd., 1939.
- KRUEGER, Joel W. James on Experience and the Extended Mind. *Contemporary Pragmatism*, [S. l.], v. 3, n. 1, p. 165-176, Jun. 2006. DOI: <https://doi.org/10.1163/18758185-90000038>. Available at: [https://brill.com/view/journals/copr/3/1/article-p165\\_11.xml](https://brill.com/view/journals/copr/3/1/article-p165_11.xml). Accessed on: 20 Feb. 2020.
- KULL, Kalevi. Vegetative, Animal, and Cultural Semiosis: the semiotic threshold zones. *Cognitive Semiotic*, [S. l.], v. 4, issue supplement, p. 8-27, Spring 2009. DOI: <https://doi.org/10.1515/cogsem.2009.4.spring2009.8>. Available at: <https://www.degruyter.com/view/journals/cogsem/4/Supplement/article-p8.xml?language=en>. Accessed on: 05 Mar. 2020.
- LAKKOF, George; JOHNSON, Mark. *Philosophy in the flesh: the embodied mind and its challenge to western thought*. New York: Basic Books, 1999.
- LEONE, M. Bacteria. In: FAVAREAU, Donald; COBLEY, Paul; KULL, Kalevi (Eds.). *A more developed sign: interpreting the work of Jesper Hoffmeyer*. Tartu: Tartu University Press, 2012.
- MANCUSO, Stefano. *The revolutionary genius of plants: a new understanding of plant intelligence and behavior*. New York: Atria Books, 2017.
- MATURANA, Humberto R. Funções de representação e comunicação. In: GARCIA, Célio (Org.). *Um novo paradigma em ciências humanas, física e biologia*. Belo Horizonte: UFMG-PROED, 1987. p. 23-52.

MENARY, Richard. Introduction to the special issue on 4E cognition. *Phenomenology and the Cognitive Sciences*, [S. l.], v. 9, p. 459-463, Nov. 2010. DOI: <https://doi.org/10.1007/s11097-010-9187-6>. Available at: <https://link.springer.com/article/10.1007/s11097-010-9187-6?shared-article-renderer>. Accessed on: 12 Mar. 2020.

MERLEAU-PONTY, Maurice. *La structure du comportement*. Paris: Éditions Gallimard, 1942.

MERLEAU-PONTY, Maurice. *Phénoménologie de la perception*. Paris: Éditions Gallimard. 1945.

MERLEAU-PONTY, Maurice. *Résumé de cours (1952-1960)*. Paris: Gallimard, 1968.

MERLEAU-PONTY, Maurice. *La nature: notes/cours du college de France*. Paris: Edition du Seuil, 1995.

MERRELL, Floyd. *Peirce, signs and meaning*. Toronto: Toronto University Press, 1997.

NEISSER, Ulric; WINOGRAD, Eugene (Eds.). *Remembering reconsidered: ecological and traditional approaches to the study of memory*. Cambridge: Cambridge University Press, 1988.

NOË, Alva. *Action in perception*. Cambridge, MA: The MIT Press, 2006.

PATTEE, Howard H.; KULL, Kalevi. Between Physics and Semiotics. In: EMMECHE, Claus; KULL, Kalevi (Eds.). *Towards a semiotic biology: life is the action of signs*. London: Imperial College Press, 2011.

PEIRCE, Charles Sanders. *Collected Papers of Charles Sanders Peirce*. HARTSHORNE, Charles; WEISS, Paul; BURKS, Arthur W. (Eds.). Cambridge, Ma: Harvard University Press, 1931-35 and 1958. 8 v. [Quoted as CP, which the first number means the volume, and the second, the paragraph].

PERRY, Ralf B. *The thought and character of William James: as revealed in unpublished correspondence and notes, together with his published writings*. Vol. II Philosophy and Psychology. London: Oxford University Press, 1976.

PICKERING, John. Signs in the Flesh: Whitehead and Evolutionary Metaphysics. In: BERVE, Aljoscha; MAAßEN, Helmut (Eds.). *A. N. Whitehead's thought through a new prism*. Cambridge: Cambridge Scholars Press, 2016. p. 243-260.

REID, Chris R.; LATTY, Tania; DUSSUTOUR, Audrey; BEEKMAN, Madeleine. Slime mold uses an externalized spatial “memory” to navigate in complex environments. *Proceedings of the National Academy of Sciences of the United States of America*, Tucson, v. 109, n. 43, p. 17490-17494, Oct. 2012. DOI: <https://doi.org/10.1073/pnas.1215037109>. Available at: <https://www.pnas.org/content/109/43/17490>. Accessed on: 07 Feb. 2020.

ROBERT, F. Maurice Merleau-Ponty (1908-1961). In: WEBER, Michel; DESMOND, Will (Eds.). *Seven process philosophers*. Heusenstamm: Ontos/Verlag, 2008. p. 667-675.

ROSENFELD, Israel. *A invenção da memória*. Tradução de Vera Ribeiro. São Paulo: Nova Fronteira, 1994.

ROWLANDS, Mark. *The new science of the mind: from extended mind to embodied phenomenology*. Cambridge: A Bradford Book; The MIT Press, 2010.

SAIGUSA, Tetsu; TERO, Atsushi; NAKAGAKI, Toshiyuki; KURAMOTO, Yoshiki. Amoebae anticipate periodic events. *Physical Review Letters*, [S. l.], v. 100, n. 1, p. 1-5, Jan. 2008. DOI: 10.1103/PhysRevLett.100.018101. Available at: <https://pubmed.ncbi.nlm.nih.gov/18232821/>. Accessed on: 11 Feb. 2020.

SEBEOK, Thomas. The Sign Science and the Life Science. *Applied Semiotics / Sémiotique Appliquée*, [S. l.], v. 3, n. 6/7, p. 85-96, 1999. Available at: <http://french.chass.utoronto.ca/as-sa/ASSA-6-7/Vol3.No6-7.Sebeok.pdf>. Accessed on: 27 Dec. 2019.

SEBEOK, Thomas; DANESI, Marcel. *The forms of meaning: modeling systems theory and semiotic analysis*. New York; Berlin: Mouton de Gruyter, 2000.

SHAROV, Alexei A. The origin of mind. In: MARAN, Timo; LINDSTRÖM, Kati; MAGNUS, Riin; TØNNENSEN, Morten (Eds.). *Semiotics in the wild: Essays in honour of Kalevi Kull on the occasion of his 60<sup>th</sup> birthday*. Tartu: University of Tartu Press, 2012. p. 63-69.

SHAROV, Alexei A.; VEKKAARA, Tommi. Protosemiosis: Agency with Reduced Representation Capacity. *Biosemiotics*, [S. l.], v. 8, p. 103-123, Apr. 2015. DOI: <https://doi.org/10.1007/s12304-014-9219-7>. Available at: <https://link.springer.com/article/10.1007/s12304-014-9219-7#citeas>. Accessed on: 28 Dec. 2019.

Simondon, Gilbert. *L'Individuation: à la lumière des notions de forme et d'information*. Grenoble: Éditions Jérôme Millon, 2013.

STEWART, John; GAPENNE, Olivier; DI PAOLO, Ezequiel A. *Enaction: toward a new paradigm for cognitive science*. Cambridge, MA: The MIT Press, 2010.

STEWART, John. Foundational Issues in Enaction as a Paradigm for Cognitive Science. In: STEWART, John; GAPENNE, Olivier; DI PAOLO, Ezequiel A. *Enaction: toward a new paradigm for cognitive science*. Cambridge, MA: The MIT Press, 2010. p. 1-32.

SUTTON, John. Introduction: Memory, Embodied Cognition, and the Extended Mind. *Philosophical Psychology*, [S. l.], v. 19, n. 3, p. 281-289, June 2006. DOI: <https://doi.org/10.1080/09515080600702550>. Available at: <https://www.tandfonline.com/doi/abs/10.1080/09515080600702550>. Accessed on: 05 Feb. 2020.

SUTTON, John; Harris, C. B.; Keil, P. G.; Barnier, A. J. The psychology of memory, extended cognition, and socially distributed remembering. *Phenomenology and the Cognitive Sciences*, [S. l.], v. 9, p. 521-560, Dec. 2010. DOI: <https://doi.org/10.1007/s11097-010-9182-y>. Available at: <https://link.springer.com/article/10.1007/s11097-010-9182-y>. Accessed on: 28 Dec. 2019.

THOMPSON, Evan; STAPLETON, Mog. Making Sense of Sense-Making: Reflections on Enactive and Extended Mind Theories. *Topoi*, [S. l.], v. 28, p. 23-30, Mar. 2009.

DOI: <https://doi.org/10.1007/s11245-008-9043-2>. Available at: <https://link.springer.com/article/10.1007/s11245-008-9043-2>. Accessed on: 28 Dec. 2019.

TURNER, John S. *Purpose and desire: a new model for understanding life*. New York: HarperOne, 2017.

UEXKÜLL, Jakob von. *A foray into the worlds of animals and humans*. Translated by Joseph D. O'Neil. Minneapolis: University of Minnesota Press, 2010.

UEXKÜLL, Jakob von. The Theory of Meaning. *Semiotica*, [S. l.], v. 42, n. 1, p. 25-82, Jan. 1982. DOI: <https://doi.org/10.1515/semi.1982.42.1.25>. Available at: <https://www.degruyter.com/view/journals/semi/42/1/article-p25.xml>. Accessed on: 18 Dec. 2019.

VAZ, N. M. Francisco Varela and the Immunological Self. *Systems Research*, [S. l.], v. 28, n. 6, p. 696-703, 2011. DOI: 10.1002/sres.1126. Available at: <https://maint.onlinelibrary.wiley.com>. Accessed on: 15 Mar. 2020.

VARELA, Francisco J. *et al. Naturaliser la phénoménologie: essais sur la phénoménologie contemporaine et les sciences cognitives*. Paris: CNRS Éditions, 1999.

VARELA, Francisco J.; THOMPSON, Evan; ROSCH, Eleanor. *The embodied mind: cognitive science and human experience*. Cambridge, MA: MIT Press, 1993.

VARELA, Francisco J.; COHEN, Amy. Le corps évocateur: une relecture de l'immunité. *Nouvelle Revue de Psychanalyse*, [S. l.], n. 40, p. 193-213, 1989.

WHITEHEAD, Alfred N. *Process and reality: an essay in cosmology*. New York: The Free Press, 1978.

WHITEHEAD, Alfred N. *Symbolism: its meaning and effect*. New York: Macmillan, 1927.

WHITEHEAD, Alfred N. *The adventures of ideas*. New York: The Free Press, 1933.

ZLATEV, Jordan. Meaning = Life (+ Culture): an outline of a unified biocultural theory of meaning. *Evolution of Communication*, [S. l.], v. 4, n. 2, p. 255-299, 2002. Available at: <https://lup.lub.lu.se/search/publication/967f6797-a7d9-4ebf-ac3b-e0e09a13c577>. Accessed on: 28 Dec. 2019.