CITE AS: Barandiaran, X. E., & Rama, T. (2025). The Organismic Turn. Teleosemantics after 4E. In M. Heras-Escribano (Ed.), *Analytic Philosophy and 4E Cognition* (p. in press). Routledge.

The Organismic Turn

Teleosemantics after 4E

Xabier E. Barandiaran[1] & Tiago Rama[2]

ABSTRACT: This chapter calls for an "organismic" approach to teleosemantics, integrating insights from the 4E cognition paradigm (Embodied, Enactive, Extended, and Ecological) and deeply transforming one of the strongest naturalizing projects in analytic philosophy. Classical teleosemantics traditionally explains mental intentionality through evolutionary selection, positing that the function of cognitive states derive from historical adaptive advantages. However, this view faces challenges, including insufficient explanatory power regarding specific intentional properties and conflicts with contemporary biological theories that emphasize structural constraints and developmental processes over pure selection pressures. The proposed organismic turn shifts normativity from evolutionary history to current autonomous organization, particularly to sensorimotor dynamics in embodied organisms. Drawing on organizational biology and enactivism, we suggest that intentionality and normativity naturally emerge from the organization of a network of sensorimotor schemes. This perspective reframes intentional states as integral to the immediate, dynamic organization of an organism's sensorimotor life, providing a grounding for cognitive normativity and teleology. Bringing together environmental (ecological) and agent-side (neurodynamic and musculoskeletal) support-structures for the enaction of sensorimotor schemes, makes possible to reconcile internalist theories of meaning (such as Conceptual Role Semantics and Semantic Networks) with teleosemantics. This connection provides a holistic, biologically plausible, foundation for the naturalization of meaning and intentionality in more traditional yet renewed analytic (and synthetic) terms.

KEYWORDS: Organicism, 4E-cognition, autonomous systems, sensorimotor organization, normativity, teleosemantics

---

[1] IAS-Research Centre for Life, Mind, and Society. Department of Philosophy, University of the Basque Country (UPV/EHU), Donostia - San Sebastián, Spain. xabier.barandiaran@ehu.eus, **corresponding author**.
ORCID: https://orcid.org/0000-0002-4763-6845

[2] Department of Philosophy, University of the Republic, Uruguay. trama.folco@gmail.com
ORCID: https://orcid.org/0000-0002-1531-7233

Table of Contents

1. Introduction: to descend little by little **3**

2. The Organismic Turn: Shifting Foundations for Teleosemantics **5**

- 2.1. Limitations of Evolutionary Grounding: The Need for a New Perspective. 5
- 2.2. The Organismic Alternative: Normativity from Organizational Self-Maintenance 8
- 2.3. Sensorimotor Organization: The 4E Locus of Cognitive Normativity. 9

3. An organismic twist to semantics in analytic philosophy **11**

4. Conclusion: Supposing a natural order **13**

Acknowledgements **15**

References **15**

> "The third, to lead my thoughts in order, beginning by the most simple objects, and the easiest to be known; to rise by little and little, as by steps, even to the knowledg of the most mixt; and *even supposing an Order among those which naturally doe not precede one the other*." (Emphasis added)
>
> DESCARTES

1. Introduction: to descend little by little

The philosophical quest to provide a naturalistic account of the mind, one that situates mental phenomena within the causal realm of a scientifically addressable world, has been a cornerstone of analytic philosophy. This pursuit gained particular momentum following the "linguistic turn" that characterized much of early to mid-20th-century philosophy (Rorty, 1967). During this period, many philosophical problems, including those concerning the mind, were often rephrased in linguistic terms. The focus was on the logical structure of language, with the hope that understanding linguistic representation would solve classical epistemological issues, particularly concerning scientific knowledge, and illuminate (or fade away) the psychological, inner, or first-person dimension of meaning (Carnap, Wittgenstein). However, by the mid-20th century, the rise of cognitive science made increasingly apparent that a purely linguistic approach was insufficient for addressing old epistemological questions and explaining the nature of meaning (Quine, 1969). This realization, advanced by the likes of Chomsky, Tolman, Turing, and Miller, coupled with the rise of new scientific disciplines like cybernetics, cognitive psychology, generative linguistics, information theory, and early artificial intelligence, paved the way for the "cognitive turn" (Gardner, 1985). This shift refocused attention directly onto mental processes as internal cognitive states, seeking to understand them as informational tokens processes by the brain in analogy with the way in which digital tokens are processed in a computer; with the weight of the linguistic turn still pressing the explanation of (representational) meaning (Fodor, 1980; Putnam, 1975).

Central to this renewed focus on the mind was the persistent puzzle of intentionality, the mind's capacity to be "about" or "directed at" objects, properties, and states of affairs. This feature had been famously highlighted by Franz Brentano (1995) in the 19th century as a distinctive, if not defining, mark of the mental, distinguishing it from the merely physical. Brentano argued that every mental phenomenon is characterized by "intentional inexistence" or the "reference to a content, direction toward an object". The challenge for naturalistic philosophy, then and now, has been to explain this "aboutness" in terms compatible with a scientific, non-mysterious view of reality, without recourse to irreducible mental substances or properties, and beyond the purely descriptive frame of behaviourism.

Alongside intentionality, the problem of error or misrepresentation has posed a profound difficulty: how can a purely physical system be *wrong* about the world? If mental states are just physical states, what makes one such state a correct representation and another an incorrect one? More generally, these problems are entangled with the *problem of normativity*: namely, the task of providing a normative standard by which correctness can be assessed—a standard that is not readily available if one relies solely on physical descriptions or the descriptive, non-prescriptive character of scientific explanation.

In this historical context classical teleosemantics developed in the 1980s (Millikan, 1984; Dretske, 1988; Papineau, 1987) offering a powerful research program—for recent advances see (Neander, 2017; Shea, 2018). The central ambition of this approach was to demonstrate that intentional states—such as beliefs and desires—can be accommodated within a physicalist ontology, insofar as they can be explained by naturalistic theories of biological function. Classical teleosemantics is a form of etiological theory (Wright, 1976). Among the various etiological frameworks, classical teleosemantics relies most heavily on natural selection. Within this paradigm, the Selected-Effect theory of function (henceforth: SE) was developed (Ayala, 1970; Millikan, 1989; Neander, 1991; Ruse, 1971), according to which the proper function of a biological trait is defined by the beneficial causal role it historically played in the reproductive success of the organism. As such, the teleosemantic solution proposed that the "proper function" of a cognitive mechanism (e.g., a belief-forming system or a perceptual state) is determined by the effects for which that type of mechanism was selected during its evolutionary history. A mental state, therefore, correctly represents the world if it is fulfilling its evolutionarily endowed function, and errs if it malfunctions or is triggered in ancestrally atypical conditions.

However, in recent decades, the landscape of cognitive science has been significantly reshaped by 4E Cognition (Embodied, Enactive, Extended, and Ecological approaches). These perspectives challenge the traditional cognitivist assumptions that underpin many classical teleosemantic accounts, particularly the disembodied, computational view of mind and the sharp separation between agent and environment. While 4E approaches offer compelling alternatives for understanding cognition as a dynamic, world-involving activity, many strands within this broad movement have struggled to articulate a robust, intrinsic source of *normativity*. Some embodied or dynamical systems approaches, by focusing purely on descriptive dynamics, even appear to sideline or deny the need for normative concepts, thereby precluding a direct path to naturalizing meaning or solving the problem of error within an embodied agency framework (Hutto & Myin, 2012; Villalobos & Palacios, 2021).

Others directly reject the possibility of naturalizing norms below the social domain (Heras-Escribano et al., 2014; for a recent critical assessment see Prokop & Barandiaran, Under review).

Various, deeply interconnected trends have attempted a systematic naturalizing path to normativity within 4E approaches, with a strong influence of autopoietic theory, complex system's theory and theoretical biology. The organizational approach to biology as an autonomous grounding of cognitive capacities (Barandiaran, 2002; Bickhard, 2000; Christensen & Hooker, 2000; Moreno & Mossio, 2015) and *enactivism*, as a specific and increasingly prominent branch of 4E cognition (Di Paolo et al., 2017; Thompson, 2010; Varela et al., 1991)[3], stands out by explicitly addressing the issue of normativity (Barrett, 2017). All seek to ground norms not in evolutionary history (alone), but in the ongoing, self-maintaining organisation of living autonomous systems. This chapter proposes to build on this foundation to articulate an organismic path to teleosemantics. This path aims to retain the teleosemantic ambition of naturalizing meaning and purpose but shifts the primary locus of normativity from distant evolutionary selection to the present organizational embodied dynamics of sensorimotor life. We call it the *organismic turn*, implying also a gradual descent of philosophy to the materiality of (biological) organisation, its embodiment and embeddedness.

2. The Organismic Turn: Shifting Foundations for Teleosemantics

2.1. Limitations of Evolutionary Grounding: The Need for a New Perspective.

The opening path for an organismic teleosemantics emerges from the convergence of two significant developments within the philosophy of the life sciences. On one hand, the biological—neo-Darwinian—underpinnings of classical teleosemantics have come under sustained critique in recent decades. On the other hand, this critique has led to the rise of an "organism-centered perspective" in the life sciences (Laland et al., 2015) in which rich theoretical and empirical advances have been made. We have both reasons and resources to move beyond classical teleosemantics. Focusing on the criticisms directed at classical teleosemantics, we can discern two principal lines of argument. i) First, some scholars contend that SE is insufficient to support the explanatory goals of teleosemantics. ii) Second, others argue that SE is inadequate in light of recent developments and debates in evolutionary theory.

---

[3] For a detailed account of how enactivism relates to the ecological E of 4E cognition, see Heras-Escribano (2021)

Regarding the point (i), some critics argue that an evolutionary account of function fails to adequately capture the kinds of phenomena that teleosemantics seeks to explain. This line of critique—hereafter referred to as the *intrinsic-grounding problem* of classical teleosemantics—asserts that if the goal is to account for the specific properties that render a system genuinely intentional (or, conversely, to identify the properties absent in non-intentional systems), then the historical and population-level framework of traditional teleosemantics remains largely silent on these matters (Rama, 2025). A canonical illustration of this issue is provided by the Swampman thought experiment (Davidson, 1987). Swampman is a replica of a human being that comes into existence through a sudden, fortuitous process (e.g., a random collision of atoms). The absence of a phylogenetic history appears to generate counterintuitive implications, since, even if it is materially identical to a human, classical teleosemantics is committed to claiming that Swampman does not possess intentionality—that it does not make behavioral errors, perform successful actions, or have true or false beliefs. In light of such a scenario, Bickhard (2000) characterizes teleosemantics as epiphenomenal at the individual level: it fails to illuminate the internal causal processes that ground intentionality within the organism (Mossio et al., 2009). Moreover, normative explanations in the biomedical sciences are typically grounded in analyses of causal processes, their systemic organisation, and their embeddedness in environmental contexts, rather than in purely historical accounts (Gerrans, 2021). Rama (2023) extends this critique by emphasizing that the inherently statistical nature of natural selection precludes classical teleosemantics from offering a robust causal foundation for its naturalistic ambitions—rendering SE causally epiphenomenal even at the population level. Due to the *intrinsic-grounding problem*, evolutionary-selectionist models appear insufficient to support the explanatory aspirations of teleosemantics.

Regarding point (ii), a body of critics converges in their rejection of several foundational biological assumptions underpinning Neo-Darwinism, upon which the concept of SE is built. Ongoing debates concerning the necessity of extending or revising the Modern Evolutionary Synthesis (Laland et al., 2015; Lewens, 2019) have highlighted a range of biological phenomena that directly challenge two central theses of SE theory (see Rama, Forthcoming for a detailed exposition).

The first thesis holds that the function of a trait explains its existence. However, research programs aligned by structuralist thinking—particularly evolutionary developmental biology (evo-devo)—have increasingly emphasized that certain traits may arise due to structural or developmental constraints rather than adaptive selection alone (Griffiths, 2006; Wagner, 2014). This line of thought was articulated in Gould and Lewontin's (1979) celebrated *Spandrels* paper, which argued that some features of organisms may be evolutionary by-products rather than direct adaptations. Further investigations into developmental constraints (Amundson & Lauder, 1994) and self-organization (Newman, 2023) support the view that, much like spandrels are architectural necessities in church construction, many biological traits may be structurally indispensable for organismal development. By taking the developmental dimension of evolution seriously, it becomes plausible that some traits persist in nature not because they confer selective advantage, but because they are necessary conditions for viable development (Balari & Lorenzo, 2012; Fodor & Piattelli-Palmarini, 2011). These traits may thus be relatively stable across taxa—such as the conserved tetrapod limb plan—and largely invisible to selection (Kraemer, 2014). Consequently, the assumption that trait function always explains trait existence is undermined, posing a significant challenge to the explanatory power of SE within teleosemantic frameworks.

Secondly, the SE framework maintains that it is natural selection that confers functions upon traits. As articulated by Garson (2016: 51, 2019: 28), there can be no function without selection. This reflects a strong Neo-Darwinian commitment: variation is assumed to be random—adaptively undirected—and functional explanations are decoupled from the origin of traits. Under this view, function only emerges *post hoc*, once selection has acted upon blind, stochastic variations. From a contemporary perspective, however, this principle has faced growing criticism, particularly when applied to the evolution of intentionality (Christie et al., 2022). Multiple lines of research—including ecological developmental biology (eco-devo), niche construction theory, molecular epigenetics, and developmental psychobiology —have converged on a developmentalist, adaptively-oriented framework for understanding trait variation and novelty. At the core of this alternative paradigm is a decisive move away from gene-centrism and from the notion that phenotypic development is merely a passive unfolding of inherited genetic programs. Instead, contemporary biology emphasizes the systemic embeddedness of gene expression within cellular, multicellular, and ecological contexts. Within this framework, the regulation of trait formation can be responsive to functional demands—suggesting that development itself is an adaptive, context-sensitive process (Bouchard, 2013). As a result, functional explanations in evolutionary biology need not be contingent upon prior selection. Rather, development can generate traits for functional reasons independently of selection. From this vantage point, the relationship is reversed: "evolution is adaptive because development is adaptive" (Walsh, 2015: 236). Consequently, since the explanation of the very origins of life (Moreno & Ruiz-Mirazo, 2009) to the origins of evolutionary change (Reid, 2007), it may be more accurate to invert the SE principle and propose instead that there is "no selection without function" (García-Valdecasas & Deacon, 2024; Rama, Forthcoming).[4]

---

[4] Note that this problem is not solved by adopting a pluralist view of function in the manner of Shea (2018). It is one thing to argue that there are ontogenetic functions in addition to evolutionary SE functions (e.g., through learning mechanisms). However, it is another thing to say, as we do here, that ontogenetic functions influence evolutionary functions because ontogenetic processes are involved in adaptive evolutionary change.

2.2. The Organismic Alternative: Normativity from Organizational Self-Maintenance

An alternative approach to naturalizing normativity emerges from the study of autonomous systems, manifested in traditions like interactionism (Bickhard, 2000; Bickhard & Terveen, 1995)[5], organizational biology (Bich, 2024; Moreno & Mossio, 2015), and enactivism (Di Paolo et al., 2017; Varela et al., 1991). This perspective defines an autonomous system by its *self-maintaining organizational closure*. Autonomous systems are understood (in the Kantian tradition of his third critique[6]) as emerging from a set of interdependent, mutually enabling processes, so that each process depends (at least) on another one on the network and enables at least another one; with the effect that the network actively sustains itself and distinguishes itself from its environment (Maturana & Varela, 1980). *Normativity is intrinsic* to this process organization; the "proper" functioning of a component or process is determined by its contribution to the continued, far-from-equilibrium or precarious functioning and existence of the whole system. Functions arise from the *dynamic presuppositions* among the system's components on its contribution to self-maintenance (Christensen et al., 2002; Mossio et al., 2009)[7]. An analysis of how different processes contribute to self-maintenance at specific rates and coordinations delivers a *normative field* for adaptive processes under varying internal and environmental conditions (Barandiaran, 2025).

The best illustration of this principle is given by (proto)cellular models (Barandiaran & Egbert, 2014; Piedrafita et al., 2012; Ruiz-Mirazo & Moreno, 2004; Varela et al., 1974). A cell is basically a network of metabolic reactions that produces itself. None of the reactions would take place (at the same consistent rate) out of the autocatalytic network that the (proto)cell makes possible; and every reaction is dependent-upon and contributes-to at least another reaction of the network. Altogether, the system creates some of its boundary conditions, like its membrane encapsulating the reaction network and retaining far-from-equilibrium concentrations (Ruiz-Mirazo & Moreno, 2004); while actively distinguishing itself from its environment. Embodiment matters. Materiality manifests in multiple aspects, energetic and thermodynamic considerations are crucial, autonomous systems channel energy to

---

[5] The naturalist project advanced by Bickhard throughout his career has stimulated many of the ideas developed here, particularly his insights on emergent normativity. The path toward a non-standard, autonomy-based teleosemantics was originally initiated by him, even if it differs from our proposal in other respects (e.g., we do not adopt his interactionist approach on representations).

[6] For a proper historical trace of how Kantian organicism has influenced recent philosophy of biology and cognitive science, see Varela & Weber (2002), Gambarotto & Nahas (2022) and, for a more complexified reading, see Cuciniello (Forthcoming).

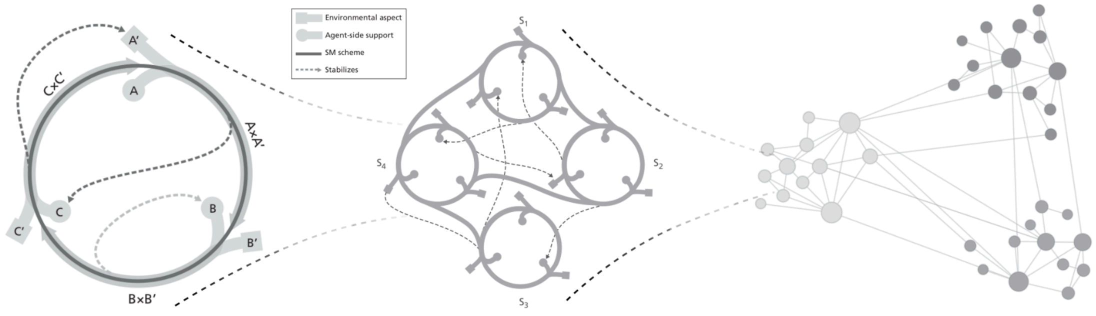
[7] There have been notable attempts to undermine the organizational approach. Some have even claimed that organizational and SE theories are ultimately the same (Artiga & Martínez, 2016), which could be tempting to use against our narrative in this chapter, but this criticism has also been contested (Mossio & Saborido, 2016), and by putting the emphasis on "cross-generational traits" bear little impact on the research program we defend here.

produce constraints, that in turn make possible the production of more work, including that of moving and ensuring the supply of energy and matter to keep the organization going (Kauffman, 2000; Moreno et al., 1994; Moreno & Etxeberria, 2005). What the system is and what it does (as the enactment of physical work) is deeply intertwined; thereby grounding normativity. There are certain things the system *must do* to become itself. Physiological functions in multicellular organisms (respiration, digestion, motility, etc.) respond to a similar logic of self-maintenance. The function of the heart is not to pump blood because it has been selected for it, but because pumping blood is dynamically and materially presupposed by the rest of the body parts for their existence and operation (and, in a circular fashion, for the maintenance of the heart itself); thus providing an organizational embodiment for functional normativity.

Autonomous *monists* defend a single source of normativity, the biological one, whose closure is fundamentally metabolic. The cognitive domain is then established as a type of function (e.g. representational) that ultimately subserves this normativity (Bickhard, 2000; Christensen & Hooker, 2000). Others have defended an autonomous *pluralism* by which recursively self-maintaining (or organizationally closed) precarious systems can emerge with different domains, embedded-in (and ultimately dependent-on) but still distinct-from the basic biological domain. Some of these domains include the immune system (Varela & Coutinho, 1991), neural and sensorimotor domains (Barandiaran, 2017; Barandiaran & Moreno, 2006; Di Paolo et al., 2017; Smithers, 1997), or the linguistic (Di Paolo et al., 2018) or social (Lewis-Martin, 2022; Luhmann, 1995); generating a variety of normative sources (García & Barandiaran, 2025; Prokop & Barandiaran, Under review).

2.3. Sensorimotor Organization: The 4E Locus of Cognitive Normativity.

The principles of autonomy, organizational closure, and normative functionality extend beyond basic biological metabolism to the *sensorimotor domain*. This is a space where neural electrochemical dynamics and their internal and environmental sensory and effector surfaces make possible the emergence of a behavioural domain that gives rise to cognitive normativity. Piaget (1969) provided early insights, framing knowledge as an organizational function, not subordinated to biological self-maintenance, but to the very organization of behaviour. Autonomous robotics, dynamical cognitive science and progress in neuroscience made it possible to formulate the claim more explicitly: “the specificity of cognitive dynamics [...] is given by a particular kind of dynamic organization within the NS [nervous system] and between the NS and the internal and external environment, i.e. the adaptive preservation of a web of dynamic sensorimotor structures sustained by continuous interactions with the environment and the body” (Barandiaran & Moreno, 2006, p. 180).



Sensorimotor Scheme
made of 3 interdependent
SM coordination patterns

Network of Sensorimotor Schemes
made of 4 interdependent schemes

Web of Sensorimotor Schemes
made of 3 interconnected networks

Figure 1: Illustration of sensorimotor organization, from a single sensorimotor scheme to the identity of a sensorimotor agent expressed as a web of sensorimotor schemes (see text for details) [Adapted, with permission, from Di Paolo et al. 2017 with a CC-by-sa licence]

Building on this, Barandiaran describes *mental life* (2007, 2008) and Di Paolo et al. (2017) *sensorimotor life* as constituted by networks of habits or sensorimotor schemes. Figure 1 depicts a minimal approximation to sensorimotor organization. A sensorimotor scheme (Fig. 1 left) is a structured set of sensorimotor coordinations composed by agent-side (N) and environment-side (N') support structures and mutual dependencies (dashed lines). These sensorimotor schemes or habits are typically *precarious*, meaning they require recurrent enactment to be maintained and strengthened, to avoid decay or disintegration (Egbert & Barandiaran, 2014). Moreover, they embody a basic or elementary sense of mindedness (Segundo-Ortin & Heras-Escribano, 2021). An adaptive sequence of sensorimotor schemes constitutes a strategy, marked by an inherent normative character. A network of sensorimotor schemes and a set of strategies is organized into an *activity* (e.g., cooking, dancing, writing, building, etc.). The emerging web of sensorimotor activities constitutes the *identity* of a sensorimotor agent (often composed of regional or role identities, like being a parent or a teacher).

The viability of the entire sensorimotor web depends on the appropriate functioning and coherent coordination of its constituent schemes and networks. As Di Paolo et al. (2017, p. 154) argue, "every enacted scheme in the network can have positive or negative consequences for the viability of the whole. The set of structural and functional dependencies between schemes defines the viability conditions for the ongoing maintenance of the sensorimotor network…". This rich organizational framework provides a foundation for understanding *sensorimotor teleology* and addressing the *problem of normativity*—that is, the *explananda* that concerns teleosemantics. This analysis was carried on in detail in Barandiaran & Rama

(2025), including the nature of goals as dynamic attractors, the heterarchical organization of actions, and a detailed analysis of the minimal necessary requirements for genuinely teleological behaviour. As we proposed, "[t]he intrinsic normativity and teleology displayed by autonomous sensorimotor agents, that stems from the dynamic presuppositions within the sensorimotor organization, manifests as a complex set of tensions established by the goal heterarchy" (Barandiaran & Rama, 2025, p. 28). This alternative teleosemantic approach employs conceptual tools from autonomous organizational theory to explain how behaviour becomes goal-directed, how errors are constituted as disruptions to this organization, and how purposeful activity emerges.

The crucial point for this chapter is that the fundamental normativity underpinning such teleology is sourced from the current, precarious, and self-maintaining organization of sensorimotor life itself, embedded-within yet distinct-from mere (multi)cellular, metabolic, or physiological organization.

3. An organismic twist to semantics in analytic philosophy

The shift proposed by the organismic turn is not merely a matter of revising the biological foundations of teleosemantic theory; it also carries significant implications for long-standing debates within the analytic tradition. Notably, organismic teleosemantics offers a framework through which several internalist insights—previously marginalized by classical teleosemantics—can be rehabilitated. The internalist-externalist debate about the mind has been repeatedly formulated in semantic terms—see Schulte (2023) and Braddon-Mitchell and Jackson (2006) for overviews of the debate.[8] In this context, as Millikan (2006, p. 1) noted, "naturalistic teleological theories are 'externalist' theories of mental content," in which the content of a mental representation is dependent on its referent, a position advanced most prominently by figures such as Bertrand Russell, Saul Kripke, Hilary Putnam, and Jerry Fodor. In contrast, internalist approaches contend that intentional states are defined by the internal relations among their constituent components —an intellectual lineage that traces back to Gottlob Frege. Classical teleosemantics emerged, in part, as a response to perceived shortcomings in internalist theories, particularly their tendency to explain intentionality in terms of other intentional concepts, thereby risking circularity. A central *desideratum* of naturalistic theories of intentionality is that intentional phenomena—whatever their ontological status—must be explicable in non-intentional

---

[8] Disputes between externalist and internalist approaches to semantics—whether in linguistic terms (primarily during the first half of the twentieth century) or mental terms (predominantly in the second half)—have been framed in various ways: as debates between content externalism and content internalism, referentialism and intensionalism, narrow and broad content, or Fregean and non-Fregean perspectives.

terms. Thus, *original* intentionality (Haugeland, 1981) must be grounded in causal relationships between representations and their referents. However, this commitment to causalist (and information-theoretic) models has given rise to a persistent problem of normativity: the difficulty of explaining how content can be correct or incorrect in naturalistic terms. As previously discussed, classical teleosemantics attempts to resolve this issue by appealing to evolutionary functions.

The organismic approach challenges Millikan's assertion that teleological theories of intentionality must necessarily be externalist. It argues that alternative teleological frameworks are indeed possible. Our proposal contributes two key elements to a naturalistic theory of intentionality. First, from an organismic standpoint, internalism need not imply cognitive closure or solipsism. Rather, internalism should be interpreted through the lens of autonomy: a cognitive system is constituted by the dynamic *organizational closure* of sensorimotor schemes, its identity. This closure is *extended* into the environment (since sensorimotor schemes are both dependent on agent-side and environment-side support structures), yet it remains crucially tied within the agent. It is within the agent's brain-body where most part of the meaning-producing sensorimotor integration takes place. This enables an *asymmetrical interaction*, agency, between the system and its environment. Second, the theory avoids the threat of vicious circularity by drawing on the ontological foundations of autonomy: *emergence*. The central tenet of the internalist perspective is that the normativity of intentional items is determined by their interrelations within a network of intentional states. Against machine-like metaphors of the mind that disclose the mind-brain as a software-hardware relationship, our organicism foundations rely on levels of organisation and emergent properties. This ontological approach has its roots in the cybernetic and systems-theoretic view that demonstrates that a holistic conception does not necessarily entail circularity in a problematic sense—aligned thus with Quine's epistemological holism. What an organizational perspective adds is a naturalist framework for understanding normativity. As such, organismic teleosemantics can be productively integrated with various internalist frameworks within the analytic tradition. Among the many internalist theories, two deserve to be specifically mentioned: Conceptual Role Semantics (CRS) and Semantic Networks (SN)—other theories are based on definitional structures, prototypes, or mental imagery.

CRS broadly maintains that "the meaning of a representation is the role of that representation in the cognitive life of the agent" (Block, 1998). Within our organismic framework, this principle might be reformulated as *Sensorimotor Role Semantics*, wherein "the meaning or function of a sensorimotor scheme is defined by its role in the cognitive—and crucially, sensorimotor—life of the agent". This role is not merely inferential, as is often emphasized in standard CRS accounts, but is instead articulated through the contribution that a sensorimotor scheme makes to the agent's self-maintenance and adaptive organisation. Meaning, in this context, is grounded in the dynamically enacted, world-involving, and organizationally constrained patterns of sensorimotor interaction that constitute the agent's viability and mode of existence. The "use" that determines meaning is thus recast as the embodied function of a scheme within the agent's holistic, life-sustaining sensorimotor organisation.

Similarly, promising intersections can be anticipated between organismic teleosemantics and Semantic Networks (SN). Various network-based approaches to semantics—including associative analysis, connectionism, artificial neural networks, and topological models—share deep cybernetic foundations, much like the organizational perspective advanced here. SN approaches typically attribute semantic value to an item based on its topological relations to other items, reflecting a dynamic presupposition inherent in network modelling and relying heavily on a holistic epistemology. A *Sensorimotor Network Semantics* would build upon this insight: the functional meaning of a sensorimotor pattern is determined by its topological relationship with other patterns in the enactment of goal-directed behaviour. This perspective aligns closely with the enactive and organizational paradigms, emphasizing meaning as an emergent property of systemic interactions rather than as a fixed or atomistic attribute.

Our central claim is that fruitful cross-pollination may occur between these traditions. Specifically, the conceptual and modelling frameworks developed within enactive and organizational theories could enter into productive dialogue with amended internalist approaches from the analytic tradition—particularly those emphasizing structural or network-based semantics; provided that the nodes of such network are not encapsulated representational units detached from perception and action, but (re)enactuable grounded sensorimotor schemes.

As geneticist Eva Jablonka (2004, 366) once said, "it is not sufficient to point out problems with a concept. It is as important to find an alternative that will be free of these difficulties and that will offer at least as fruitful a research program as the old perspective". The organismic turn and the cross-pollination approach advanced here cannot ignore long-standing issues in analytic philosophy (of language and mind). Among these, traditional difficulties in teleosemantics come to the fore, such as *disjunctionitis* (Neander, 2017, p. 149), content indeterminacy (Fodor, 1990), and the problem of novel contents (Garson & Papineau, 2019). It is therefore a collaborative task for future research to delve into the nightmares of analytic philosophy and reconcile them with the sweet dreams of 4E.

4. Conclusion: Supposing a natural order

As articulated in this chapter, the organismic approach to teleosemantics seeks to re-establish the naturalization of meaning and purpose—a central objective in analytic philosophy. It does so by relocating the source of normativity from the distal, evolutionary past characteristic of classical teleosemantics to the immediate, dynamic, and self-sustaining organisation of autonomous sensorimotor agents. This conceptual shift aims to address long-standing difficulties inherent in evolutionary accounts of normativity while capitalising contemporary developments in 4E cognition. It offers a synchronic foundation for understanding how behaviour acquires goal-directedness, how errors manifest as disruptions within this organizational coherence, and how purposive activity emerges from the autonomous regulation of action.

The proposal advanced here offers several advantages derived from its organismic foundations. Most notably, it addresses the *intrinsic-grounding problem* outlined in Section 2.1, providing a robust framework that accommodates cases such as the Swampman scenario, avoids epiphenomenalism, and sidesteps the limitations of a purely statistical account of normativity. What are the properties that render a system intentional? Conversely, what properties are absent in non-intentional systems? These questions were answered in Section 2, where it is argued that the self-organization of sensorimotor schemes—underpinning the maintenance of mental autonomy—is central to intentionality. Furthermore, the organismic grounding of this approach establishes a deep conceptual affinity with organism-centered perspectives in evolutionary theory, such as niche construction theory, developmental systems' theory, and ecological developmental biology. As such, this framework is not only philosophically significant, but also holds promise for broader applicability and operationalization across the life sciences. Moreover, we can now complement the descent of analytic philosophy from language to cognition to biological materiality with a synthetic philosophy that makes use of complex simulation techniques to deliver explanations of how normative and semantic properties emerge in nature.

The history of 4E cognition could be summarized as the last attempt to claim a "definitive" victory over Cartesian dualism, after its computationalist revival. But less attention has been paid to the methodological Cartesianism. In fact, early analytic philosophy embraced Descartes' third principle with which we opened this chapter: "to lead my thoughts in order, beginning by the most simple objects, and the easiest to be known; to rise by little and little, as by steps, even to the knowledge of the most mixt; and *even supposing an Order among those which naturally doe not precede one the other*". Logical atomism and its many descendants turned the analyst's ladder into an ontological blueprint: reality *is* a set of atomic facts and meanings that combine by the rules of logic. The astonishing fruitfulness of that stance was won at a price. Problems of holism, context-sensitivity, and normativity—especially the puzzles of error and mis-representation—grew in the cracks left by an architecture too linear for lived cognition. Classical teleosemantics tried to patch those cracks by appealing to the *historical* order of natural selection; but the more deeply it tied content to remote evolutionary antecedents, the less grip it had on the synchronic, organism-bound norms that emerge from the natural order of organic beings. It is the turn of organicism to try to explain how meaning emerges in the physical universe. Time for an organismic turn in a synthetic becoming of analytic philosophy.

Acknowledgements

XEB and TR acknowledge IAS-Research group funding IT1668-22 from Basque Government, grants PID2019-104576GB-I00 for project Outonomy, and PID2023-147251NB-I00 for project Outagencies funded by MCIU/AEI/10.13039/501100011033. TR also acknowledges the National Agency of Investigation and Innovation (Uruguay), grant PD_NAC_2023_1_176930. We are deeply grateful to Manuel Heras-Escribano for organizing the workshop in Granada and for careful revision and edition of this chapter and the whole book.

References

Amundson, R., & Lauder, G. V. (1994). Function without purpose: The uses of causal role function in evolutionary biology. *Biology & Philosophy*, *9*(4), 443–469. https://doi.org/10.1007/BF00850375

Artiga, M., & Martínez, M. (2016). The Organizational Account of Function is an Etiological Account of Function. *Acta Biotheoretica*, *64*(2), 105–117. https://doi.org/10.1007/s10441-015-9256-x

Ayala, F. J. (1970). Teleological Explanations in Evolutionary Biology. *Philosophy of Science*, *37*(1), 1–15. https://doi.org/10.1086/288276

Balari, S., & Lorenzo, G. (2012). *Computational Phenotypes: Towards an Evolutionary Developmental Biolinguistics*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199665464.001.0001

Barandiaran, X. E. (2002). *Adaptive Behaviour, Autonomy and Value systems. Normative function in dynamical adaptive systems* [MSc Thesis, University of Sussex]. https://xabierbarandiaran.files.wordpress.com/2022/06/barandiaran_-_2002_adaptive_behavior_autonomy_and_value_systems_-_msc_thesis.pdf

Barandiaran, X. E. (2007). Mental Life: Conceptual models and synthetic methodologies for a post-cognitivist psychology. In B. Wallace, A. Ross, J. Davies, & T. Anderson (Eds.), *The World, the Mind and the Body: Psychology after cognitivism* (pp. 49–90). Imprint Academic.

Barandiaran, X. E. (2008). *Mental Life: A naturalized approach to the autonomy of cognitive agents.*

[PhD Thesis, University of the Basque Country (UPV-EHU)]. https://xabier.barandiaran.net/phdthesis/

Barandiaran, X. E. (2017). Autonomy and Enactivism: Towards a Theory of Sensorimotor Autonomous Agency. *Topoi*, *36*(3), 409–430. https://doi.org/10.1007/s11245-016-9365-4

Barandiaran, X. E. (2025). Organizational Accounts of Malfunction: The Dual-Order Approach and the Normative Field Alternative. *Biological Theory*. https://doi.org/10.1007/s13752-025-00500-z

Barandiaran, X. E., & Egbert, M. D. (2014). Norm-establishing and norm-following in autonomous agency. *Artificial Life*, *20*(1), 5–28. https://doi.org/10.1162/ARTL_a_00094

Barandiaran, X. E., & Moreno, A. (2006). On What Makes Certain Dynamical Systems Cognitive: A Minimally Cognitive Organization Program. *Adaptive Behavior*, *14*(2), 171–185. https://doi.org/10.1177/105971230601400208

Barandiaran, X. E., & Rama, T. (2025). *Sensorimotor teleology and goal-directedness. An organismic framework for normative behaviour*. https://philsci-archive.pitt.edu/id/eprint/25369

Barrett, N. F. (2017). The Normative Turn in Enactive Theory: An Examination of Its Roots and Implications. *Topoi*, *36*(3), 431–443. https://doi.org/10.1007/s11245-015-9355-y

Bich, L. (2024). *Biological Organization* (1st ed.). Cambridge University Press. https://doi.org/10.1017/9781009393959

Bickhard, M. H. (2000). Autonomy, function, and representation. *Communication and Cognition—Artificial Intelligence*, *17*(3–4), 111–131.

Bickhard, M. H., & Terveen, L. (1995). *Foundational Issues in Artificial Intelligence and Cognitive Science: Impasse and Solution*. Elsevier.

Block, N. (1998). Conceptual Role Semantics. In *Routledge Encyclopedia of Philosophy* (pp. 242–256). Routledge.

Bouchard, F. (2013). How Ecosystem Evolution Strengthens the Case for Functional Pluralism. In P. Huneman (Ed.), *Functions: Selection and mechanisms* (Vol. 363, pp. 83–95). Springer Netherlands. https://doi.org/10.1007/978-94-007-5304-4_5

Braddon-Mitchell, D., & Jackson, F. (2006). *Philosophy of Mind and Cognition: An Introduction*. Wiley.

Brentano, F. (1995). *Psychology from an empirical standpoint.(trans. AC Rancurello, DB Terrell, & LL McAlister).(Original work published 1874)*. London: Routledge.

Christensen, W. D., Bickhard, M. H., & The Hegeler Institute. (2002). The Process Dynamics of Normative Function: *Monist*, *85*(1), 3–28. https://doi.org/10.5840/monist20028516

Christensen, W. D., & Hooker, C. A. (2000). Autonomy and the emergence of intelligence: Organised interactive construction. *Communication and Cognition*, *17*(3–4), 133–157.

Christie, J. R., Brusse, C., Bourrat, P., Takacs, P., & Griffiths, P. E. (2022). Are Biological Traits Explained by Their 'Selected Effect' Functions? *Australasian Philosophical Review*, *6*(4), 335–359. https://doi.org/10.1080/24740500.2024.2370630

Cuciniello, R. (Forthcoming). *The Organisational Approach to Naturalised Biological Teleology: With Kant, Beyond Kant.*

Davidson, D. (1987). Knowing One's Own Mind. *Proceedings and Addresses of the American Philosophical Association*, *60*(3), 441. https://doi.org/10.2307/3131782

Di Paolo, E. A., Buhrmann, T., & Barandiaran, X. E. (2017). *Sensorimotor Life: An enactive proposal*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198786849.001.0001

Di Paolo, E. A., Cuffari, E. C., & De Jaegher, H. (2018). *Linguistic bodies: The continuity between life and language*. MIT press. http://gen.lib.rus.ec/book/index.php?md5=9969BBD6CC722AE0EF427DE8C57585FC

Dretske, F. I. (1988). *Explaining behavior: Reasons in a world of causes*. MIT Press.

Fodor, J. A. (1980). *The Language of Thought* (1st edition). Harvard University Press.

Fodor, J. A., & Piattelli-Palmarini, M. (2011). *What Darwin got wrong* (First Picador edition). Farrar, Straus and Giroux.

Gambarotto, A., & Nahas, A. (2022). Teleology and the organism: Kant's controversial legacy for contemporary biology. *Studies in History and Philosophy of Science*, *93*, 47–56. https://doi.org/10.1016/j.shpsa.2022.02.005

García, E., & Barandiaran, X. E. (2025). Varieties of normativity and mental health: An enactive approach. *Synthese*, *205*(2), 1–29. https://doi.org/10.1007/s11229-024-04854-y

García-Valdecasas, M., & Deacon, T. W. (2024). Biological functions are causes, not effects: A critique of selected effects theories. *Studies in History and Philosophy of Science*, *103*, 20–28. https://doi.org/10.1016/j.shpsa.2023.11.002

Gardner, H. (1985). *The Mind's New Science: A History of the Cognitive Revolution* (First Edition). Basic Books.

Garson, J. (2016). *A Critical Overview of Biological Functions* (1st ed. 2016). Imprint: Springer.

Garson, J. (2019). *What Biological Functions Are and Why They Matter* (1st ed.). Cambridge University Press. https://doi.org/10.1017/9781108560764

Gerrans, P. (2021). Harmful Dysfunction and the Science of Salience: Adaptations and Adaptationism. In L. Faucher & D. Forest (Eds.), *Defining Mental Disorder* (pp. 397–414). The MIT Press. https://doi.org/10.7551/mitpress/9949.003.0024

Gould, S. J., & Lewontin, R. C. (1979). The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme. *Proceedings of the Royal Society of London. Series B, Biological Sciences*, *205*(1161), 581–598.

Griffiths, P. E. (2006). Function, Homology, and Character Individuation. *Philosophy of Science*, *73*(1), 1–25. https://doi.org/10.1086/510172

Haugeland, J. (1981). Semantic engines: An introduction to mind design. In *Mind Design: Philosophy, Psychology, Artificial Intelli- gence* (pp. 1–34). The MIT Press.

Heras-Escribano, M. (2021). Pragmatism, enactivism, and ecological psychology: Towards a unified approach to post-cognitivism. *Synthese*, *198*(1), 337–363.

Heras-Escribano, M., Noble, J., & de Pinedo, M. (2014). Enactivism, action and normativity: A Wittgensteinian analysis. *Adaptive Behavior*. https://doi.org/10.1177/1059712314557364

Hutto, D. D., & Myin, E. (2012). *Radicalizing Enactivism: Basic Minds Without Content*. MIT Press.

Kauffman, S. A. (2000). *Investigations*. Oxford University Press US.

Kraemer, D. M. (2014). Revisiting recent etiological theories of functions. *Biology & Philosophy*, *29*(5), 747–759. https://doi.org/10.1007/s10539-014-9430-6

Laland, K. N., Uller, T., Feldman, M. W., Sterelny, K., Müller, G. B., Moczek, A., Jablonka, E., & Odling-Smee, J. (2015). The extended evolutionary synthesis: Its structure, assumptions and predictions. *Proceedings of the Royal Society B: Biological Sciences*, *282*(1813), 20151019. https://doi.org/10.1098/rspb.2015.1019

Lewens, T. (2019). The Extended Evolutionary Synthesis: What is the debate about, and what might success for the extenders look like? *Biological Journal of the Linnean Society*, *127*(4), 707–721. https://doi.org/10.1093/biolinnean/blz064

Lewis-Martin, J. (2022). What kinds of groups are group agents? *Synthese*, *200*(4), 283. https://doi.org/10.1007/s11229-022-03766-z

Luhmann, N. (1995). *Social Systems*. Stanford University Press.

Maturana, H. R., & Varela, F. J. (1980). *Autopoiesis and cognition*. D. Reidel Publishing Company.

Millikan, R. G. (1984). *Language, Thought, and Other Biological Categories: New Foundations for Realism*. MIT Press.

Millikan, R. G. (1989). In Defense of Proper Functions. *Philosophy of Science*, *56*(2), 288–302.

Millikan, R. G. (2006). Mental Content, Teleological Theories of. In *Encyclopedia of Cognitive Science*. John Wiley & Sons, Ltd. https://doi.org/10.1002/0470018860.s00128

Moreno, A., & Etxeberria, A. (2005). Agency in natural and artificial systems. *Artificial Life*, *11*(1–2), 161–175.

Moreno, A., Etxeberria, A., & Umerez, J. (1994). *Universality without matter?* 406–410.

Moreno, A., & Mossio, M. (2015). *Biological Autonomy: A Philosophical and Theoretical Enquiry*. Springer.

Moreno, A., & Ruiz-Mirazo, K. (2009). The problem of the emergence of functional diversity in prebiotic evolution. *Biology & Philosophy*, *24*(5), 585–605. https://doi.org/10.1007/s10539-009-9178-6

Mossio, M., & Saborido, C. (2016). Functions, Organization and Etiology: A Reply to Artiga and Martinez. *Acta Biotheoretica*, *64*(3), 263–275. https://doi.org/10.1007/s10441-016-9283-2

Mossio, M., Saborido, C., & Moreno, A. (2009). An Organizational Account of Biological Functions. *The British Journal for the Philosophy of Science*, *60*(4), 813–841. https://doi.org/10.1093/bjps/axp036

Neander, K. (1991). Functions as Selected Effects: The Conceptual Analyst's Defense. *Philosophy of Science*, *58*(2), 168–184. https://doi.org/10.1086/289610

Neander, K. (2017). *A mark of the mental: In defense of informational teleosemantics*. MIT Press.

Newman, S. A. (2023). Inherency and agency in the origin and evolution of biological functions. *Biological Journal of the Linnean Society*, *139*(4), 487–502. https://doi.org/10.1093/biolinnean/blac109

Papineau, D. (1987). *Reality and representation*. B. Blackwell.

Piaget, J. (1969). *Biology and Knowledge*. University of Chicago Press.

Piedrafita, G., Ruiz-Mirazo, K., Monnard, P.-A., Cornish-Bowden, A., & Montero, F. (2012). Viability Conditions for a Compartmentalized Protometabolic System: A Semi-Empirical Approach. *PLOS ONE*, *7*(6), e39480. https://doi.org/10.1371/journal.pone.0039480

Prokop, M., & Barandiaran, X. E. (Under review). Sensorimotor Norms and Social Norms: A Pluralistic Proposal. *Submitted to Review of Philosophy and Psychology*.

Putnam, H. (1975). *The Meaning of "Meaning."* https://hdl.handle.net/11299/185225

Quine, W. (1969). Epistemology Naturalized. *Ontological Relativity and Other Essays*, *13*(3), 69–90.

Rama, T. (2023). Evolutionary Causation and Teleosemantics. In J. M. Viejo & M. Sanjuán (Eds.), *Life and Mind* (Vol. 8, pp. 301–329). Springer International Publishing. https://doi.org/10.1007/978-3-031-30304-3_14

Rama, T. (2025). *The Phylogeny Fallacy and Teleosemantics*.

Rama, T. (Forthcoming). *Function and Selection Beyond Externalism*.

Reid, R. G. B. (2007). *Biological emergences: Evolution by natural experiment*. MIT Press.

Rorty, R. M. (Ed.). (1967). *Linguistic Turn: Recent Essays in Philosophical Method* (1st edition). University of Chicago Press.

Ruiz-Mirazo, K., & Moreno, A. (2004). Basic Autonomy as a Fundamental Step in the Synthesis of Life. *Artificial Life*, *10*(3), 235–259. https://doi.org/10.1162/1064546041255584

Ruse, M. E. (1971). Functional Statements in Biology. *Philosophy of Science*, *38*(1), 87–95. https://doi.org/10.1086/288342

Schulte, P. (2023). Mental Content. *Elements in Philosophy of Mind*. https://doi.org/10.1017/9781009217286

Segundo-Ortin, M., & Heras-Escribano, M. (2021). Neither mindful nor mindless, but minded: Habits, ecological psychology, and skilled performance. *Synthese*, *199*(3), 10109–10133. https://doi.org/10.1007/s11229-021-03238-w

Shea, N. (2018). *Representation in cognitive science* (First edition). Oxford University Press.

Smithers, T. (1997). Autonomy in robots and other agents. *Brain and Cognition*, *34*(1), 88–106.

Thompson, E. (2010). *Mind in life: Biology, phenomenology, and the sciences of mind*. Belknap.

Varela, F. J., & Coutinho, A. (1991). Second generation immune networks. *Immunology Today*, *12*(5), 159–166. https://doi.org/10.1016/S0167-5699(05)80046-5

Varela, F. J., Maturana, H. R., & Uribe, R. (1974). Autopoiesis: The organization of living systems, its characterization and a model. *BioSystems*, *5*(4), 187.

Varela, F. J., Thompson, E., & Rosch, E. (1991). *The embodied mind: Cognitive science and human experience*. MIT Press.

Villalobos, M., & Palacios, S. (2021). Autopoietic theory, enactivism, and their incommensurable marks of the cognitive. *Synthese*, *198*(1), 71–87. https://doi.org/10.1007/s11229-019-02376-6

Wagner, G. P. (2014). *Homology, genes, and evolutionary innovation*. Princeton University Press.

Walsh, D. M. (2015). *Organisms, Agency, and Evolution*. Cambridge University Press. https://doi.org/10.1017/CBO9781316402719

Weber, A., & Varela, F. J. (2002). Life after Kant: Natural purposes and the autopoietic foundations of biological individuality. *Phenomenology and the Cognitive Sciences*, *1*(2), 97–125.

Wright, L. (1976). *Teleological explanations: An etiological analysis of goals and functions*. University of California Press.