2 Horizons for the Enactive Mind: Values, Social Interaction, and Play

Ezequiel A. Di Paolo, Marieke Rohde, and Hanne De Jaegher

2.1 Introduction

Almost two decades since the publication of *The Embodied Mind* (Varela, Thompson, and Rosch 1991), the term *enactive* has moved out of relative obscurity to become a fashionable banner in many regions of cognitive science. It has found its way into diverse areas, from education and human-computer interaction, to autonomous robotics and consciousness studies. On the surface, this acceptance indicates the success of the ideas articulated by Varela and his colleagues, and their view of the mind with its emphasis on the role of embodied experience, autonomy and the relation of co-determination between cognitive agents and their world. Theirs was not only an achieved synthesis of existing criticisms to a predominantly computationalist paradigm, but also the articulation of a set of postulates to move these ideas forward. Indeed, the increasing use of enactive terminology serves as an indication that the time is ripe for a new era in cognitive science. To a great extent, we believe this to be so.

However, on closer inspection, a significant variety of meaning is revealed in the use of the word "enactive" (as happens with closely associated terms such as *autonomous*, *embodied*, *situated*, and *dynamical*). The label sometimes indicates only the partial adoption of enactive views, vaguely connected to the ideas in *The Embodied Mind*. In the worst cases, we see the raising of implausible hybrids risking self-contradiction in their mixture of the new and the old. There seems to be a lack of consensus about what constitutes enactivism or embodied cognitive science in general (Wilson 2002). Enactive has often been taken simply as synonymous of active, embodied as synonymous of physical, dynamical as synonymous of changing, and situated as synonymous of exchanging information with the environment, all properties that could be claimed by practically every robot, cognitive model or theory proposed since symbolic artificial intelligence (AI) first made its debut as the theoretical core of cognitive science about fifty years ago. This situation can lead to confusion and eventually to the loss of meaning attached to these terms—indeed, a perceived ambiguity between revolution and reform was already noticed by early commentators (Dennett, 1993).

We find at least two reasons for this situation, both indicating pressing problems that must be addressed if enactive cognitive science is to get off the ground. The first one is a watering down of the original ideas of enactivism by their partial adoption or sublimation into other frameworks. The second, related reason is a genuine lack of enactive proposals to advance open questions in cognitive science that motivate more traditional frameworks, such as the problems of higher-level cognition. These reasons lead to the misappropriation of the previously mentioned keywords through the acceptance of the lessons of enactivism, but only for a restricted range of influence. In the opinion of many, the usefulness of enactive ideas is confined to the "lower levels" of human cognition. This is the "reform-not-revolution" interpretation. For instance, embodied and situated engagement with the environment may be sufficient to describe insect navigation, but it will not tell us how we can plan a trip from Brighton to La Rochelle. Or enactive-like ideas could well account for complex skills such as mastering sensorimotor contingencies in visual perception (O'Regan and Noë 2001), or becoming an expert car driver (Dreyfus 2002), but—important though these skills are—they remain cognitively marginal (Clark and Toribio 1994) and fall short of explaining performances such as preparing for a mathematics final or designing a house. For some researchers, enactive ideas are useful but confined to the understanding of sensorimotor engagements. As soon as anything more complex is needed, we must somehow recover newly clothed versions of representationalism and computationalism (Clark and Toribio 1994; Clark 1997; Clark and Grush 1999; Grush 2004).

We would do wrong in ignoring such positions. They are good indicators of what is at the core of the struggle between traditional and unorthodox temperaments in cognitive science today. Indeed, the current situation serves as a reminder of the dangerous fate that fresh and radical ideas may suffer: that of dilution into a background essentially indistinguishable from that which they initially intended to reject. We believe that it is mistaken to conclude that what enactivism cannot yet account for must necessarily be explained using an updated version of old ideas with a debatable success record. But it will remain tempting to do so *as long as the principal tenets and implications of enactivism remain insufficiently clear*. It would also be wrong to ignore arguments that show the limitations of enactivism. These challenges reveal how much is left to be done. *Enactivism is a framework that must be coherently developed and extended.*

For this reason, in trying to answer the question "What is enactivism?" it is important not to straightjacket concepts that may still be partly in development. Some gaps may not yet be satisfactorily closed; some contradictions may or may not be only apparent. We should resist the temptation to decree solutions to these problems simply because we are dealing with definitional matters. The usefulness of a research program also lies with its capability to grow and improve itself. It can do so only if problems and contradictions are brought to the center and we let them do their work. For this, it is important to be engendering rather than conclusive, to indicate horizons rather than boundaries.

There are still many important areas in enactive cognitive science that demand serious development. These remain the stronghold of traditional conceptions. Most of the underdeveloped areas within the enactive approach involve higher levels of cognitive performance: thinking, imagining, interpreting the behavior of others, and so on. For as long as enactive ideas are taken as filling in details or as playing a contextual role in the explanation of such phenomena, the situation will not change.

We dedicate this chapter to clarifying the central tenets of enactivism and exploring some of the themes currently under development. In this exercise, following the logic of the central ideas of enactivism can sometimes lead to unexpected hypotheses and implications. We must not underestimate the value of a new framework in allowing us to *formulate questions in a different vocabulary*, even if satisfactory answers are not yet forthcoming. Implicitly, the exploration of these questions and possible answers is at the same time a demonstration of the variety of methods available to enactivism, from phenomenology, to theory/experiment cycles, and to the synthesis of minimal models and validation by construction—an additional thread that runs through this chapter and that we will pick up again in the discussion.

In particular, after introducing the five core ideas of enactivism, we focus on value generation and question the coherence of the idea of a *value system* in cognitive architectures (both computationalist and embodied) and similar modular structures whose function is to generate or judge the *meaning* of a situation. This question allows us to highlight right from the start one of the main differences between enactive and traditional views: a grounding of notions such as values and meaning. Many influential theories in cognitive science make use of the idea that value or meaning is some information appraised by an internal module within an agent's cognitive architecture, whereas in an enactive perspective, meaning is inseparable from the whole of context-dependent, life-motivated, embodied activity, without being at all a hazy concept beyond the reach of scientific understanding. We also explore, continuing on the issue of the origins of meaning, the field of social cognition, the focus of many recent phenomenologically inspired criticisms (Thompson 2001; Gallagher 2001, 2005). Our exploration leads us toward a middle way between individualistic and holistic views of social interaction and to highlighting the central role played by the temporality of social engagements in generating and transforming social understanding at different time scales through joint participation. In the final part, we take a speculative look at the embodied capability to manipulate the meaning of concrete situations by exploring the role of play in the development of human cognition. These explorations do not attempt to be complete, nor do they put the whole of human cognition within the reach of enactivism and forever banish representational/computational explanations. But they do extend the conceptual horizon and allow us to formulate the problem of higher cognitive performance in an alternative, enactive way.

2.2 The Core of Enactivism

It would be misleading to think of the enactive approach as a set of all radically novel ideas. It is much rather a synthesis of some new but also several old themes that mutually support each other. Overall, enactivism may be construed as a kind of nonreductive, nonfunctionalist naturalism. It sees the properties of life and mind as forming part of a continuum and consequently advocates a scientific program that explores several phases along this dimension.

Among the predecessors to enactivism we find, for example, Piaget's theory of cognitive development through sensorimotor equilibration (Piaget 1936, 1967), Poincaré's theory of the active role of movement in the construction of spatial perception (Poincaré 1907), Goldstein's theory of the self-actualizing organism (Goldstein [1934] 1995), and others. The very term "enactive" has been similarly used before, for example by Bruner in the 1960s, to describe knowledge that is acquired and manifested through action (Bruner 1966). Equally, we find philosophical affinities with existential phenomenology (Heidegger 1962; Merleau-Ponty 1962), with Eastern mindfulness traditions, with Hans Jonas's biophilosophy (Jonas 1966), and with pragmatic thinkers such as Dewey (1929). Current compatibilities can be also found with many embodied and dynamical systems ideas in contemporary cognitive science (Beer 2000; Chiel and Beer 1997; Thelen and Smith 1994; Hutchins 1995a; Juarrero 1999; Kelso 1995), neuroscience (Bach-y-Rita et al. 1969; Damasio 1994; Skarda and Freeman 1987; Engel, Fries, and Singer 2001), evolutionary biology (Lewontin 1983; Oyama 2000), and AI/robotics (Beer 2003; Brooks 1991; Harvey et al. 1997; Nolfi and Floreano 2000; Winograd and Flores 1986). Some of these connections are made explicit in *The Embodied Mind*, others have been elaborated later in the literature, and still others remain to be better established.

What is the core of the enactive approach? Views that take cognition as embodied and situated, or take experience seriously, or explore the purchase of dynamical systems ideas, will all share something with enactivism. But to call them enactive just because there is some conceptual overlap may only contribute to a meaningless proliferation of the term. This is unless we can show both that (1) such views share or are developed from a basic core of enactive ideas, and (2) extensions to these ideas do not result in irresolvable contradictions with this basic core. We can identify five highly intertwined ideas that constitute the basic enactive approach (Varela, Thompson, and Rosch 1991; Thompson 2005): *autonomy*, *sense-making*, *emergence*, *embodiment*, and *experience*. Partially implying each other, these ideas sit on the blind spots of traditional views. We will not attempt to disentangle all of their connections in order to obtain a set of perfectly independent postulates. Indeed, the internal relations between these concepts speak for the strength of their association under a single banner.

2.2.1 Autonomy

Living organisms are autonomous—they follow laws set up by their own activity. Fundamentally, they can be autonomous only by virtue of their self-generated identity as distinct entities. A system whose identity is fully specified by a designer and cannot, by means of its own actions, regenerate its own constitution, can only follow the laws contained in its design, no matter how plastic, adaptive, or lifelike its performance. In order for a system to generate its own laws, it must be able to build itself *at some level of identity*. If a system "has no say" in defining its own organization, then it is condemned to follow an externally given design like a railroad track. As such, it may be endowed with ways of changing its behavior depending on history, but at some level it will encounter an externally imposed functional (as opposed to physical) limitation to the extent to which it can change itself. This can be avoided only if the system's limitations result partly from its own processes.

The autonomy (or freedom) of a self-constituted system is by no means unconstrained (being able to influence one's own limitations does not imply being able to fully remove them; on the contrary, it means being able to set up new ways of constraining one's own actions). Hans Jonas (1966) speaks of life as sustaining a relation of *needful freedom* with respect to its environment. Matter and energy are needed to fuel metabolism. In turn, by its constant material turnover, metabolism sustains its form (its identity) by dynamically disassociating itself from specific material configurations.

It should be clear that by expressions like "self-constitution" and "generating its own laws" no mysterious vitalism is intended. However, the acceptance of an operational concept of emergence (discussed shortly) is implied. By saying that a system is self-constituted, we mean that its dynamics generate and sustain an identity. An *identity* is generated whenever a precarious network of dynamical processes becomes operationally closed. A system is operationally closed if, for any given process *P* that forms part of the system (1) we can find among its enabling conditions other processes that make up the system, and (2) we can find other processes in the system that depend on *P*. This means that at some level of description, the conditions that sustain any given process in such a network always include those conditions provided by the operation of the other processes in the network, and that the result of their global activity is an identifiable unity in the same domain or level of description (it does not, of course, mean that the system is isolated from interactions with the environment). Autonomy as operational closure is intended to describe self-generated identities at many possible levels (Varela 1979, 1997; Di Paolo 2009).

Cognitive systems are also autonomous in an interactive sense in terms of their engagement with their environment as agents and not simply as systems coupled to other systems (Moreno and Etxeberria 2005; Di Paolo 2005). As such, they not only respond to external perturbations in the traditional sense of producing the appropriate action for a given situation, they do in fact actively and asymmetrically *regulate* the conditions of their exchange with the environment, and in doing so, enact a world or cognitive domain.

To view cognitive systems as autonomous is therefore to reject the traditional poles of seeing mind as responding to environmental stimuli on the one hand, or as satisfying internal demands on the other—both of which subordinate the agent to a role of obedience to external or internal factors. It is also to recognize the "ongoingness" of sensorimotor couplings that lead to patterns of perception and action twinned to the point that the distinction is often dissolved. Autonomous agency goes even further than the recognition of ongoing sensorimotor couplings as dynamical and emphasizes the role of the agent in constructing, organizing, maintaining, and regulating those closed sensorimotor loops. In doing so, the cognitive agent plays a role in determining the norms that it will follow, the "game" that is being played.

2.2.2 Sense-Making

Already implied in the notion of interactive autonomy is the realization that organisms cast a web of significance on their world. Regulation of structural coupling with the environment entails a direction that this process is aiming toward: that of the continuity of the self-generated identity or identities that initiate the regulation. This establishes a *perspective on the world* with its own normativity, which is the counterpart of the agent being a center of *activity in the world* (Varela 1997; Weber and Varela 2002; Di Paolo 2005; Thompson 2007). Exchanges with the world are thus inherently significant for the agent, and this is the definitional property of a cognitive system: the creation and appreciation of meaning or *sense-making*, in short.

It will be important to notice already— this issue is treated more extensively in the following section—that sense-making is an inherently active idea. Organisms do not passively receive information from their environments, which they then translate into internal representations. Natural cognitive systems are simply not in the business of accessing their world in order to build accurate pictures of it. They participate in the generation of meaning through their bodies and action often engaging in transformational and not merely informational interactions; *they enact a world*. Enactivism thus differs from other nonrepresentational views such as Gibsonian ecological psychology on this point (Varela, Thompson, and Rosch 1991, 203–204). For the enactivist, sense is not an invariant present in the environment that must be retrieved by direct (or indirect) means. Invariants are instead the outcome of the dialog between the active principle of organisms in action and the dynamics of the environment. The "finding" of meaning must be enacted in a concrete and specific reduction of the dimensions that the organism-environment system affords along the axis of relevance for autonomy; it is always an activity with a *formative* trace, never merely about the innocent extraction of information as if this was already present to a fully realized (and thus inert) agent. This is another idea that sets the enactive framework apart from more traditional views in cognitive science: a dynamical, biologically grounded, theory of sense-making. Like few notions in the past, this concept strikes at the heart of what is to be cognitive. We will elaborate this point in the next section and show how elusive this way of thinking can be even among researchers who have taken embodiment and situatedness very seriously.

2.2.3 Emergence

The overarching question in cognitive science is: How does it work? For the enactive approach, the connected concepts of autonomy and sense-making already invoke some notion of emergence in addressing this question. Autonomy is not a property of a collection of components, but the consequence of a new identity that arises out of dynamical processes in precarious operational closure. Meaning is not to be found in elements belonging to the environment or in the internal dynamics of the agent, but belongs to the relational domain established between the two.

The idea of emergence has been much debated in various domains from metaphysics to epistemology and has had a furious revival over the last three decades with the advent of the sciences of complexity. Beyond the debates about the possibility of ontological emergence (Kim 1999; Silberstein and McGeever 1999), there is a pragmatic application of the term that stems from the well-understood phenomenon of self-organization. This has served to remove the air of mystery around emergence in order to bring it back in line with a naturalistic project. There is also a demand for emergentist explanations in biology, in which hierarchical organization is all too evident (e.g., genetic regulation, cells, extracellular matrices, tissues, organs, organism, dyads, groups, institutions, societies).

Emergence is used to describe the formation of a novel property or process out of the interaction of different existing processes or events (Thompson 2007; Thompson and Varela 2001). In order to distinguish an emergent process from simply an aggregate of dynamical elements, two things must hold (1) the emergent process must have its own autonomous identity, and (2) the sustaining of this identity and the interaction between the emergent process and its context must lead to constraints and modulation to the operation of the underlying levels.[1] The first property indicates the identifiability of the emergent process whose characteristics are enabled but not fully determined by the properties of the component processes. The second property refers to the mutual constraining between emerging and enabling levels (sometimes described as circular or downward causation).

We find the clearest example of emergence in life itself. The property of continuous self-production, renewal, and regeneration of a physically bounded network of molecular transformations (autopoiesis) is not to be found at any level below that of the living cell itself. Being a self-sustaining bounded network of chemical transformations is not (it cannot be) the property or the responsibility of single components in this network. The new level is not only autonomous in terms of exhibiting its own identity and laws of transformation; it also introduces, through interaction with its codefined context, modulations to the boundary conditions of the lower-level processes that give rise to it.

This phenomenon repeats itself at various levels in multicellular organisms and in particular animals and humans. Variations on this theme have been used to describe the emergence of the self/nonself distinction in immune networks (Stewart and Coutinho 2004); the generation, maintenance, and eventual dissolution of coherent modes of synchronous activity in the brain (Engel, Fries, and Singer 2001; Thompson and Varela 2001); and also between these coherent modes and action/perception cycles (Rodriguez et al. 2001; Le Van Quyen and Petitmengin 2002). Emergent phenomena, as indicated in the previous examples, can be fleeting. Single acts can bear a relation of emergence with respect to their sensorimotor component phases.

Taking emergence seriously makes the enactive approach very skeptical about the localization of function corresponding to one level in specific components at a lower level (homuncularity) and consequently leads to the rejection of "boxology" as a valid method to address the "how does it work" question. Any labeling of subsystemic components and variables with names belonging naturally to properties of emergent levels (e.g., value systems, cognitive maps, emotional modules, mirror neurons) should be treated with extreme caution.

Having said all this, emergence remains problematic, due often to its opaqueness and the ease with which the term can be misused. The weight of explaining how a given phenomenon constitutes a proper case of emergence remains with the supporters of this view. The very blurring of distinctions between levels that the enactive approach criticizes of cognitivism has allowed the latter paradigm to connect personal and subpersonal levels with indiscriminate ease. The properties of higher levels are thus explained in terms of lower-level ones, because they are already magically present there. For the emergentist, instead, the connection and the interaction between levels becomes a problem to be addressed case by case, often by recourse to complex concepts and tools derived from dynamical systems theory. It is clear that much work is still needed for clarifying and operationalizing the concept of emergence. In this context, synthetic models can prove very valuable as tools for grasping emergent phenomena.

2.2.4 Embodiment

In a concrete and practical sense, a cognitive system is embodied to the extent to which its activity depends nontrivially on the body. However, the widespread use of the term has led in some cases to the loss of the original contrast with computationalism and even to the serious consideration of trivial senses of embodiment as mere physical presence—in this view, a word processor running on a computer would be embodied, (cf. Chrisley 2003). It is easy to miss a fundamental motivation behind embodiment. Nontrivial dependence on the body can easily be construed in functionalist term, and this falls short of the more radical implications of enactivism. It is not only a question of moving the mind from a highly sheltered realm of computational modules in the head into messy bodily structures. So-called embodied approaches that do not move beyond this first step remain largely functionalist and see the body as yet another information processing device; a convenient way to offload computations that would be too hard to handle by the neural tissue (Clark 1997). This is a Cartesian view of embodiment in its separation between mind as function on the one hand and body as implementation on the other. A similar adopted view is that of the mind as controller and the body as controlled. Despite their tension, these views often go together. By contrast, for the enactivist the body is the ultimate source of significance; embodiment means that mind is inherent in the precarious, active, normative, and worldful process of animation, that the body is not a puppet controlled by the brain but a whole animate system with many autonomous layers of self-constitution, self-coordination, and self-organization and varying degrees of openness to the world that create its sense-making activity.

Indeed, to say that cognition is embodied is to express a tautology—it simply cannot *but* be embodied if we understand the core of cognition as sense-making. The latter goes hand in hand with the conservation of emergent identities (autonomy) ultimately constituted by material processes in precarious conditions (i.e., unable to sustain a 'function' independently of each other or indefinitely). In other words, mind is possible because a body is always a decaying body (a fact that cannot be captured in functionalist terms).

For enactivism, therefore, cognition is embodied in a fundamental, non-functionalist sense although it may still nurture itself by the fascinating examples of how bodily structures and dynamics may be cleverly exploited to resolved complex problems both in human performance (Lenay 2003) and in robots (Pfeifer and Scheier 1999; Salomon 1998). The relevance of the body is not restricted to concrete sensorimotor activities. There is much evidence that higher-level cognitive skills, such as reasoning and problem solving, mental image manipulation, and language use depend crucially on bodily structures (Wilson 2002; Lakoff 1987).

There are enactive accounts of the potential layering of several identities into a more or less integrated body-in-interaction (Varela 1997; Di Paolo 2005, 2009). These can serve to make sense of a further twist to the role played by the body in the case of human cognition—one that could explain the resilience of Cartesian modes of thinking. Even though our bodies are not puppets, to say that we control our bodies is, in a sense, not entirely wrong. We certainly do. But we do so in subtle ways that relate to the emergence of forms of reflexive autonomy, this time of a sociolinguistic nature. Like an alien presence, I set new aims for my body (I decide to embrace the pain of a yoga class, I decide to go on a diet). Being able to support and transform new identities is one way in which the body creates the experience of a self not quite the same as (and sometimes at odds with) the metabolic self. Taken in isolation, this is an experience that nurtures Cartesianism. In fact, the body, by further manipulating its sense-making activity, is capable of putting itself in a novel situation that is partly its own creation. In doing so, it is playing a highly skillful dual role. This is afforded by the plasticity of the human body, but it would not be possible without immersion within a symbolic order and the social mediation that makes our bodies fit to a scheme of control and observation of behavioral and cultural norms thus giving rise to sociolinguistic and narrative selves.

2.2.5 Experience

For enactivism, experience is central both methodologically and thematically. Far from being an epiphenomenon or a puzzle as it is for cognitivism, experience in the enactive approach is intertwined with being alive and immersed in a world of significance. As part of the enactive method, experience goes beyond being data to be explained. It becomes a guiding force in a dialog between phenomenology and science, resulting in an ongoing pragmatic circulation and mutual illumination between the two (Gallagher 1997; van Gelder 1999; Varela 1996, 1999).

Many modern accounts of cognitive activity already take experience seriously. For instance, Dreyfus's defense of nonrepresentational skill acquisition (2002) is based on paying careful attention to the experience of undergoing a process of task improvement. As we make the journey from beginners to experts through practice, not only is skillful performance improved, but experience is also transformed. This is to be expected if embodiment in the enactive sense is taken seriously. If experience and the body-in-interaction were to relate to each other as two mutually external systems, we would expect either an unchangeable or a fleeting relation between our bodies and our experience. Instead we find a lawful relation of bodily and experience transformations. Becoming a wine connoisseur is certainly an achievable goal but expertise in this field (as in any other) is not obtained through gaining the right kind of *information* but through the right kind of *transformation*—one that can only be brought about by appropriate time-extended training (experimenting, making mistakes, and so on). Experience is altered in a lawful manner through the process. It is itself a skillful aspect of embodied activity.

An embodied perspective results in serious attention being paid to isomorphisms between mechanisms and experience. Varela (1999) and van Gelder (1999) provide different, but related, dynamical systems accounts of mechanisms that might underlie the protentive and retentive structure of time consciousness as described by Husserl. Kelly (2000) considers neural models of pointing and grasping that run parallel to Merleau-Ponty's concepts of the intentional arc and maximal grip. Wheeler (2005) explores isomorphic relationships between embodied/embedded accounts of situated action and Heideggerian categories such as the ready-to-hand, breakdowns, and present-at-hand. What is interesting in many of these accounts is that the process of circulation is not one of assimilating scientific hypotheses into phenomenology, but may itself inform phenomenology. This is as it should be in a proper dialog, and such is the methodology advocated by first-person methods in the joint study of experience and brain-body activity (Varela 1996; Lutz 2002).

Experience may also serve the role of clarifying our commitments. Hans Jonas (1966) looks into the world of living beings and sees that life is a process with interiority. Metabolism has all the existential credentials of concernful being. It is precarious, it separates itself from nonbeing, it struggles to keep itself going and preserve its identity, and it relates to the world in value-laden terms. However, the inward aspect of life cannot be demonstrated using our current scientific tools. This does not make it any less factual for Jonas. He knows that all life is connected along evolutionary chains, and he knows that we ourselves are embodied living creatures with an inner life. This is how we can then know that living beings are forms of existence and that they also have an inner life.

This example is telling, because it already contains a difficult-to-swallow consequence of the dialog between science and experience, which is, at the same time, perhaps its most revolutionary implication. Phenomenologically informed science goes beyond black marks on paper or experimental procedures for measuring data, and dives straight into the realm of personal experience. No amount of rational argument will convince a reader of Jonas's claim that, as an embodied organism, he is concerned with his own existence if the reader cannot see this for himself. Jonas appeals to the performance of a gesture that goes beyond comprehending a scientific text. The implication is that in order to work as a source of knowledge, enactivism will contain an element of personal practice. It is necessary to come back to the phenomenology and confirm that our theories make sense, but this means that sometimes we must become skillful in our phenomenology as well—personally so.

2.3 Values and the Limits of Evolutionary Explanations

The previous section shows that there are certain ideas in cognitive science that the enactive approach clearly rejects, such as homuncularity, boxology, separability between action and perception, and representationalism. In this section, we will revisit some of these themes in a more focused manner.

In everyday life, we experience the world in value-laden terms. This fact is hard to avoid and has been the subject of much philosophical debate. For enactivism, value is simply an aspect of all sense-making, as sense-making is, at its root, the evaluation of the consequences of interaction for the conservation of an identity. Perhaps as a reaction to the subjective overtones of this issue, traditional cognitive science has not dwelled much on the explicit mechanisms involved in value judgment as an inherent aspect of cognitive activity. In general, questions about value or natural purposes have been dealt with separately, preferably with reference to evolutionary history (Millikan 1984): everything living organisms do is ultimately reduced to survival strategies in situations like those encountered by their ancestors, or to the urge to spread their genes as widely as possible. In a more traditional cognitive modeling framework, this idea translates to values being "built-in" by evolution—phylogenetically invariant yardsticks against which actual lifetime encounters are measured and

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