

CLAUDIO J. RODRÍGUEZ HIGUERA

The Place of Semantics in Biosemiotics:  
Conceptualization of a Minimal Model of  
Semiosic Capabilities





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Conceptualization of a Minimal Model of  
Semiotic Capabilities



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Department of Semiotics, Institute of Philosophy and Semiotics, University of Tartu, Estonia

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Supervisor: Prof. Kalevi Kull, University of Tartu

Reviewers: Prof. Terrence W. Deacon (University of California, Berkeley)  
Ass. Prof. Donald F. Favareau (National University of Singapore)

Opponent: Ass. Prof. Donald F. Favareau (National University of Singapore)

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# 1. INTRODUCTION

The project of a scientific biosemiotics has been met for the past few years with a multiplicity of branches, theoretical options, complements from fields outside of semiotics and reworkings of older positions that have found new relevance either as heuristic devices or as possible theories to be fully developed. The idea that semiotics can be *scientific* is not a radical one. From its more institutional foundations in Saussurean linguistics to the later developments brought together by the Tartu-Moscow school, semiotics has strived for a systematized, empirically reasonable and (rather) verifiable field for the study of meaning – what it takes for meaning to come about – and its different expressions across systems where meaning can be apprehended. Biosemiotics is no different to other prefixed varieties of semiotics in that it follows the idea that signs are *relevant* to our understanding of meaning. However, it is fundamentally different from other varieties of semiotics in that it can also be construed as a reworking of what semiotics can mean considering our current scientific understanding of the world. In a way, biosemiotics is a combinatorial aim at understanding *why* there are signs in the first place, how it is possible for us to talk about signs, what are the evolutionary reasons (if any) for their relevance to our knowledge, and so on. In other words, biosemiotics aims to *naturalize* the idea that signs are important to the life of beings with cognitive capabilities.

What that doesn't mean, however, is that we should base all of our understanding of semiotics as an epiphenomenal offshoot of scientific inquiry below the special sciences. That is, a scientific biosemiotics is not simply a scientific characterization of theories that allow us to talk about signs, nor should it be considered as a method of ontologically characterizing semiotic universals that give rise to the rest of possible descriptions of the world.

In the following section we will examine the question posed for the present work – what it takes for us to talk about minimal semiosis in a biosemiotic setting – and the relevant perspectives related to it from within biosemiotic enquiry. Then we will introduce the structure of the work to see what has been done to address our question.

## 1.1. A question of minimality

The guiding question behind this work is that of conceptualizing minimal semiotic capabilities within the modeling framework of biosemiotics. Behind this question is, however, a specific philosophical concern. We inquire about the viability of a metaphysical discourse when dealing with the assumed scientific outlook of biosemiotics as a branch of general semiotics, and ultimately what it means for a naturalized semiotics to deal with questions of the simplest possible expression of semiotic functions.

In this vein, the work deals with the construction of a framework from which to tackle the issue of a potential minimal semiosis, an issue intimately related to



the concepts of semiogenesis, emergence and biosemiosis. We make the assumption that semiotic activity finds its ground in biology, but we characterize it further in order to make claims about the necessary components of semiotic activity in simple systems. In this we find the need for the proposal we begin with: That biosemiotics makes claims about the use of signs in the biological world, and that such claims need to be construed in units of analysis that respond to the view that semiosis in organisms is relative to their environmental relations. In the specifics we are treating here, we want to theorize a *parsimonious* form of biosemiosis, an abstract point of simplicity that can be complemented further in claims about evolutionary scales of semiosis – if at all possible – and complex systems analyzed from a semiotic point of view.

### **1.1.1. A brief overview of biosemiotic parsimony**

Earlier we mentioned the relation of the present work to concepts such as semiogenesis, and the reason for that lies in the fact that finding a minimal expression of semiosis has been treated as part of a diffuse research program on the building blocks of semiosis, its point of origin, emergence and precursors. The concept of semiogenesis, one that has been phased out of current biosemiotic parlance, plays a prominent role in the naturalistic framework of Koch (1984; 1986) in the construction of an all-encompassing semiotic model across different scales. This perspective is taken by Nöth as a starting point in the investigation on the origins of semiosis (1994). The relevance of this lies in that Nöth opens the discussion on institutionalized semiotics about the potential origins of semiosis, the fundamentals on which we must build our theories. The origin of semiosis is what leads to the investigation of basic conditions in which one can talk about semiosis. However, this view leads to a predominantly ‘syntagmatic’ understanding of such research. The evolutionary view of semiosis encompassing, quite possibly, universal origins and leading towards cultural expressions is, however, a difficult position to hold, and it is not one that finds a strong footing in the current biosemiotic paradigm, at least not to the degree that it can be fleshed out in concrete terms as Koch does in his work on cultural evolution.

However, this is a particularly important starting point in that it creates the conditions for us to talk about minimal expressions of semiosis by way of arguing for an abstract origin or emergence situations. Beyond semiogenesis as the emergence of semiotic processes in any given system, we begin to see the problem of the *emergence* of semiosis. In the biosemiotic landscape delineated by Hoffmeyer, we find more tangible expressions of the problem (Emmeche 1992: 78), for the understanding of semiosis as a biological phenomenon at the cellular level makes the question of origins of sign usage possible with specific concepts and units of analysis, such as the cell as the basic organism capable of sign action and signs as the units of analysis of life (Emmeche et al. 2002: 13–24). In this vein, the most relevant work on emergentist accounts of semiosis

can be found in the works of Queiroz, El-Hani and Emmeche (2009 in particular), but as we will later see, biosemiotic investigations related to complexity can be construed as proper emergent accounts as well.

The prospect of an emergent account of semiosis in the biological world finds a relevant place in the more theoretical areas of biosemiotics, and the question posed by this perspective is of the utmost importance for our particular research, as establishing the basal theoretical conditions on which one can talk about the emergent processes of semiosis gives us an important place to consider what the minimal expression of semiosis may be. The conceptual approach here is very much perfused by Peircean terminology, and it is easy to see why: Peircean concepts lend themselves much more easily when referring to processual sign conceptions and the organization of conceptual necessities to present signs in some form. The strong Peircean hold of biosemiotics gives the field thus a particular flavor to its ontological commitments and analytical requirements. That is not to say that the field is exclusively Peircean in its conception of the sign, but in any case we must remain clear that sign concepts are both informed and compatible with standard Peircean talk on signs.

There are certainly other related terms that have been used in approaching our subject to some degree of specificity, and one in particular that stands out as functionally relevant: The idea of *protosemiosis*, first introduced by Prodi “to investigate the natural foundations of semiotics” (Petrilli 2013: 36). The concept, originally applied “to molecular processes in the cell” (Sharov et al. 2015: 6), serves as a different illustration of the research on the issues of emergence and basic constituents for semiosis. Here we see another level of investigation that deals with minimal or presemiotic capabilities and the value they have for a fully-fledged semiosis in more complex levels of organization. In fact, when referring to protosemiosis, we will only deal with Prodi’s concept as developed later in biosemiotics, but it is worth noting that one could construe protosemiotic features as part of non-linguistic signification systems (Zappavigna 2011: 259) in an understanding of semiotic features as those related to complex sign systems.<sup>1</sup> However, given that in accepting the premise that sign action is valid in simpler biological forms than mammals, it makes sense to come up with a formal argument for some less developed sign types or sign action when semantic information is hard to describe beyond simpler reactive mechanisms. While the number of examples utilizing the concept of protosemiosis is very limited, a biosemiotic conceptualization can be made in a couple of different ways. De Albuquerque Vieira (1994: 829) uses the concept of protosemiosis as “semiosis possibility in inanimates [involving] the open system’s thermodynamics and the Peircean classification of interpretants” in an

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<sup>1</sup> Wąsik (2014: 48–49) puts protosemiosis and physiosesemiosis in the same prebiotic bag, but terminologically speaking, these two represent different positions in biosemiotics, one related to basic or pseudosemiotic activity and the other to signs entailed by physical systems (including physical interpretants). At the same time, Petrilli and Ponzio (2011: 311) warn us about conflating the concept of protosemiosis with ‘quasi-semiotic’, with the last one being constituted by physical interactions.

earlier approach to the concept through a Peircean framework, much reminding us of other Peircean approaches such as Brier's (2008). Perhaps the most concrete proposal for a protosemiosis comes from Sharov and Vehkavaara (2015), who first define it as a "primitive 'mindless' semiosis" (104), but flesh it out as signaling, and more specifically, "as a kind of sign processing, where agents (i.e., active systems guided by natural self-interest) initiate or modify their functional activities in response to incoming signs directly, rather than by associating signs with objects" (107).

In many ways this approach is compatible with our point of view, but the differences in their theoretical constitution prove wide enough that their conception of protosemiosis doesn't equate to the picture of minimal semiosis that we are trying to achieve here. This particular concept of protosemiosis maps sign types to "signal molecules" (116–117) based on internal functionality. At the same time they distinguish between protosemiosis and eusemiosis in that they see eusemiosis as the processing of semiotic functions through object association (108), a step further in evolution from their conceptualization of protosemiosis.<sup>2</sup> This conception of protosemiosis explain behavior with the assumption that bacteria do not *know* that there are nutrients outside so much as their observation is limited to the state of their receptors. However, this is not enough to sustain a categorization of internal states because of the assumed indirectness of perception. In this way, they specify that protosemiotic signaling networks are simple and non-redundant (111–114).

This particular view on protosemiosis is informative in that it sets some conditions to be used when considering a potential evolutionary trait of semiotic capacities (Sharov 2012). But as it stands, it describes a more precise idea altogether, something we can call an *implementational* framework for semiosis, that is, a segmentation of a more concrete set of conditions to talk about the simplest form of expression of semiotic capacities. Having a continuum of evolutionary possibilities is itself a claim we will not explore in this work as supporting it would need an exploration on specific developmental scales that can only come as a complement of the concepts we are using. That does not mean we cannot have a form of compatibility with Sharov and Vehkavaara's view on protosemiosis, but the scope of their work is both more limited and with assumed implications that we cannot cash out directly from either their or our models.

Finally, the concept of a proper 'minimal semiosis' has not appeared in many biosemiotic formulations. In fact, one of the few mentions comes from Arnellos and Moreno (2012) in an abstract regarding the asymmetry between the organism and its environment, their interwoven nature and how this asymmetry "is created and maintained by the functionality of the system through the establishment of internal constructive relations that organizationally differentiate the system from its environment" (153), further specifying the

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<sup>2</sup> In fact, they correlate protosemiosis to the origin of life and eusemiosis to the origin of a "minimal mind" (Sharov; Vehkavaara 2015: 109).

autonomy and identity of the organism. A more concrete claim, however, comes from the concept of *functional differentiation* as a prebiotic constraint that opens the possibility of signification (Arnellos; Moreno 2012a: 3). This functional differentiation is theorized to be self-maintained (5), leading to the constitution of more robust systems with signification processes involved in their development. This view is close to some conceptions of minimal cognition, which will play a fundamental role in our argument.

Minimal cognition deserves a special mention here as well, presenting a paradigm that will help in making points about minimal semiosis clearer in the present work. The conception of a minimal cognition in simple organisms becomes formalized in van Dujin et al. (2006), finding some clearer roots in Müller et al. (2001), but also spelled out in Calvo Garzón and Keijzer (2011). Briefly, the idea is that cognition at the level of simple organisms is built environmentally in a parallel expression of embodied cognition. This will be treated more concretely later in this work, as it helps flesh out our view of semiosis more clearly.

Within a more expanded field beyond semiotics and its close boundaries, it is also possible to make a case about the relation of the contributions made by Rosen regarding anticipatory systems and its impact to the core assumptions on minimality in biosemiotics. In this regard, Rosen's modeling of organisms has been of certain influence to biosemiotics (Kurismaa 2016: 179), construed either as an anticipatory requirement for meaning generation in organisms or as a complement to a Peircean understanding of meaning (Fernández 2010), that is, a relational type of characterizing life, and thus, semiosis (Kull 2010: 48). If anything, the parallel lines that can be drawn between Rosen's project and biosemiotics can give us a clearer insight on the intellectual place of biosemiotics. Take, for instance, the idea that an organism "contains coherences that cannot be expressed in terms of syntactical structures" (Goudsmit 2007: 2428), an assertion that follows the assumed directedness (or rather, finality) of an organism. This resonates profoundly with the classic biosemiotic conception that stem from Uexküll's research paradigm (Kull 2001). While terminological differences exist, they coincide in pointing the relevance of meaning making for biological processes. This, in fact, is considered an essential enough trait that the formulation of a relational biology (Rosen 2000: 259–265) depends on organization, but assigns no ontological value to this organization and only makes claims about evaluation maps, the constituents of causation in the organism. At the heart of the relational biology championed by Rosen and Rashevsky is the idea that the nature of biosystems lies not in the elements that constitute them, but in their (functional) structure, that is, their system of relations (Rashevsky 1954; 1965; Rosen 1958; see also Louie 2009). This is also one of the core statements of the semiotic view of life (cf. Fernández 2010), which certainly has some critical ontological implications, because the organism is described not on the basis of molecules or any kind of matter, but on mappings, correspondences and functions (what is meant by structures). Rosen (1958) formulated a minimal model for a relational biological system in

his description of a metabolic-replication system, and this view has been of certain relevance to biosemiotics (Kull 2007a), but this particular topic would require a separate work and will not be analyzed here.

Another potential candidate for a similar object of research can be found on the notion of ‘minimal self’ as presented by Zahavi (2010), but the boundaries of the properly phenomenological are, in our opinion, beyond the scope of this work.

### **1.1.2. Biosemiotic parsimony and naturalization**

The naturalization of semiosis and the intuition that there must be something of a relation across different levels of complexity is perhaps one of the drivers of this research on minimal cognition. When I refer to parsimony in this sense, I mean that in construing a hypothesis of simple semiosis we aim for the simplest expression of its constitution. In semiotics, parsimonious explanations are perhaps not always the norm because of the amount of elements needed to get a strong sense of meaning in complex creations with highly involved conceptualization apparatuses, but we see a commitment to significance within the cellular world even from the more foundational approaches of Hoffmeyer (1997, 2000), Deacon (2011) or Barbieri (2007). Many of the semiotic explanations detail possible internal significance for simple organisms, either by corresponding notions of protosemiosis (or endosemiosis), autonomy (Deacon 2012), the usage of codes or even the idea of *microsemiosis* (Yates 1997). This approach has been partially set aside for our purposes as we are trying to come up with an analytical possibility of an assumed minimal model of semiotic capabilities. In the construction of the hypothetical model we have described we assume a different type of description that does not search to explain the origins of life or the evolution of semiosis towards mental phenomena, a much wider and more complex set of results that cannot be obtained from explanatory values of parsimony, and part of the assumed explananda of the biosemiotic theories we have just mentioned. We must remember that cells, for all their assumed simplicity, present an incredibly complex organization, and part of the biosemiotic literature that treats the subject of cellular semiosis does so with this caveat in mind, explaining semiosis as a phenomenon of complexity.

In the abstract notion of semiosis, however, we can also find Stjernfelt’s contribution (2007, 2014) to the debate on cognition with the implementation of a Peircean framework to characterize the *dicisign* as an expression of cognition. This has been taken into account in the work, but our approach is less committed to a Peircean vision of semiosis to the extent that it is even possible to do so while still accepting many of his terminological and logical implications.

## 1.2. Outline of the thesis

The current work is comprised of seven sections (starting from Chapter 2) and conclusions. **Chapter 2** opens the discussion on the metaphysical underpinnings of biosemiotics, and whether it is a discussion worth having at all. The relation between metaphysics and biosemiotics is, in our view, clear, and a necessary point to make when constructing our theories on biosemiosis. This is of particular relevance to the present work in that the expression of biosemiotic concepts and their consequences are hinged on certain metaphysical assumptions and claims, and the biosemiotic project of naturalization of semiotic concepts is still highly dependent on our philosophical positions.

**Chapter 3** refers to one of the first metaphysical problems we face when developing a model of minimal semiosis, that is, the concept of *physiosemiosis*. The concept itself is a philosophical argument about the standing of semiosis, one that can hinder the ontological standing of biosemiosis if left unchecked.

**Chapter 4** takes the discussion of naturalization as essential to the problem of conceptualizing minimal semiosis. This is partly carried from the issues of physiosemiosis as a way to delineate the particular possibilities of a naturalized biosemiotics versus the more sweeping claims about universals that cover all levels of sign action. Here we try to distinguish the role of semiotics as a special science that does not deal with such general claims as the ones made by philosophical positions like the ones that espouse physiosemiosis.

**Chapter 5** moves to the problem of the emergence of semiosis and tries to account for different views of emergence within the biosemiotic framework. This is also important because it constrains the setting for speaking of a possible minimal expression of semiotic capabilities. This discussion also proves to be of certain relevance for current biosemiotics as the exploration of emergence deals with complexity while giving a naturalized constitution to the sign as an emergent of specific processes in nature. **Chapter 6** deals with the conception of minimality for both models and objects of those models, allowing the discussion of parsimony in the act of modeling within semiotics. As we are trying to develop a hypothesis on minimality and biosemiosis, this is a relevant point to develop.

**Chapter 7** then lays the more specific groundwork for our proposition by bringing the discussion on models from the previous chapter towards a more biosemiotic-centric approach, including a general notion of semantics. Many of the concepts used in this chapter set the theoretical focus for the model of minimal capabilities proposed in the next chapter. **Chapter 8**, finally, presents a proposition for a model of minimal semiosis based on the underlying theory used earlier as well as complements from minimal cognition. The proposal we make at this point is construed within the limits of the scope we have set before, that is, without claims about its extension beyond the idea that the model *could* lend itself to more complex proposals in the description of systems requiring it. We make extensive use of Pattee's special conception of semantics in order to describe our position. The conclusions cover the construction of the argument

and discusses some of the problems that may be associated to the model, as well as tentative answers to these problems.

It is impossible to claim a full understanding of semiosis and account for it in all its complexity. This work has tried to use a complementary approach to the issues of describing semiosis, a bottom-up view of the metaphysical standing of semiosis with a top-down approach on certain aspects of cognition. However, there is a certain limit to how much a model can say about semiosis, leaving ultimately many gaps in our understanding of the specificities of sign action in even the simplest of organisms. This work is not an attempt at telling the whole story of semiosis; instead, it is, I hope, a way to set a background theory for making claims about semiosis in a minimal condition, approachable as philosophical discourse and useful in the discussion of the biosemiotic standing of semanticity at a level in which it is hard to speak of a proper conception of semantics.

Ultimately, speculation at the roots of the phenomenon of semiosis is an area of certain usefulness in the development of our theories of biosemiotics, even if its nature is frightfully hypothetical. Biosemiotics, as a special – and foundational, in our opinion – form of semiotic research, is one of the main fields in which the discussions on the ontological standing of semiosis should take place, and it is our hope that this work contributes to the landscape of biosemiotics in its discussion about both the requirements for something to pertain to sign action and the background philosophical theories of biosemiotics.

The biosemiotically informed reader may, however, find the language employed uncommon within the discipline. The intention to scrutinize the elements that conform the theoretical basis of biosemiotics is better suited to what can be characterized as the technicalities of philosophy, which may lead to some terminological incongruence at face value. I have tried to expand on the concepts meriting a more thorough explanation for the biosemiotician in order to make them compatible with the more general idea of what biosemiotic concepts do. When this has not been possible, the acknowledgment of a paradigmatic difference has been made in order to mitigate possible conflicts in the reading of the work. Yet, the stylistic difference accounts, hopefully, for an attempt at making biosemiotic claims more accessible for analysis, for when biosemioticians try to say something about semiosis, very often we find ourselves stranded by the enormous complexity that comes from understanding just what the implications of our theories are, and how these may be related to other areas of investigation that deal with overlapping subjects, such as the way to treat cognition in simple organisms or the origins of life itself. This way of tracking our understanding of semiosis and the logic behind it can help us overcome some problems related to unexpected commitments we make when, say, we accept a physiosemiotic account of the sign, and while this manner of addressing the problems of biosemiotics is rather uncommon, it is my thought that it provides a suitable and fertile ground for examining the more abstract areas of the discipline.

## 2. METAPHYSICS AND BIOSEMIOTICS

Does Biosemiotics need metaphysics? That may be a redundant question. After all, no one really *needs* metaphysics. In fact, the question implies a certain number of other related questions, so it is not quite straightforward as it may seem. We do not really get to ask if metaphysics is indeed necessary, but rather, the theories we deal with are construed under some metaphysical stipulations.

The problem we face can be stated like this: When you choose a hat, you're not limited by your taste in hats, but to which hats fit your head (if it is in your interest buying a hat for wearing it, of course). If you have a big enough head, chances are you won't be able to wear all of the hats you like. In the same way, you do not get to simply choose the metaphysic underpinnings of a semiotic theory, but instead these are appended inextricably to the definitions that appear on the preferred theories of semiotics that someone may espouse.

One thing we may be concerned about, before starting to wonder about the need for metaphysics, is whether we actually need to worry about metaphysics at all. If the internal consequences of a theory do not collide with the results, there seems to be no need for making a fuss about how it works *as long as it works*. But this is not the argument I am willing to make. It would seem to me that deciding to commit ourselves to some degree of naturalization of semiotic concepts implies a lesser dependence on metaphysical devices, and this by itself holds some value in that our explanation of semiotic concepts will not depend on seemingly inconsequential, invisible metaphysical machines. This chapter will particularly focus on the concept of semiosis as central to biosemiotics, its ontology and the consequences of Peircean thought when considering the specificity of biosemiosis. It will be argued in this chapter that metaphysics in biosemiotics takes an inflationary pattern, positing entities necessary to explain the tenets of sign action, and that constraining the ontology that comes from this practice, that is, limiting the description of causes and potential entities that take part in forming the elements of our theories, can be a good measure for the long-term prospect of naturalization in the sense of its compatibility with a scientific worldview<sup>3</sup> and what this entails for the concepts in semiotics. While this chapter will set the tone for the philosophical explanations given, it is important to note that not all terms map to current biosemiotic concepts. This being the case, I will try to provide a compatible account of concepts that may be unfamiliar to the biosemiotician while also accounting for those concepts that may be incompatible with the biosemiotic view.

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<sup>3</sup> Broadly speaking, this would qualify as Quinean naturalism. This type of naturalism does not, as Leng notes, "imply that we ought to be realists about all of the objects indispensably posited by our best scientific theories" (Leng 2010: 20) in any case. While I wish to retain this as the main sense for this chapter, it is only used in a broad manner.



## 2.1. Metaphysics and Biosemiotics

Dealing with the metaphysics of biosemiotics is not an easy task in that threading through the philosophical assumptions made in biosemiotics can result in individual positions with little resemblance between one another. This does not mean it is impossible, but rather that there is a lack of literature documenting the different metaphysical positions between the possible views in biosemiotics, with a wider focus on tackling problems concerning the already explicit biosemiotic aspects that stem from underlying philosophical assumptions, as for instance the idea of an emergent semiosis (Emmeche et al. 2000) or the possibility of semiotic scaffolding (Hoffmeyer 2008), to name just a couple of them. The more philosophical bent of biosemiotics allows a greater deal of openness with regards to the possibilities that may come from reframing biology through a different lens, as it has been suggested by Hoffmeyer (2008a), and this openness makes the discipline more prone to explore options that may not necessarily find correspondence within other areas of the discipline itself. The fact that Peircean ideas and concepts are so relevant to biosemiotics is a testament to both Peirce's contributions to philosophy as it is to biosemiotics's capacity for incorporating elements that will count with a great variation when interpreted under different perspectives. But Peircean philosophy will turn to have various outcomes. For instance, Vehkavaara (2008) proposes a differentiation between the biosemiotic endeavor and Peircean metaphysics, a distinction that must be made in order to retain the cohesion of older and newer paradigms when integrated. Brier, on the other hand, uses the Peircean paradigm to develop his own metaphysics aligned with cybernetics (2006, 2008). Deely (2009), uses Peirce as an extension of scholasticism in a different system of metaphysics that leads to the necessity of semiosis.

Pattee (2005), on the other hand, covers some of the problems of metaphysical assumptions outside and inside biosemiotics, while Favareau (2008) provides some descriptions to the philosophical issues in biosemiotics. Rattasepp (2013) describes a broader alternative for general semiotics when it comes to considering ontology and metaphysics. More recently, Champagne (2015) and Chevalier's comments (2015) have presented opposite points of view on what the necessary metaphysical assumptions and systems must do within the framework of Peircean semiotics. This is not an exhaustive review, so it should be taken as a way to exemplify the state of the discussion in the field. The aim of this quick survey though is not to show whether we should commit to Peircean philosophy or to endorse a certain type of materialism, but rather to open the dialogue on the need to be careful about our metaphysics.<sup>4</sup>

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<sup>4</sup> More generally, the Peircean bent of general semiotics has some Aristotelian foundations that are made explicit by Peirce himself (Tiercelin 2006: 158; Pencak 2010: 25) and that can be reflected across different views, either minor and general, such as Budrevičius (2012), or of definite relevance to the discussion of biosemiotics, such as the historical discussion presented in Favareau (2010). These foundations, however, will not be treated here.

One issue that must also be mentioned is that when talking about metaphysics, the concept itself lends to various interpretations, many of which may not be charitable considering the more scientific expectations of biosemiotics. While the more precise definition we will use can be found in 2.2.1., it is important to keep in mind that the concept itself is only limited here in its use to more or less explicit questions on the ontology of semiosis. In that sense, the ontological questions of biosemiotics – the properties of biosemiosis, its origins and its relation to other types of semiosis, if there are any – are here considered to be essential to the discipline, but answering them will depend on how we can develop metaphysical systems to support them. In this regard, we can see at least in general lines that for (bio)semiotics to explain semiosis there must be a couple of lines of reasoning, either following the path of a universal evolutionary scale (Koch 1986; Brier 2008), a type of universal law (Deely 2009), an emergent in cognition (Emmeche 1992; Deacon 2011) – all of these following some variety of Peirce –, or through the connection of two different ‘worlds’ through a code (Barbieri 2009).<sup>5</sup> Evidently, the working assumption here is that biosemiosis takes precedence in the landscape of general semiotics. It is also more than clear that Peirce himself developed a well-documented system of metaphysics<sup>6</sup> that exerts great influence on current biosemiotics, and that Jakob von Uexküll had some specific underlying conceptions about the world that complemented his work.<sup>7</sup> It would seem however that in its extension, most biosemioticians lie on the vast camp of antireductionism, some form of naturalism and universal evolutionism, as it were (Favareau 2007; Kull et al. 2009; Nöth 1994). This is simply a rule of thumb, but in general it seems to cover the paradigm of biosemiotics and its project to a large degree.

In what follows we will attempt to provide a more general account of the relation of the description of biosemiosis and the consequences that are expressed at the metaphysical level inside biosemiotics. Taking into account what has been already mentioned with regards to possible metaphysical assumptions, the discussion will focus on some specific possibilities of Peircean metaphysics and questions on the ontology of biosemiosis.

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<sup>5</sup> Krampen (1997) provides a thorough description of models of semiosis from different perspectives that goes beyond this little overview inside biosemiotics.

<sup>6</sup> Many volumes have been written on this specific topic, but the particular influence of Peirce’s metaphysics on biosemiotics can be seen described in Romanini et al. (2014).

<sup>7</sup> The idea that “Nature plays her symphony of meaning beyond time and space” (Uexküll 2010: 208) has specific undertones that can be better examined when considering Uexküll’s own philosophical and biological thought. Kull (2001) describes Uexküll’s paradigm extensively.

## 2.2. Propositions of being

For the sake of brevity, and to establish some common ground, we have to consider the following: semiotics in all its different flavors posits the *being* of signs to some degree or another. The mere positing of signs, however, does not imply anything in particular about their ontology, and thus our interpretation of this proposition needs to be fine-grained according to how we build our own theories. As a matter of generalities, the proposition that there are signs is trivial, because signs can be categories, properties or even shorthands to make our models work. The assertion that signs exist is vague enough that we can consider at least a couple of different ways to account for the *being* of signs, these being ontological properties of objects, shorthands for epistemological processes or instrumental descriptions of other processes. While the difference may seem sketchy, it can be better explained in terms of how the ontology of the sign is taken. If we consider signs as individual elements or instantiations, we will find problems with our particular accounts of sign properties. Thinking of the ontology of signs as being a property instantiated by an object in the sign relation will provide us with a way of stating that all things can be perceived because they have the property of being a sign. If we go the other way round and insist that the being of signs is but topology as considered by the senses, we will have functional signs that do not depend on a particularly deep exterior substance. The instrumental alternative bypasses this problem by not declaring any sort of realism about signs. This is also problematic because there is a case to be made that if signs are not exactly real, then perception is impossible.<sup>8</sup>

If, with Peirce, we characterize signs as relations (despite the numerous definitions given to signs), the difference is seemingly eschewed, replaced by a formal codependent constitution, where apparently the sign is dependent on the object, its perceiver and its perception.<sup>9</sup> This amounts, again in general terms, to a large explanatory capability which, taken at face value, does not seem to be extremely vague, and thus as a normative principle for semiotics, it seems to work quite well. The problem however is that this explanation amounts to little

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<sup>8</sup> However, an instrumentalist semiotics does not need to care for the metaphysical proposition at all for as long as the usage of signs can be accounted for. There is more to be said about this possibility and its extraneous consequences, but I will not go into detail about it here.

<sup>9</sup> Instead of pigeonholing Peircean definitions, it seems to be the case that for Peirce, signs always imply a relation considering its subdivision in three parts. This is consistent with CP 1.346, CP 2.242 and CP 8.346, to name only a few possible references. I will favor the object-representamen-interpretant triad to refer to the parts of the sign. I will not dwell into the universal categories, but these also amount to developing Peirce's system of metaphysics and as such should be kept in mind in the general panorama of things. Peirce's synechism and tychism, both also important parts in the development of the philosophy of biosemiotics, will play a specific role in the views taking an evolutionary or causal standpoint for semiosis, such as Deely's (in the case of causality) and Koch's (in the case of evolution). My focus here is on the sign and semiosis, which should provide the most foundational ground to biosemiotics in all its different flavors.

when considered solely under its own terms. In other words, the methodology for the analysis of signs constructed on this premise alone amounts simply to the indication that a sign *is present* in a situation, and then we are bound to find the same problems described above. The case is that semiotics doesn't exactly need to deal with the notion of the sign as excluded from a wider context (cf. Kull 2002). That is, the functional aspect of the sign cannot be isolated from the fundamental notion of semiosis, and at the same time these concepts require a more precise exploration of both a typology and a contextual condition. In fact, arguing for the sign requires us to consider a more in-depth approach than what might be taken from its tripartite articulation at face value.

The first thing to mention is that if we do consider the sign as *something* instead of *nothing* – or rather, if we are realists about signs<sup>10</sup> – we will also need to consider a certain ontology that comes along with it. Now, with basic propositions of things that stand for other things there doesn't seem to be a big mystery, but at the same time it is hard to say much if our whole method of semiotic research is just stating that indeed sometimes some things stand for other things. This instrumentalist view of the sign does not provide us with much more than this indexical. The upside, however, is that in most cases, terminological developments allow us to explore what those signs are, typologically speaking, what they entail and how they are organized. My concern here is not exactly with sign specification though, for their descriptions do not refer necessarily to the ontological/epistemological divide. Simply put, as semiotics studies semiosis (Deely 2009), it bases its theories on the fact that semiosis is, depending on the academic variety, a process or condition of the action of signs. However, there is a certain depth to the problem when considering that semiosis is “an action, or influence, which is, or involves, a coöperation of three subjects, such as a sign, its object, and its interpretant, this tri-relative influence not being in any way resolvable into actions between pairs” (CP 5.484) in the Peircean description because such definition requires us to see semiosis as conceptually true.<sup>11</sup> If we are realists about the Peircean sign, then we must acknowledge the fact that signs are irreducible in this variety and what that implies for the rest of the theory. To put it differently, in order to have this variety of semiosis, our theories must be consistent with the ontological

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<sup>10</sup> In other words, if we are realists about signs, we want to characterize them more strongly than as an instance of a process that may as well be described in a different way without having to mention signs. This counterpoint ultimately doesn't need signs, but uses them out of necessity. A realist about signs would, on the other hand, deny this and accept that signs exist in a more relevant capacity, or that sign relations take form, instead of simply being mentioned as such.

<sup>11</sup> This can be construed as a form of metaphysical or logical necessity. Logical necessity in this sense should be considered as conceptually true and true throughout all possible worlds (Chalmers 1996: 50). Peirce's description of semiosis is quite strict in its indivisibility and so describing it as logically or metaphysically necessary makes this condition more precise, conceptually. It would seem that thinking of Peirce's concepts in modal terms is quite close to some of his aims according to Ramharter and Gottschall (2011). I will argue this position further in the following sections.

form that is introduced by its definition.<sup>12</sup> This claim should not be seen as strange, as the mere fact that semiosis is postulated as a triadic metaphysically necessary claim establishes already a metaphysic ground. As we follow this line of thought, it will become clearer that the metaphysical aspect is relevant.

### 2.2.1. Metaphysical underpinnings

In a general sense, when we argue *about* something being metaphysical, we are referring to the causality and ontology of the phenomenon in question (Chakravartty 2013) and thus the claim that semiosis works as an irreducible triadic relation does not seem so far removed from an ontological principle, especially following Peirce's system of metaphysics. Peirce considered general metaphysics as the study of ontology (CP 1.192), which at least as an implication means that we are on the right track in the presumption that semiosis entails some metaphysical stipulations that should be clearer. But by having irreducibility here, do we really need to consider semiosis as a *necessary* relation of elements, as I earlier presumed? What does that mean in particular for the elements involved on the triads where we can consider semiosis as actual? These questions seem to apply if we are dealing with apparent necessity in the logical sense. Semiosis is defined primarily as a metaphysical construct that works as a base-level assumption for biosemiotics after taking the Peircean turn. Again, as we have seen, most metaphysical positions in biosemiotics will depend on some interpretation of Peirce. While this fact does not entail a specific way to consider the ontology of signs in any detailed way,<sup>13</sup> the point is that Peirce's starting position makes semiosis definable under the previously discussed terms.

A way to see this condition in more straightforward terms is to understand that if semiosis is logically necessary, as it would seem to be from the interpretation of Peirce's definition, we will be able to define it as *the impossibility of perception in situations where further mental representations cannot be entailed by the same act of perception*. The main problem with this view however is in specifying what we mean with each of the terms, that is, in how we limit the necessity of the relation to specific classes.<sup>14</sup> I am using the term of mental representation loosely here though, for the sign and the further mental representations do not require that particular concept to be applied in full force. In fact some theories,<sup>15</sup> may regard the perception bit rather problematic, but con-

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<sup>12</sup> As a way to think about this, semiosis *cannot be conceived* in situations where the conditions do not apply in all of its terms.

<sup>13</sup> In fact, the more philosophically inclined biosemioticians will have very different accounts of what they mean by 'sign' and 'semiosis'.

<sup>14</sup> A different way to phrase this broad reformulation of the concept of semiosis is that *objects cannot be perceived if they cannot produce a mental representation that leads to subsequent mental representations*.

<sup>15</sup> Deely, for instance, regards perception as unnecessary because he conceives of the possibility of establishing relations only physically, a dinosaur bone being his prime example for the concept of physiosemiosis (Deely 2009: 119).

sidering that signs at least comprehend the relation between object and perceiver one would imagine that it is a fair trade, if anything.

Instead of analyzing the particular terms used for any specific definition of semiosis, it seems more useful to consider that all the aspects of the relation still imply a particular set of ontologies. That is to say, no matter how we consider relations, the fact that they are included as an integral part of biosemiotics grants them with a certain ontology as long as we are not limiting ourselves to an instrumentalist account of the sign.<sup>16</sup> Objects, for instance, have as their main attribute across different possibilities the fact that they are presented in a certain fashion through a representamen. This doesn't imply a specific take on the object as a *concretely defined object*, such as apples or magazines, but rather includes train wrecks, wizards and vacuum cleaners. This also includes objects *in absentia*, which opens a whole set of different possibilities and little ontological constraint if we are not careful with the limits of description. However, I will refer to this later. Suffice to say for now that objects are no real concern of ours (for now) except when construed as part of semiosis, instead of a separate category for indexicals to work.<sup>17</sup> The moral to take home here is that semiosis is not necessarily a clear-cut method for mentioning that signs exist in a biosemiotic framework,<sup>18</sup> but rather it is a metaphysical hypothesis that establishes further conditions that shape the theories of semiotics.

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<sup>16</sup> In those cases, the ontology would shift to a different paradigm, and while the general idea of the chapter would still apply to the removal of a Peircean ontology and the implementation of a code-based semiosis, the outcome will be different in its specificity. Barbieri (2008) presents a picture where Peircean concepts are devoid of their more entrenched ontology, but the case is that the talk about code still includes an important Peircean background.

<sup>17</sup> Peircean objects "involve two kinds of objects: immediate objects, which are just what signs represent them to be, and dynamical objects, which are instrumental in the determination of their signs but are not immediately represented in them. Signs cannot express dynamical objects but can only indicate them and leave it be to interpreters to find them by 'collateral experience'." (Houser 2010: 278) I mention this partly as an example of the treatment of objects as an abstract designator, but also as a potential conflict with some views on perception. Briefly, the indirect relation object-perceptor via sign is yet another problematic situation when it comes to dealing with the processing of signs and access to the so-called external world. This may not be so obvious at first glance, but eliciting reactions in simpler organisms is not the same as stating that there are actual *mental representations* in them.

<sup>18</sup> Hoffmeyer claims, for instance, that "semiosis is an emergent property of the universe" (Hoffmeyer 1997: 355), and according to Brier, the concept of semiosis was used by Peirce and Sebeok to refer to 'signification' (Brier 2003: 107). The problem that remains however is what the ontological status of such 'emergent property' is, or to what degree the idea of signification can be traced to specific metaphysical devices working behind the scenes in this possibility. While Brier has developed an explicit metaphysical system explained more thoroughly in his *Cybersemiotics* (2008), it remains that the concept of semiosis depends on extra legwork for making it work in current biosemiotics, as it will be shown later.

### 2.3. Ontological constraints

We might be tempted to ask whether constraining the ontology of semiosis is necessary, that is, limiting the identity description of sign elements to causal roles,<sup>19</sup> and I would argue it is. The reason appears to become clearer when we consider that if we do not put some limits to the potential ontology of semiosis in this sense, it is quite capable of extending towards pansemiotism (and pansemioticism), a common criticism to Peircean biosemiotics (Barbieri 2015: 156). But one cannot apply constraints arbitrarily, for if a theory is functionally construed to allow pansemiotism, then it is through its own merits that it has to be considered with its corresponding metaphysical machinery. This just means that the constraints have to be set by marking limits that are necessary instead of arbitrary, in the sense that semiotic phenomena need *only* that specific measure to work and *nothing else*. More generally speaking, we can agree with Armstrong's view that all the entities we postulate should have causal roles (Armstrong 1978), but to that we must add that the causal roles we postulate should nevertheless be parsimonious when there is a possibility to be so.

This endeavor may seem appropriate, but still needs some argumentation to demonstrate its general application, because insisting on constraints without providing a methodological stance is only begging for arbitrary constraints. And I will argue that this problem meets with the need for naturalization of semiotic concepts. I have previously mentioned the commitment to this naturalization, for an implicit premise of biosemiotics – as might be understood from its prefix – is that there is a sense in which semiotics is taken with a degree of “scientism”, so to speak.<sup>20</sup> By this I mean that biosemiotic concerns should give “science priority over domesticating conceptual analysis” (Ross et al. 2007: 5) while still being concerned with the ontology of its object. Some degree of naturalization appears to be necessary in grounding our views, and the import of this often innate trait is that it would seem that biosemiotic properties (whatever they may be) are to be anchored in our conceptualization of actual organisms and their relation to the world.<sup>21</sup> I am not advocating a *specific* type of naturalization

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<sup>19</sup> In the naturalist paradigm that I favor, ontology is constrained by natural laws. The problem of how we *define* natural laws at this point will, however, be left for another occasion.

<sup>20</sup> This particular word, while terrifyingly pejorative, is not intended as a marker for an unnecessary commitment to reductionism, but rather as an implication of the synthetic condition of biosemiotics. Brier (2008) presents a reflection on this particular topic.

<sup>21</sup> A clever reader may ask: “And what if it is the other way round?” to which we could simply answer that there is no need to go that way. This particular reader may retain Sebeok's premise that it is theories that do the convincing instead of facts, but the premise is already subsumed under the idea that we are using a philosophical apparatus to approach our subject matter. Long story short, the reader would be right in thinking that theories do the convincing, and the grounding of biosemiotic properties comes from the hope that organisms can entail them.

here,<sup>22</sup> only a view that responds to the prospects of a constrained ontology for semiosis.

### 2.3.1. Alternatives and denaturalization

There are some viable ways to fulfill the task of defining the ontology of semiosis that do not require a constrained description of what there is when we talk about sign properties and such. For instance one may argue, *contra* the naturalist position that I have described above, that Peircean metaphysics pave the way for a maximalist ontology of causal phenomena involving signs. A maximalist ontology would be characterized by the preference to postulate more causal entities to explain other possible causal entities. For instance, we would be talking of a maximalist view if it considered that the possibility that something would ‘cause’ semiosis would be good enough to postulate it as a robust entity in its own system.

Biosemiotics seems to be readily able to shift towards the direction of maximalism, which stands diametrically opposed to the project of a constrained ontology as defined earlier. Maximalism is a way to express the project of an inflationary ontology, that is, claiming

the existence of things unknown to ordinary sense perception and to common sense, indeed things that are invisible. [...] Moreover, these invisible things which the inflationary ontologist claims to have discovered are supposed to be supremely important” (Putnam 2004: 17).<sup>23</sup>

As a matter of example in biosemiotics, we can consider Salthe’s personal ‘naturalization’ program entailed by a hylozoic perspective (Salthe 2008), ascribing semiotic properties to basal levels by assuming property similarity between emergents and their causes. The hylozoic premise, however, already carries a large baggage that must first be explained away satisfactorily in order to proceed with set descriptions of reality. This premise is an a priori that shapes the whole theory.<sup>24</sup>

Other forms of what I refer to as inflationary ontology can be seen in Nöth’s recent account of an ontologically robust symbolic growth based on “the Peircean theory of semiotic evolution” (Nöth 2014: 184), postulating new properties

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<sup>22</sup> An example of that can be seen in Vehkavaara (2002) regarding Peircean concepts. This particular discussion strikes a chord with the discussion on the naturalization of phenomenology, as one can see in Roy et al. (1999) and in the criticisms by Zahavi (2004). The parallel cannot be followed in this space though, but our focus is much narrower.

<sup>23</sup> Putnam notes here that modern physics acts in a similar fashion, yet the things postulated by the inflationary ontologist are unknown to modern physical science, such as “Platonic forms” (Putnam 2004: 17). The caveat however is that realism also falls prey to forms of inflationary metaphysics (Van Fraassen 1980: 73).

<sup>24</sup> It is important to note that this particular view has found some adoption in emergent accounts of semiosis such as (Queiroz et al.: 2006). This is treated further in chapter 5.



for signs against what he calls the ‘culturalist’ objection (Nöth 2014: 180); Deely’s causal ontology of semiosis that derives in physiosemiosis (Deely 2001), and in general, all accounts that attempt to construe sign relations within a deeper ontological layer based on principles such as Peircean synechism as ontologically significant.<sup>25</sup>

### 2.3.2. Laws and speculation

I deem the view I am advocating in general terms as relevant not for the prospect of naturalization of biosemiotic concepts itself, but because biosemiotics is already part of the process of a naturalized semiotics. There is no redundancy here, for this progress, if we can call it that, responds to the same logic with which perception and cognition are explored. That is, for semiosis to remain coherent, it cannot be taken outside of experience in any degree. The reasoning for such an assumption is that reducing the ontological baggage of presumptions such as the ones just described we end up with a reduced account of semiosis, one that may, again, reduce the categories of the Peircean sign to its bare bones – the logical subsumption of triadicity. That is, instead of postulating that since Peirce declared ‘Mind’ to be a property of all matter, we can embrace semiosis in its more conservative flavor as, for instance, grounds for (mental) representation in similarity and causation (Von Eckardt 2012: 35) or simply a wide ethological perspective on semantics. This way we would avoid extraneous forms of potential representations and limit semiosis and sign usage to grounded limits in biology.

It would seem that *a priori* metaphysics,<sup>26</sup> despite its explanatory power, cannot report credibility in the arena of biosemiotics without creating a conflicting situation between the idea that our causal entities lie one step below sign usage (giving it a robust composition and existence) and the weaker sense of representation or action. More specifically, if semiosis is taken to signify an *a priori* condition that subsumes all other conditions related to signs, we need a good argument to sustain our position that does not include the final ontological conclusion in its premise. By analogy, if we want a good-looking hat, we can only think it will look good on us for as long as it fits, perhaps considering that an oversized or an extremely small hat will be an inscrutable choice.

To explain the ontology of semiosis, as we have seen thus far, some may feel the need to postulate additional entities for its actuality, or different hierarchies for it to work. However, if we assume that semiosis can be experienced and modeled (be it as mental causation via synechism, behavior or even in instrumental sign descriptions), its ontology is still up for grabs. Attempts at creating a consistent picture with the more complex aspects of Peircean thought

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<sup>25</sup> Synechism is seen by Deledalle as the metaphysical version of the three phaneroscopic universes (Deledalle 1978: 11).

<sup>26</sup> A discussion on the opposition of this type of metaphysics and naturalized metaphysics can be found in Allen (2012).

are nothing new,<sup>27</sup> so instead of dealing with such specifics, we can imagine that the main strategies for postulating different ontologies of semiosis can move from teleological pertinence – that is, directed evolution towards anthroposemiosis (Koch 1986) –, causality (Deely 2009), emergence (El-Hani et al. 2009) to pansemioticism (Merrell 2010; Salthe 2007) and so on. It is hard to argue whether the metaphysical backgrounds are more or less contrived, but if anything, aiming for a reduction of these metaphysical devices helps in justifying our theoretical choices.<sup>28</sup> Again, if semiosis can be explained as an experiential relation, there seems to be little reason to resort to fancy *a priori* apparatuses to explain relations beyond ontologically trivial descriptions. This doesn't imply that the task of any (rather) naturalistic endeavor is simple. Quite on the contrary. In any case, it seems reasonable to think that, even when we impose semiosis as a radical fact for theories that deem sign usage as basic, we probably need to frame our explanations to be constrained on a specific, fundamental law, but “it is in the nature of fundamental laws that they are the end of the explanatory chain (except, perhaps, for theological speculation)” (Chalmers 1996: 74).

The question is then, why *should* we accept an inflationary ontology such as the options that have been already presented when we can do without it? Maybe we can't, and the attempt would be futile, but if this is the case, then bio-semiotics becomes only a moniker for such high-level speculation. Accepting highly complex metaphysical mechanisms simply takes away from the highly complex base-level mechanisms in semiosis, even when we have reduced its definition and causes.

### 2.3.3. Peirce's expansion

One possible reason for the preponderance of highly complex deliberations on an expanding ontology of semiosis may stem from Peirce's own dedication to his cosmology and the ample body of work containing his system of metaphysics. The project of unifying the Peircean system – from synechism and tychism to all forms of complexity and everything in between – towards a “more complex” type of semiotics has enough relevance for general semiotic and biosemiotic theory<sup>29</sup> that it dominates the philosophical discourse, making

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<sup>27</sup> I have talked elsewhere (Rodríguez Higuera 2012) specifically about physiosesemiosis with respect to Peircean elements.

<sup>28</sup> The other option being the *expansion* of metaphysical explanations in a maximalist sense. The limit is apparently arbitrary. As Putnam (2004) warns us about these “inflationary ontologists” (17), he also warns us about *deflationary* metaphysics such as reductionism and eliminationism (19). Balance, it seems, is hard to come by.

<sup>29</sup> Scholars of Peircean inclination such as Kruse (1990), Santaella (2001) or Houser (2013), to name just a few, take an integral approach to Peircean metaphysics and its central role in semiotics. This would, by virtue of its system, extend into a type of inflationary ontology, but each author would present a different account of the particulars.

‘Peircean’ metaphysical devices of the order when ascribing causal roles to sign elements and the organon connecting hierarchies, classes and possibilities, all of which can contain an extended ontology on their own.<sup>30</sup> The dominance of Peirce in the field is positive to the degree that it creates analytical tools for its philosophical discourse, giving a coherent picture of potential concepts to explore. However, this dominance cannot bring the majority of explicantia for biosemiotic theories. As a matter of example, ancient atomism can be seen to have provided hints for scientific enquiry, but giving Democritus’s atoms the same ontology as that of current atoms in physics would be a disservice to both paradigms. This is not to say that Peircean metaphysics do not contain any insight worth exploring, but rather to show that with the changes that come from further developments, we need to see that the elements of our theories can also allow change in their philosophical characterization. Revisiting our beliefs regarding the inner workings of semiosis can accommodate further particularities we may bump into without having to ascribe our positions to hard-line Peircean metaphysics. Surely this can be contested too by pleading to either tradition or obscurantism, and while those options *may* be viable to some, they are hardly a final solution. On the other hand, it is not necessary to throw out the baby with the bath water, but we can surely provide more clean water for hygienic purposes. The question here is not specifically about Peircean cosmology in the end,<sup>31</sup> but rather about the consistency of whatever we value as the ontological constraints of biosemiotic concepts.

### 2.3.4. Conceptual issues

Realizing that the concepts of metaphysics do not always lend themselves to a common and conclusive usage within biosemiotics, we have to be careful in how we try to understand the compatibility of exploring the metaphysics of biosemiotics and the concepts as used by biosemioticians. What must be made clear though is that theories contain assumptions, with biosemiotics being no different. More explicitly, even if we assume Peircean metaphysics to be both correct and providing the background for biosemiotics, we can still observe the ‘inner workings’ of the theories by seeing how the concepts play out when put together. This is not to mean that semiotics is, ultimately, metaphysics, because that would be wrongheaded.<sup>32</sup> Still, the concepts used in the more philosophical direction of the debate can have a relevant impact in how we do biosemiotics, informing the field about its own interpretative frameworks and how these may act when assuming, for instance, that biological functions are semantically

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<sup>30</sup> This is also one of the general criticisms Barbieri raises when it comes to institutionalized biosemiotics (2015: 168).

<sup>31</sup> Vehkavaara (2007) presents a discussion on the problems of the application of Peircean metaphysics in biology.

<sup>32</sup> Chevalier (2015: 558) drives the point home when stating that there is no reason to assume modality corresponds to sign triadicity in that the latter does not define the former.

efficient. The discussion the degree of interpretation that is given to bio-semiotics is something that will remain pending, but for now we can at least focus on trying to put the analysis of biosemiotic models and the analysis *made* by biosemiotic models closer together. In this, then, the project of describing a clear, constrained ontology for semiosis is of the order.

## 2.4. Causal closure

An idea to explore, in the form of a thought experiment for analyzing the possibility of constraints, is considering the causal closure of the physical vis-à-vis semiosis. It may be a charitable beginning, but it seems safe enough as a starting ground to discuss some issues concerning the establishing of the metaphysical background of semiotics. This is a good place to start as a rather intuitive assumption on the physical that creates some interesting situations for semiotics, at least for the sake of discussing the impact of these issues within the field.

The causal closure of the physical states that “every physical event has a sufficient physical cause” (Van Gulick 1992: 160), which puts the idea of semiosis in an extraneous dimension, having the possibility to either assume thus that semiosis is sufficient physically speaking or that causal closure is not the whole story and that semiosis provides a different, unrelated layer of existence, as it were. The point is, if we think that semiotic properties, whatever we want to define them as, are not entirely physical yet dependent on basal conditions that by themselves are not entirely physical, then we have a paradox in our hands, and this incompatibility must be explained away in adequate terms with respect to the scientific knowledge of natural laws.<sup>33</sup> The paradox, however, would be fatal to the monism implied by the Peircean ontologist as it would require the institution of a different substance that wouldn’t necessarily be physical. Even if we are committed to a deep synechistic principle, this gradualism will not save us from the difference between point A and point B and the causation of B by A.

If we still *want* semiosis to be an element of our metaphysics, we need to state how it can be entailed given a causally closed world.<sup>34</sup> In response, we could state that semiosis holds because the being of signs is a stable property of the physical, making either purely physical relational systems<sup>35</sup> or removing monism from the equation. We could also state that there may be more fundamental laws than what can be gathered from the physical, making thus semiotic causality work as a base-level law. And we could also state that given a causally closed world, there must be a parallel, causally open world where semiosis

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<sup>33</sup> Note that this holds only if we ascribe semiosis or the entities that cause it to a basal position.

<sup>34</sup> Emmeche (2000) sketches an explanation to this problem.

<sup>35</sup> I will not delve into the problem of defining relation versus interaction for now, but it is a problem that demands some attention.

comes from. The problem is basically setting constraints to act in a logical manner.

In general, ontological constraints should respond to the base-level laws that are already in place. Postulating a new base-level law requires both an enormous effort and an enormous argument.<sup>36</sup> The ontology of semiosis should aim at covering the gaps from this particular conceptual scheme, but aggrandizing its status *ad absurdum* leaves little to work with.

Returning to causal closure and semiosis, while it may seem that there is no need to pit the two against each other, there are reasons to do so as well, for considering the former as a base-level *suspicion* and the second as a different base-level *necessary fact*, we can see that in the more specific issues of semio-genesis this is far from a trivial matter, and a good enough reason to use it as an example of the problems of semiotic metaphysics, despite the self-evident problems of the premise of the causal closure of the physical. It is quite valid to ask ourselves if semiosis is causal, emergent or epiphenomenal, and what matters in this case is that the assumption of the causally closed physical world could set a strong limit on semiotic causality and a robust sign ontology. In fact, if we deal with semiosis as epiphenomenal, then we are left with a trivialized proposition on the need of a semiotic approach, a point that we are not willing to pursue.

#### 2.4.1. Objecting the principle

If we retain the previous consideration of a causally closed world, a quick objection that may be raised can be found in the application of a ‘quantum’ model of semiosis in the way it is entailed.<sup>37</sup> But not only is this highly speculative, it doesn’t really answer to any question about the ontology of semiosis.<sup>38</sup> Of course this is mostly an issue about hard-line materialism not holding, and there is no need to discuss it here. What needs to be stated however is that objections pro obscurantism will not take us far. That is, the awe-inspiring complexity of physical phenomena cannot be used as an excuse to assume the inexplicability of semiotic phenomena, nor can it be used *as* the explanation to it. And we hardly need to base all of our theories on *a priori* principles. All *a priori* concessions have to be taken with the utmost care. The same physicalist principle of the causal closure of the physical, problematic as it is, provides a double case about why we should not necessarily accept wide ranging para-

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<sup>36</sup> We can create base-level laws for everything, from economy to vacuum cleaners, but it will be hard to retain them as ontological base-level laws in the grand scheme of things. It is not plausible, for instance, to have a base-level law that only applies to vacuum cleaners while being in the same category as, say, gravity.

<sup>37</sup> Voetmann Christiansen (1985) presents a synechistic approach to quantum mechanics. More recently, Fernández (2014) has offered some generalizing ideas on habits and causation against a quantum backdrop. There are certainly more examples of this trend, but these two, I believe, are representative enough.

<sup>38</sup> In a similar fashion, “when it comes to the problem of experience, nonalgorithmic and algorithmic thought are on the same boat” (Chalmers 1996: 117).

doxical premises and why in the face of conflicting principles, our metaphysics should not expand towards uniting as many causes as possible (in the fashion of causal overdetermination), but limit the inferences by parsimony.

## 2.5. Semiosis entailed

I have avoided going into detail with regards to specific accounts of the ontology of semiosis for the reason that detailed criticisms of each position would be a task of enormous proportions. There are no clear *a priori* cuts in the construction of a semiotic theory, as semiosis may be evidenced by the fact that signs are indeed experienced. This makes matters more complex, for some elements *may* be ostensibly taken in support of *a posteriori* truths regarding the ontology of semiosis. If this is the proposed case, it is even harder to support *any* ontology of semiosis, considering that its triadic constitution may be taken as a random set, making the assumption fall again in the field of the *a priori*.

Another issue that hasn't been mentioned enough is that by assuming constraints over our particular object, we are making implicit metaphysical assumptions about the world. All theories must make base-level assumptions about the nature of the thing it studies. While in no way this is a decisive stance, it seems like a good policy to stop the escalation of issues with grounding our ontological constraints. It is not a matter of chance, evidently, and this is related to the commitment to the naturalization of concepts. Stating that Peirce was a realist does little in this respect though, and being vocal about *this* commitment is not in and by itself enough to provide a naturalized account of semiotic concepts. The point here is that despite the fact that we do make metaphysical assumptions when we accept some base-level laws, we should strive to reduce the extension of the metaphysical landscape of our added devices in semiotics.<sup>39</sup>

The ontological commitments in different theories of (bio)semiotics should always be taken with a measure of caution. Surely the ontology of semiosis is and will remain open, constraints notwithstanding, and the methods for arriving at a certain metaphysical conclusion will vary wildly, considering the interdisciplinary nature of this particular perusal. But taking semiosis seriously requires some commitment to naturalized concepts. I am still taking this premise in a relativistic way, for it is hard to deny that semiotics has the

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<sup>39</sup> Without being an absolute guiding point, it still seems that “the entities of any special science are complex aggregate structures of the entities dealt with in physics, and there inevitably will be structural/compositional differences among entities falling under a single kind in any special-science taxonomic system” (Kim 2010: 300). The ‘laws’ in semiotics may not necessarily be rigid laws, but rather they are specified by the constitution of the discipline. But this point brings a different controversy, for semiotics in some forms does strive for universality through its particular perspective. The caveat in the end lies in whether we think that semiotics can discover anything about the world that happens to be at the same level as physical laws.

instruments to arrive at some ontologically significant conclusions,<sup>40</sup> but when it comes to choosing a hat, we should see that it fits and hesitate at the offer of a dunce cap as a practical alternative.

In the next chapter, we will examine the particular case of physiosemiosis as a working theory of semiotics and how it can be construed as an inflationary ontology that may prove challenging for a more parsimonious perspective on semiosis. This should present a relevant picture of a committed philosophical view from within semiotics that has some bearing on what biosemiotics can say about its object of study and, consequently, about what its premises are.

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<sup>40</sup> Putnam's critique of Quine (2004: 84) is quite fair in that 'our best scientific theory' cannot be the end of the story and we can still provide some relevant insights from a theory that doesn't occupy the base-level of all assumptions (avoiding supervenience as an explanation for the phenomenon), but I remain attached to the specific ontological constructs in semiotics as, at least, placeholders and support in the gaps that halt the progress of its theories.

### 3. THE PROBLEM OF PHYSIOSEMIOSIS FOR A THEORY OF MINIMAL SEMIOSIS

The contentions for a semiotic threshold have been useful in the constitution of disciplinary boundaries when it comes to semiotics. But the general clarity of the issue of the threshold cannot be arbitrary. Eco's introduction of the concept (1979) appears with more clarity in Nöth (1994) following an evolutionary premise. The relevance of the concept here is that it appears fundamentally as a way to give a more robust constitution to the study of semiosis as a fundamental object of semiotics, its origin and development. The semiotic threshold is a methodological instrument for establishing the potential boundaries of studies that proclaim the sign as its concern, and while it seems that "there can be no search for one origin of a field as broad as this one" (Nöth 1994: 1), this concern is by itself a contentious approach in that semiosis can be a fundamental principle from which the disciplinary development stems. This is not to say that there can only be one type of semiosis, but rather that semiosis as a principle has to be taken seriously in the constitution of a disciplinary threshold. This particular problem brings out all sorts of related complications when dealing with what seems to be more developed layers of semiosis, such as those appearing as cultural aspects, thus this exploration will retain the biosemiotic aspect as foundational, that is, taking into account the so-called lower semiotic threshold instead of the higher distinction of the symbolic threshold (Deacon 1997) or the possibility of an emonic threshold (Kull 2016). A particular problem that we find here is arguing for the exactitude of the claims at the lower threshold, however. This chapter will deal with the problem of physiosemiosis, the validity of the concept of threshold and the first steps to take towards a theory of minimal semiosis. The reason to take physiosemiosis as a claim to be examined comes from the way the claim is grounded as initial for all semiotic possibilities and because, as we will see, it counts as a developed metaphysical background – and one of the most developed systems at that – for some form of semiotic exploration. This is significant because when referring to how semiosis works at its most basic level, we deal with theoretical assumptions that can shape the outcome of our theories of biosemiotics, as we will see.

#### 3.1. Causality and causation

The main normative principle I will use to describe theories of physiosemiosis is the distinction between prebiotic and postbiotic (Rodríguez Higuera 2012). Briefly, a theory of physiosemiosis is prebiotic if it assumes that sign action is effective without having to depend on actual organisms to be instantiated before even the existence of organisms, whereas a postbiotic perspective assumes that sign action can be possible based on organization, but modeled *after* them. I will only focus on prebiotic physiosemiosis here, as I think this is the area that



brings the most important discussion on the foundations of a theory of minimal semiosis. In particular, the hypothesis espoused by Deely (2001; 2009) is the main relevant axis for discussing the idea of physiosemissis.

In general, Deely's theory can be described by the concepts of semiosic causality and virtual relations, the first being the causality proper to signs (2001: 27)<sup>41</sup> and the second being the specific instantiations of semiosic potentiality without any actual cognition.<sup>42</sup> Both of these concepts give way to Deely's assertion that semiosis can happen in nature before the existence of actual cognitive agents. Semiosic causality needs to be seen in the larger discussion of causality and causation.<sup>43</sup> A descriptive stance of this causality is that it "specifies vital activity but specifies also the causality at work in chance interactions of brute secondness [...] making present what it itself is not" (Deely 2009: 115) bringing thus signs to action. It is just as important to add that semiosic causality is seemingly distinct from physical causality and not necessarily teleological (115). This sets semiosic causality as an effective base-level law. The question whether semiosic causality and semiosis refer to one and the same thing needs to be explored further. If semiosis consists in the *action* of signs, and semiosic causality refers to the causality *proper* to signs, we may be in overlapping grounds terminologically, but this does not imply that one refers exactly to the other. A way to conceptualize this is that, given that there are potentially different types of specific semioses, there might also be a more general type of semiosis that predisposes the existence of said specific semioses. However, that doesn't do justice to such a strong concept as semiosic causality. In order to clarify this particular issue, we might rely on the idea that semiosic causality works as the base-level law that allows semiosis to be an ontological property of the universe. A problem that comes from the previous formulation is that this causality implies a sort of dualism, for if semiosic causality is opposed to the physical, then it must lie on a second realm of existence. This perspective solves pretty much all of the problems of semiogenesis, for considering it as a base-level law implies that it is a principle that cannot be explored further. I am not convinced of this formulation because it seems like an unnecessarily powerful element, and while it does have large explanatory capabilities, postulating semiosic causality as a base-level law requires of something more telling than the fact that signs *exist*. But this is a point that needs further explaining.

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<sup>41</sup> I will use the concept of 'semiosic causality' to refer to this formulation.

<sup>42</sup> Nöth (2001) describes this as "the thesis that physiosemissis is the potential of natural objects to be taken as signs" (17).

<sup>43</sup> I make this distinction in what I assume Deely (2001) implies, that is, causality appears to be a sort of passive situation while causation is an active stance. Since semiosic causality appears to be a type of universal (Rodríguez Higuera 2012), the difference has to be taken on the way causality is used as a measure of difference from causation. A similar point is made by Hulswit (2004).

### 3.1.1. Semiosis and laws

Semiosis is the core element in all theories of semiotics, even if only implicitly. The problem of extending the powers of semiosis towards semiotic causality may not seem evident at first. In order to see these problems, it is necessary to observe the recourse taken in this extension. While the triadic formula of the sign apparently remains consistent, the fact that signs *can* exist indicates that there may be something *about* signs that *needs* to pertain to a base-level law for its effectiveness. The proposed evidence for this is the fact that elements in nature *may* introduce meaningful indications of something related to its past. Such would be the case of a dinosaur bone as proposed by Deely (2009: 119), bringing about a virtual relation. If this is possible, then there must be something about the universe that causes it, and being that interpretants are real and yet not physical, semiotic causality must lie on the opposite side of physical causalities.

I mentioned that the triadic formula remains consistent, but this is not entirely certain. A reflection on the terms will lead to pointing out some identification of sign, interpretant and object with elements in nature that *could* perform those functions (even in a completely random setting one could apply this identification and conclude with some success that the elements have indeed been identified), but problems become evident once we attempt to verify these claims. If we take Deely's previous example we have the dinosaur bone performing the role of the sign, its object being the actual dinosaur and its interpretant the geological stone formation which used to be a bone (2009: 119), but upon closer inspection, it seems unlikely that a geological process per se consists of an interpretant given its mental nature. A number of options have been put forth in order to provide support for this idea of the interpretant,<sup>44</sup> namely the Peircean conception of mind from synechism (Santaella 2001: 49) and the claim of a "natural Mind" (Taborsky 2001: 92), which work as an attempt to present a viable variety of monism. In both cases the metaphysics involved require instituting a base-level law to explain another base-level law. In general terms, even if we are charitable towards this inflationary ontology, we are bound to face important issues. Most importantly, an extreme ontological synechism such as the one required for the interpretant to work in a purely physical setting would require a series of mental operations that are actualized without any access to (complex) mental capabilities. In the case of the 'natural Mind', we face a similar twofold problem. First is the conflation of terms such as mind as it appears in different branches of cognitive psychology and philosophy with the idea of a different set of properties that resemble the more 'standard' conception of mind that is called 'natural Mind'; and second is the insistence on such property being capable of embodying semiosis. What can be said about both cases is that they argue for mental functions to be natural, which sounds like a good bet. But they also argue for the existence of these functions in the non-living in an axiomatic form.

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<sup>44</sup> Though not necessarily supporting Deely's hypothesis.

At this point it is necessary to revise the relation of these arguments to panpsychism.<sup>45</sup>

### 3.1.2. Panpsychism and pansemiotism

In extremely general lines, panpsychism is simply “the view that everything is conscious” (Chalmers 1996: 150). Similarly, pansemiotism can be construed as the idea that “every process in our world is defined as a process of semiosis” (Nöth 2001: 15) or that “every thing or process in the universe as such is semiotic, that *the universe consists of nothing but signs*.” (Deely 2006: 162) Both concepts are necessarily interrelated, but do not overlap completely. This is important in that pansemiotism and panpsychism have very different outcomes when considered ontologically. In the case of panpsychism, pansemiotism would most likely be an unavoidable result as a matter of reaction towards environments considering that if everything is conscious, there will be some type of perception and experience in everything, causing the possibility of perceiving signs in everything. But if we take pansemiotism as the base assumption, there seems to be a reversal of roles: The universe becomes intrinsically meaningful and reality becomes fundamentally noumenal. One idea that appears in pansemiotism is that interpretants can be implemented by physical systems without the need of cognitive processes.<sup>46</sup> Taborsky goes on to state that

The triad, as an irreducible process, includes codal processes that act to promote symmetry or cohesion. This is the referential focus, the representamen. And, it has two processes that measure instances or asymmetrical actualities; there is the measurement of the input energy, known as the object, which then becomes measured as the output, the interpretant. (Taborsky 2003: 11)

Despite the more idiosyncratic concepts used in this interpretation, it seems that its implication is that the physical composition or appearance of an object will become its interpretant. It is necessary to stress that this relation is metaphysically necessary in the way that it has been postulated. That is, no matter can appear to have a cohesive structure if it is not part of this relation. In other words, all matter comes to be because of semiosis. I have already dealt with the

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<sup>45</sup> Deely criticizes the concept (and the proponents) of pansemiotism because he does not believe that “signs are the whole story of everything” (2006: 162) so this does not apply directly to his argument, but it is still necessary to explore the possibilities of some potential supporting arguments. In this case, panpsychism provides a framework for physiosemiosis, even if it is not the variety that Deely himself espouses.

<sup>46</sup> A hint here is the quote that Taborsky takes from Peirce (2001: 88) stating that interpretants do not need to exist as long as they are taken for granted with regards to their future existence. This is certainly coherent with Deely’s statements about virtual relations as we have seen already. In any case, it is quite different arguing for nonexistent but future interpretants and for physically implemented interpretants, as we will see.

specifics of such an argument<sup>47</sup> so what I will focus on here is in how this can be framed more generally under the concept of causality.

### 3.1.3. Pansemiotism and semiosic causality

Semiosic causality is not necessarily pansemiotic in that it does not require to be the only basic ontological constituent of reality. A different way to state this is that semiosic causality may be one of the basic causes of reality without excluding the possibility of others. Pansemiotism can be understood, however, as the conception of semiosic causality as primary, considering radically that semiosis is the foundational basis from which other elements come to be. However, a pansemiotic account can be taken as a variety of semiosic causality given its status as a base level law.

In this way the general idea would be that semiosic causality is the essential law of existence, assuming that triadic elements can be implemented in purely physical interactions. But it would be the fact that semiosic causality is a base level law what would allow physical interactions to be fully implemented triadic relations. The premise itself appears described under the idea that the universe consists of energy, and as such “Energy is stabilized as a dimensional substance by being organized within codes of measurement. As measured in such patterns, energy is operative as “informed or interpreted” matter. The architecture of this transformation of energy into informed matter is semiosis or codification, which operates within a series of ontological and epistemological cuts that increase the asymmetrical gradients of energy which are then mediated or ‘sewn back together’ by complex semiosic relations.” (Taborsky 2003: 5). This means then that, at least under this particular variety of pansemiotic semiosic causality, the only necessary condition for things to come to existence is that semiosis acts on energy.

A pansemiotic account of semiosic causality will necessarily move the goal-posts by reworking semiosis as a physical process (such as the ‘encoding’ seen here) and so the primary assumption becomes normative, depending on an extended approach to semiosis – usually attributed and defended as a Peircean claim – to articulate the base level law. The question whether applying triadic models to different situations and calling them by the same name is not whimsical, and this doubt may appear clearer if we are to consider how implementations may or may not work in this particular argument. One of the most important claims is that the concept of mind should be seen as natural law (Taborsky 2001: 92) instead of a cognitive disposition, a natural universal. This would be akin to renaming the process of walking ‘gravitation’ and further assuming that since there are two related concepts the both of them must be causally equal.

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<sup>47</sup> In Rodríguez Higuera 2012.

The first and more evident problem with pansemiotic semiotic causality is that it insists on an unnecessary base-level law. To this we must add the conflation of concepts and imposition of triadic models with whatever seems to suit the idea that semiosis causes things to be (in) the world. The resultant model simply contains too large a metaphysical apparatus to sustain its own claims.

### 3.1.4. Non-pansemiotic semiotic causality

A non-pansemiotic variety of semiotic causality as the one that was mentioned before has more strengths when construing an argument for extracognitive semiosis. Framing a more logical variety of causality, where something enacts some power over something else, the variety espoused by Deely does not construct a metaphysical apparatus that reworks all base-level laws, but adds to them. Semiotic causality here is a necessary aspect of base-level laws, but by being complementary to them – that is, at the same level – it does seem to be in a more acceptable condition.

In general lines then, this semiotic causality relates to how a triadic relation can be implemented with the interpretant being only virtual and actualized later, bringing about a series of possibilities of description of the past and reference to a change in the future. This formulation is quite different to the pansemiotic semiotic causality, but the differences need to be further explored.

The element of the *vis a prospecto* (Deely 2012: 12) provides part of the groundwork in making the action of signs effectively causal, but beyond issues related to time,<sup>48</sup> it seems that the main application to this variety of semiotic causality lies in that referentially, the relation established in signs has the property of being implemented unrestrictedly by relatively independent means. That is, given that virtual relations are not actual but entailed in time, they do not need a present form to be considered semiosis according to this point of view. A different way to understand it is considering that elements inside virtual relations have the property of being able to cause an interpretant.<sup>49</sup>

### 3.1.5. Things and objects

Deely uses the concepts of things and objects as differentiated to relate them to an external reality and things that have become signs. Things are explained as "anything as existing whether or not any organism has an awareness of it" (Deely 2003: 8) whereas objects are defined as "anything cognized or known as

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<sup>48</sup> I will simply skip the temporal implications of the proposition because I do not think their application as a specific subset inside the typological construction of the hypothesis provides much in the way of an explanation and taking it at face value works for the most part in a straightforward manner, as I will try to show.

<sup>49</sup> This is akin to Nöth's interpretation as it has been mentioned before.

such (anything apprehended in whatever way)" (Deely 2003: 8),<sup>50</sup> which is coherent with aforementioned concept of virtual relations. The leap from thing to object could be explained by the advent of virtual relations. What this relation between things and objects doesn't say though is where the limits of the things as translated to objects are set. If we are to work with these concepts as part of semiotic causality, then we must make the assumption that while things and objects cannot be the same, because perception is relative to the perceiver, they necessarily overlap to some extent, for if things can become objects that are related both to the thing and the interpretant, then there must be something about things that allows this process to happen. At a certain moment in time thing X may be perceived as object Y because of virtual relations, but since there's no need for a cognitive agent to entail Y, X must have the property of being perceived as Y (as long as it happens to be in relation to a specific interpretant). Roughly, things have the property of being able to be perceived. This may sure not be an elegant way to put it, but it seems necessary to continue with the argument for semiotic causality.

In order to make the assumption that one of the base level laws pertains the action of signs, and that the triadic relation cannot be active at all moments in time (because cognitive powers are not necessarily present in all situations), but that it must still hold in some way, then we need to either assume some specific and complex time relation that is not attractive not because of its counter-intuitivity – this is not good enough a reason – but because of the implied requirements over other base-level laws that render them inviable; or we need to focus the proposition on the corresponding elements that allow it to be viable. I am of the opinion that this second option is less problematic when dealing with the argument, and so it would make sense to talk about semiotic properties as an ontological characteristic. If such is the case, then semiotic causality is partly entailed because semiotic properties would be part and parcel of the constitutive elements of reality. The relation goes then as follows: Given that all elements of reality have semiotic properties, that is, can be perceived as signs, it follows that semiotic properties are fundamental and shape their perception by a perceiver in a relation to the perceiver's capabilities and the properties themselves. The idea is that "the sign determines the interpretant but determines it as a determination of the object. The interpretant as such is determined by the object insofar as the interpretant itself is determined by the sign" (Santaella 1999: 515).

Semiotic causality needs to be thought of under the premise of semiotic properties to make sense of its status, and ascribing semiotic properties solves some conundrums related to virtuality. In this sense, we would be speaking of a noumenal reality whose connection to phenomenology comes to be via semiotic properties. However, the attempted distinction here is only a terminological shorthand because one of the attempts of the hypothesis on physiosemiosis and

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<sup>50</sup> A more complex treatment of this distinction can be found in Deely (2009a).

semiosic causality is to develop a way of monism<sup>51</sup> through the concept of semiosis.

### 3.1.6. Phenomenal properties and supervenience

One important point here though is that semiotic properties are not independent. That is, semiosic causality as a whole depends on semiotic properties and phenomenal properties of some sort,<sup>52</sup> this being then the metaphysical necessity implied by virtual relations. If we take the strong formulation of virtual relations under the condition of *vis a tergo*, it follows that phenomenal properties are necessary for semiotic properties to have an effect. In fact, there cannot be one without the other because of the temporal implications and metaphysical necessity as expressed above. These phenomenal properties need not be strong to work in the theory, and they certainly cannot simply emerge because of semiotic properties, for they are interdependent. If these phenomenal properties are not of a strong variety,<sup>53</sup> we can talk about *protophenomenal properties*, which “are special properties that are not phenomenal (there is nothing it is like to have a single protophenomenal property), but that can collectively constitute phenomenal properties, perhaps when arranged in the right structure” (Chalmers 2015: 259).

Something that stands out here is that by this argument semiosic properties entail some degree of panpsychism, which is clearly something not intended by the non-pansemiotic variety of the hypothesis. If we are to entertain this position, then we end up with two sets of non-physicalist ontological properties, and a serious case of property trialism. But the most important aspect to take home in this case is that phenomenal properties can take part in semiosis without the need of semiotic properties, which is a big drawback for arguments favoring semiosic causality. The problem stems from the fact that semiosic properties cannot entail phenomenal properties, but phenomenal properties do not need semiosic properties to be effective.

To put it in perspective, we would need to consider the following: Semiosic properties need phenomenal properties to be positive in order to exist as a relation, but if we invert the order, phenomenal properties do not need of semiosic properties to cause a relation unless we deny the world except as a condition of the necessity between semiosic and phenomenal properties. If we consider phenomenal properties first, semiosic properties could be taken as an emergent process from the fact that there are phenomenal properties but they would not have the same ontological character. What’s even more troubling is

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<sup>51</sup> This attempt is also attributed generally to Peirce’s “radical antidualism” (Santaella 2001: 50). The connection between mind, matter and causality from this perspective is further explored in Santaella (1999).

<sup>52</sup> I am considering phenomenal properties here as “properties characterizing what it is like to be a subject, or what it is like to be in a mental state.” (Chalmers 2002: 271)

<sup>53</sup> Even in this sense it would be hard to make sense of them from an outside perspective.

the fact that there is no need to have such properties because the characteristics of the external world are perfectly supervenient on physical facts. Semiotic causality cannot be nomologically necessary.

The implication of this point is that perception, and thus semiosis, does not need to be established via a different fundamental law beyond the fact that there is cognition. If semiotic properties do not hold, then physiosemiosis cannot hold either.

### **3.2. The association to a theory of minimal semiosis**

The main problem posed by physiosemiosis to a theory of minimal semiosis in biosemiotics is that the concept is too far-reaching and, as a base-level law, it simply doesn't need to be considered in terms of minimal.<sup>54</sup> It is nomological and that's where it ends, for its explanatory capabilities can also comprehend all dominions under the same guise. But the fact that phenomenal properties do not need of semiotic properties to establish a relation towards the environment poses a bigger problem for physiosemiosis, hinting at the idea that semiotic properties are either not necessary or emergent from the physical in relation to the phenomenal, not the other way round. With this in mind, it seems necessary to explore the issues of emergence and supervenience to consider the way a model of minimal semiosis might work. As it stands, physiosemiosis is not only problematic, but it doesn't bring answers with regards to the necessary conditions of semiosis either, and it faces enough internal contradictions that prevent it to be a suitable candidate for both a base-level law and a condition to establish minimal semiosis in its current formulation.

In the following chapter we will examine some questions on the description of semiosis once we have moved past the idea that semiotics describes fully fledged meaning from a prebiotic position.

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<sup>54</sup> Or maximal, for that matter.



## 4. DESCRIPTIONS AND THE TASK OF NATURALIZED SEMIOTICS

When confronted with the question of what you had for breakfast, you may reply, unfazed, that you had toasts with butter and a café au lait. You may also say that you had bread and coffee and leave it at that. This is hardly a problematic situation, but it exemplifies an important characteristic of the academic endeavor. Our theories about the things we want to talk about will be defined by the way we frame our objects of study, and the act of framing implies a certain underlying theory we ascribe to when dealing with a particular field of knowledge. This is uncontroversial, and it is an important cornerstone of the special sciences.<sup>55</sup> In the case of biosemiotics, however, the postulate that semiosis is central to the discipline seems at odds with the difference the concept receives in its description, with disparate properties and predicates that may pick out more (or less) than what might be expected from such a central object. And even though idiosyncrasies are not undesirable, there is a great gap between the core concepts of different theories of general semiotics that affect the way biosemiotic explananda are developed.

The objective of this chapter will be to analyze what goes into describing semiosis from a general semiotics that accept biosemiotic premises, whether the concept of semiosis can be individuated, and whether we can exclude some forms of description based on their explanatory powers.

### 4.1. The idiosyncrasy of the description of semiosis

At its core, semiotics does not possess strongly fixed concepts because a great deal of semiotic terminology depends on the adherence to or rejection of some arguments based on the quandary of whether some concepts are compatible with some other concepts, mainly the Peircean and the Saussurean. This has been repeated ad nauseam throughout the history of semiotics as an established discipline,<sup>56</sup> but for biosemiotics, this dilemma appears in a completely different way.<sup>57</sup> When I talk about general semiotics, I wish to convey the idea of a semiotics directed to different applications, yet having as its basis the biosemiotic, that is, the “theory of semiosis in living systems” (Emmeche et al. 2002: 26), which is an extremely wide guideline that provides a robust enough ground to intuitively consider it foundational, but this is an issue I will return to later. For a general semiotics that considers the validity of biosemiotics, the

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<sup>55</sup> In the sense of Fodor (1974).

<sup>56</sup> Take, for instance, Jakobson (1980 [1975]).

<sup>57</sup> However, some current efforts on consolidating and cataloguing the usage of relevant concepts to biosemiotics have provided an initial understanding of relevant differences in such concepts as agent and agency (Tønnessen 2015a) or Umwelt (Tønnessen; Magnus; Brentari 2016).

problem does not lie so much on the compatibility of founding schools, but rather on the way the elements of the theory of a general Peircean inclination, if we are to believe the extensive references in most of the current literature fit and provide explanatory power. That is, different perspectives in the area of biosemiotics will differ in how they treat the more general concept of semiosis. My claim, in any case, is that the core concepts of biosemiotics are necessarily the core concepts of any theory of semiotics, but this is something that can and will be disputed. It is because of that that this will not be a rundown of the different concepts of semiosis, but rather it will be directed to talking about the principles and properties that delimit or expand the concept.<sup>58</sup>

It is important to note how the concept of semiosis is introduced though. Peirce, as we've seen before in Chapter 2, describes semiosis as "an action, or influence, which is, or involves, a coöperation of three subjects, such as a sign, its object, and its interpretant, this tri-relative influence not being in any way resolvable into actions between pairs" (CP 5.484).<sup>59</sup> In a more modern setting though, a simpler (but perhaps just as ambiguous) way to put it is talking about semiosis as "the action of signs" (Cobley 2010: 318). General concepts serve the purpose of grounding some general categories and possibilities of the research program, but this doesn't put an end to the discussion and starts with direct applicability, because the metaphysical underpinnings of different semiotic programs provide different frames that can (and should) be discussed according to what we may consider as their adequacy or necessity.

In that sense, the first questions to ask are, why is the concept of semiosis necessary, what are the properties of this semiosis we speak of, and what does it explain. Core concepts of a metaphysical nature will tend to be idiosyncratic in that our definition of them will depend on what properties we want to accentuate or even propose in order to make our theories work. And while abduction in the Peircean sense may make that idiosyncratic propensity a regular matter for our definitions, the inferences we make for our concepts could benefit from a context-based approach.

In the conception of semiosis, we may want to use the original Peircean formulation to address the phenomenon of individuated apprehension of certain elements in the world. We may also want to consider whether this 'tri-relative influence' is in any sense nomological, that is, lawful, or we may want to justify our theories of reference by construing semiosis as a mechanism of cognition.

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<sup>58</sup> For a review of different possible conceptions of semiosis, even in the case of authors who never used the concept, Nöth (1990) provides a wide range of explanations. As mentioned earlier, Krampen (1997) also provides a thorough overview and representation of definitions.

<sup>59</sup> On the conception of the semiotic endeavor, Peirce considers it as "the doctrine of the essential nature and fundamental varieties of possible semiosis" (CP 5.488). It is important to see how this echoes with the division between general semiotics and the ramifications of the field. And it is more relevant when we consider that this basic formulation can be construed as supporting the role of biosemiotics on at least the level of general semiotics. Talk on the semiotic threshold, however, has to be put aside for now.

While all these conceptual forms may share some points, they pick out different properties. In other words, they refer to different aspects of things that may not always correspond to the totality of a certain phenomenon. And this takes us to a different question about the nature of semiosis, whether it can have such properties at all. Deeper metaphysical considerations aside, a theory of general semiotics that accepts some level of biosemiotic premises has already made some commitment to specific grounds, these being the fact that signs are part and parcel of the natural world<sup>60</sup> and that there is something about the world that allows us to speak of semiosis.

## 4.2. Semiosis and the natural world

The commitments that come from accepting biosemiotic premises can then inform our descriptions of the phenomenon of semiosis, but what matters is reaching a concept of semiosis that makes sense in the light of these commitments. That is, if we accept biosemiotic premises, then we need to make sure semiosis is effective in different types of living organisms. In any case, semiosis is not detached from signs, not only because general definitions dictate it so, but also because it would make no sense to individuate them without considering the intersection between the elements composing our definitions. But can we individuate semiosis? The answer is nothing short of ambiguous. If we take relations to be the defining characteristic of semiosis, we will be able to state that it is the relations that form semiosis, and thus we may construe semiosis as a phenomenon that emerges from the elements that compose the relations. We may, however, oppose this and state that it is because of semiosis that such relations are possible, or we may consider relations as processes and take them to be ontologically sufficient.<sup>61</sup> We may also consider ‘the action of signs’ as a causal matter, for if there is an action, there must be some formal entailment from signs to topology and not vice versa,<sup>62</sup> a rather counterintuitive assertion that seems to invert a more minimalistic naturalist view, depending on more metaphysical devices. I have already argued for a commitment to deflationary ontology when dealing with semiosis, but it is important to state how necessary it is for the same naturalist commitment of biosemiotics. If a theory of general semiotics accepts as true some of the principles of biosemiotics, then the same commitment to naturalization has to be accepted as true, eliminating the unjustified *a priori* conditions that could explain other facts about the world. More generally, I think this point is valid as a way to deal with our context-

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<sup>60</sup> This should not be confused with a full naturalization of the elements in semiotics, as some of the elements in these explanations may retain aspects that are beyond the scope of naturalization with regards to base-level laws.

<sup>61</sup> Bains (2006), following Deleuze, offers a discussion on the topic of the modality of relations against apparently ‘essentialist’ philosophies.

<sup>62</sup> That is, when the material conditional  $S \rightarrow T$  is true and it is not the case that  $S$  is true and  $T$  is false.

based assumptions regarding the nature of semiosis. If we allow that semiosis exists in some form, we also have to consider what properties it has, and if we allow that at least some biosemiotic premises are true, then we have already made some assumptions regarding semiosis.

It is important, still, to avoid mistakes in categorization, for if semiosis happens to be a process of signification in perception of living organisms, we cannot call semiosis a mode of existence of signs as well, for both definitions, if they are part of the same theory, will not amount to the same, picking out different properties that only have some things in common without necessarily referring to the same object. It seems that the form of the widest possible definitions imply a specific type of action, and whether we are dealing with prefixes or not, we cannot ascribe the same object to different definitions without running into one or more problems. Let's say we consider the 'action' definition as the basic property of semiosis. By stating that semiosis is the action of signs and giving it a causal form, we may wonder what the parts are in this causal relation. If semiosis holds as a sign causing a sign, we may be tempted to give some agentive power to signs. Notwithstanding the seemingly correct formulation, there is a lot left out when taking this at face value. By assigning agentive power to signs, we are putting a weird form of an argument that says that a sign has, on its own, power to act on the world. So not only does the sign exist, but it is also an independent entity (that is, non-relative and non-relational) that has the power to influence the world according to the previous claim of entailment. This brings a lot of questions, many of which do not seem well focused, especially those related to the modality of the sign. If at the same time we argue that there's a prefixed type of semiosis (such as, say, the semiosis of TV ads), how is this supposed to make sense under a literal form of the 'action' definition? Not that this argument cannot be construed, but it makes little sense to explore it by making two independent concepts work as if they were one and the same.

### 4.3. Semiotics and the special sciences

An important question that could possibly help in dealing with such definitions is considering the role of semiotics among other ways to know about the world. This evidently refers to how deep semiotics goes in the chain of disciplines. Does it explore laws over which allegedly everything else can be construed from, much like physics? This issue has more to do with how we perceive reduction and reductive explanations in semiotics.<sup>63</sup> We will talk more about reduction later on, and for now we will focus on the possible levels of explanation given to biosemiotics. Again, the significance of this discussion is that it allows us to understand the implications that follow from assuming, for

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<sup>63</sup> We may reject this idea, but that would entail rejecting the biosemiotic commitment to the naturalization (at least to some extent) of the ideas applied in semiotics, which would imply scrapping any deflationary ontology in favor of an inflationary perspective.

instance, that semiotics describes something so fundamental as to stand as a measure of the coming to being of things, or the limits of biosemiotic explanations when taking the concepts we use seriously. First we will explore a ‘causal’ level to ask whether it is justifiable to talk of a fundamental semiosis much in the way we explored it in the previous chapter, and then proceed to a ‘non-causal’ level that is more limited in its explanatory power.

#### 4.3.1. Causal level

The first matter to explore is, if we consider semiosis to be a fundamental element of the world with other elements explainable through it, then that means we may be able to reduce other matters to semiosis. On the other hand, we can also wonder whether semiosis itself can be, at least partially, reduced to some sort of physical truths. If semiosis corresponds to a base level law, we may have to adhere to the necessity that can be inferred from Peirce in his statement about semiosis. In order to analyze the plausibility of this claim, we need to consider how higher order phenomena can be reduced to signs. Intuitively, this implies a type of pansemiotism, that is, the reduction of everything to signs. The poverty (or extreme explanatory power) of this alternative makes it a less plausible claim. However, we may try to salvage the claims if we construe this theory not as a singular causality but as one among others, such as some sort of physical causality. But a justification can be hard to find in this particular case. If we consider that “any instance of a higher-level phenomenon occurs by being realized by a lower-level phenomenon, and it can therefore be explained in terms of its underlying realizer” (Kim 2010: 210), then we should be able in principle to explain higher-level phenomena through a semiotic explanation,<sup>64</sup> at least to a certain extent. We need to make this compatible with the metaphysical claim that comes from Peirce, this meaning that in order to achieve a semiotic explanation under this account, we would need to secure the nomological ground of the “tri-relative” influence. Things get all the more complex here, for taken at face value, the Peircean predicate seems to be extremely general, thus making the task of securing truth fairly easy. Yet, if we try to protect the unresolvable tri-relativity, then we need to find a way to avoid reducing the elements of any of its element to other type of causal relation.

In order to see if this holds, we may imagine any sort of relation in the physical world and then invert this and see if it is possible to do so in a ‘semiotic world’. If we take the implementation of semiosis first proposed by Deely (2010: 119) and assume this unresolvable triad to be ‘dinosaur’-‘dinosaur bone’-‘geological stone formation which used to be a bone’, we need to see how these elements can be held as a necessary law. But this implementation fails to represent a law, for even if we agree that the elements present at some point can be seen to need each other in a way that we could call nomological, the elements

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<sup>64</sup> We may also be aware that a higher-level phenomenon may receive more than one reductive explanation (Kim 2010: 210). In principle, this doesn’t harm the argument.

in the alleged relation do not *need* the other elements.<sup>65</sup> The objects in the relation are not metaphysical simples and can be realized purely physically at least in one part of the relation. But even more importantly, not all dinosaurs and their bones have become such geological structures. It is highly plausible that many of the bones left by dinosaur corpses did not become the same type of geological structures, exemplifying interference from below and precluding so the construction of a law based on this relation. In other words, “conditions at lower levels such that were they to occur, the law would not hold” (Kim 2010: 295). This, however, may be obscured talk on paleontological generalizations and as such we may not find truths regarding semiotic facts. A different example may be of use using simpler elements. Say, we may want to follow the lead from the first example, but applied to microphysical entities. Maybe our example could include individual photons, assuming such entities to be metaphysical simples.<sup>66</sup> But how can we conceive of such a relation when dealing with microphysical truths or metaphysical simples? The problem with attempting this exemplification is that metaphysical simples will not be precluded from existence if they are not under a relation.<sup>67</sup> At a glance, it seems hard to sustain a perspective like this, and in many cases it would depend on higher-level objects to make the relation sustainable, falling again to the previously mentioned issues.

#### 4.3.2. Non-causal level

At this point the desire for a different way to deal with this situation seems completely natural, and so we would do good in considering a higher-level type of interaction, so to speak, in order to get either some form of reductive explanation of semiosis, if that is what we are after, or a type of regularity that does not need to be as strong as a causal law, which is as good an alternative as any. For this to work, we need to construe semiosis without the constraint of ontological irreducibility of the “tri-relative influence”, for even though this would apparently go against Peircean doctrine, it is not that radical a change. The indivisibility that is presupposed in the formula does not need to be part of the ontological plane. In fact, doing away with this principle from an ontological perspective does not affect multiple possibilities of implementation of semiosis in the natural world. I say implementation, however, because if semiosis cannot be construed coherently as a base-level law, then it must

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<sup>65</sup> Or rather, it is conceivable that we can remove one of the items without destroying the others.

<sup>66</sup> This follows the assumption made by Kim (2010: 301).

<sup>67</sup> One alternative to this is accepting that no metaphysical simples are possible; or that all metaphysical simples are triads. This seems unlikely for at least some level of reduction is intuitively apt to break the relation, returning to the ‘interference from below’ argument. A second alternative would be accepting some form of idealism, as it would make the mental instantiation of signs necessary even in these cases.

supervene on at least some microphysical facts,<sup>68</sup> instead of causing them. If this holds, we may then have to give up the idea that semiotics deals with laws, for semiosis is not only supervenient on such facts, but given this, it is also multiply realized. Thus semiotic properties are higher-order properties,<sup>69</sup> that is, causally heterogeneous because of its realizers, making the object of semiotics then “ineligible to enter into projectible generalizations, that is, laws, thereby failing to represent a homogenous causal kind” (Kim 2010: 308). From a different point of view, we may consider siding with a commentator of Peirce in the supposition that “*all* hypothesis somehow involves seeing a resemblance between the case to be explained and some general rule” (Rosensohn 1974: 95), especially if we consider that “what is *supposed* in hypothesis is that the *explicandum* is an instance (case) of a certain general rule” (95). If this is the case, then we have a reason to reject the previous arguments, perhaps stating that we do not have access to the adequate vocabulary to achieve ontologically unresolvable triads, but as we will see later, this is just as problematic.

The tension between these positions is related to nomothetic considerations, and we have not completely ruled out the discovery of laws from within semiotics, but considering the plausibility of the claim of multiple realizability when it comes to semiosis, then the chances of finding laws are marginal. To put it differently, the problem lies with the implementation of semiosis and the way the elements in semiosis do not have a single principle in their constitution. Elements taking part on the sign relation can be achieved through different means, and this will be even clearer when we consider the variability of the interpretant.<sup>70</sup> What is interesting is that this does not preclude any form of odd implementation of semiosis without any cognitive capacities. We have only moved from the claim that it is a base-level law to the claim that it is a higher-level phenomenon.<sup>71</sup>

But if semiosis is indeed a higher-level phenomenon, does this imply the possibility of reduction? Not necessarily. Yet this needs some explanation. We may have the tools to argue for a partial supervenience of semiosis on the physical, but this does not imply that the whole of the relation or relations is univocally so. Since we are not talking about causal phenomena in the sense of base-level laws, we might find ourselves in conflict with the possibility that semiosis could be implemented only through physical means. When we consider, however, the mental (or cognitive) aspect of the description of signs, we seemingly end up with something that is over and above the physical, thus irreducible in the previous terms. In any case, we have not made any particular

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<sup>68</sup> However, as we’ll soon see, this is not a definitive claim, for semiosis could not be reduced nor identified solely with those facts.

<sup>69</sup> In other words, special-science properties.

<sup>70</sup> Collier (2014) presents a discussion on this point.

<sup>71</sup> I have not factored in matters of time in the discussion, because I believe these can be discounted from the analysis without actually affecting the conceptual outcome. Counterintuitive claims that deal with changes in the time flow have to be taken carefully, though, and they can be taken to work as a type of *a posteriori* necessity. For the sake of brevity I have considered the intuitive view on time to be correct.

statement with regards to nonphysical entities in the world, leaving some ground for inflationary ontologies to take place. However, following Chalmers and Jackson, we could stipulate a “*minimal world*” (2001: 317) satisfying the conjunction of microphysical truths. This would make purely physical triads a viable alternative, but if we couple that with perception in cognitive agents, then it is not the case that semiosis can be fully explained in those terms, because then we would have to argue for the coherence of having two different phenomena as one. That is, a postulated physical interpretant<sup>72</sup> would necessarily have to be the same as a mental interpretant. That, in turn, would open a new set of problems with regards to the reduction of the phenomenal.

If we set aside the so-called physical interpretants for now,<sup>73</sup> we are left with mental interpretants (of the cognitive type). This matters because it allows us to envision the description of semiosis without an expanded metaphysical machinery to make it work, in a way closer to an expanded theory of mental representation, an ethological perspective or a wide hypothesis of perception. Since the idea of this chapter is not bringing a specific description, but rather the theoretical problems and principles of this task, it seems that making this assumption presents the right opportunity for descriptions to take place.

#### 4.4. Talking about descriptions

After considering the first problems of trying to argue for a fundamental semiosis and the situation with semiosis as a higher-level phenomenon, we may feel compelled to accept the second one as a more viable alternative for the descriptions to use in our semiotic theories. The implications then are, first, that semiotics can count itself among the special sciences, if that’s how we decide to call them. This grouping is desirable for the intent of critically assessing the role of biosemiotics when set within the larger crucible of related research.<sup>74</sup> On a hierarchical aspect, this is far from a “downgrade”, as it allows for more cohesion when considering general semiotics and its prefixed varieties (though this does not close the gap between them). But it is also a disciplinary reality check, and quite a needed one. A second implication is that by limiting ourselves to a higher-level description, we are making more grounded biosemiotic assumptions that are coherent with our commitments to some degree of naturalization in the discipline.

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<sup>72</sup> I use this as a general idea derived from the type espoused by Deely (2001a: 657), for instance. A different account linking the physical interpretant to Peirce’s energetic interpretant can be found in Sarbo et al. (2011:43); however, the two concepts are not to be exchanged freely.

<sup>73</sup> In order to reconsider this we also have to examine the possibility of instantiating semiotic relations in physical systems, and there is a difference between *prebiotic* and *postbiotic* possibilities.

<sup>74</sup> A criticism to the concept of special sciences can be found in Millikan (1999), but I believe lumping biosemiotics with the non-physical sciences, be those special or historical, instills the same point I am trying to make here.



There are some things that have been left aside in this chapter. One of them, as it has already been mentioned, is the issue of time concerning base-level law theories. It may be the case that this “tri-relative influence” is not metaphysically contingent and that assuming it so means falling for a modal illusion, but this would have severe consequences that would be better captured in determinism of a wide spectrum of phenomena.<sup>75</sup> As it is though, there is not much we can take from this area to solidify the counterintuitive view.

Another aspect that has not been touched is the discussion on sign causation,<sup>76</sup> so to speak. While the Peircean framework seems apt to work as a theory of reference, the question about the *action* of signs leaves another way to investigate the problem of semiosis as a lower-level phenomenon, for we can contrast sign causation with mental causation, and it would seem that there could be an opening for agency in signs or objects to cause signs. But roughly, this view would be incorrect, for topological aspects of the world need not be construed through an agential stance. By having a cognitive element in the description of semiosis, there is no need to propose an actual ground of sign causation (from the side of signs) if the minimal conditions for signs to exist can be given without it. A different, but related discussion could take the argument towards the expansion of semiotic properties, but this would also be a mistaken enterprise, for if we follow the previous idea of topology, said semiotic properties would not have any precedence over, say, phenomenal properties, with the latter being sufficient to dismiss the former.<sup>77</sup>

A final aspect that could be expanded is the problem of implementation of semiosis in nature, the specific forms of description and its requirements. The point has been to give an explanation of the forms that the description of semiosis can take and how biosemiotic premises seem to be of the essence for a general theory of semiotics. The boundaries we use in our theories must correspond to the explanatory possibilities of the discipline, and the expansion *ad absurdum* of said explanatory possibilities can only be detrimental to the health of the discipline.

In the following chapter we will focus on the concept of emergence as a way to make sense of the point of origin of semiosis. The philosophical explanations that come from the concept and its tradition should be examined in the light of their relevance to biosemiotics as a means to describe a possible basal conception of semiosis, essential to the continued discussion on some of the essential topics of biosemiotics.

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<sup>75</sup> In a nutshell, all semiotic phenomena would be ruled by this form of necessary determinism, a claim that can hardly be substantiated from within semiotics. Still, a different perspective on time can be found in Matsuno (2011)

<sup>76</sup> Not to be confused with causality of signs.

<sup>77</sup> This is not a definitive form of the argument or a definitive explanation, and it can be contested using an inverted formula with regards to phenomenal properties vs. semiotic properties. I will not explore this further here, but it seems to me that using the opposite form of the argument stumbles with the problems I have already mentioned with regards to base-level laws and semiosis.

## 5. JUST HOW EMERGENT IS THE EMERGENCE OF SEMIOSIS?<sup>78</sup>

The origin of semiosis is an elusive and complex topic that demands some attention. In defining its origins, we may talk about its diachronic dimension, that is, the original conditions for its first emergence, and its theoretical dimension, the ahistorical conditions needed for its existence. In the philosophical exploration of the topic we have to consider what emergence really refers to, what does it have to do with a definition of semiosis and whether there are alternative accounts to the idea of an emergent semiosis. As an option, we can have a non-emergent account of semiosis within a different framework, either assuming it as basal and setting the conditions for other elements to emerge; in reductionist semiotics; or in an account of biosemiotics that only requires the heuristics of a sign relation. In this chapter we will only review the former, but we will mention the latter in passing as a contrast to the possibility of emergence. For now though, reduction theses will be abandoned given their problematic requirements for complete identity claims with regards to the semiotic: If one is to reduce meaningful phenomena to identity claims on the physical world, we are left without a biosemiotics to begin with. Emergence is, for the purposes of biosemiotics, of definite relevance in that it makes some philosophical issues apparent: That if we talk about some point of origin of sign action, we need to address it conceptually, and that when we do, we make metaphysical assumptions regarding either the constitution of signs or their role in biological systems. This in turn translates into further assumptions about ontology that may derive in incompatible accounts of sign action depending on what our initial standing is. As such, it is useful to take into consideration the concept of emergence – whether we assume it to be correct for our theories of biosemiotics or not – as an avenue for exploring the presuppositions made by biosemiotic research, and that the problems faced by the concept, if treated within biosemiotics, will also have to be overcome by the discipline. The best way to deal with this is, then, by exploring the basic tenets of emergence and see where they take us with regards to semiosis. In this regard, what we will treat will again be only limited to the so-called lower semiotic threshold, our focal point for understanding claims about minimal semiotic capabilities.

### 5.1. Emergence and Biosemiotics

The concept of emergent properties, while common in the philosophical discussion on the origin of life and mind, has been historically less problematized in the study of biosemiotics. This may have to do with the programmatic approach stating that biosemiotics deals, among other things, with “the emergence of

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<sup>78</sup> A version of this paper has been published on *Biosemiotics* 9 (2): 155–167.

semiosis in nature, which may coincide with or anticipate the emergence of living cells” (Emmeche 1992: 78).<sup>79</sup> In other words, it would seem that emergent accounts of semiosis are some of the de facto preferred explanations for sign action.

The philosophical nature of this concept certainly requires a wider characterization, but in a nutshell, it refers ‘to the idea of ‘new properties’ showing up in systems of sufficient complexity’ (Stjernfelt 2007: 218). The relevance of the concept to biosemiotics becomes apparent when considering Sebeok’s axiom that life and semiosis are coextensive, as the origin of one will yield information about the other. This is not the end of the story, for in any case the axiom itself can be problematized as well as its relation with emergence. Semiosis could prove to be epiphenomenal to life in the same way that mental properties may be epiphenomenal to certain physical causes, but for the sake of brevity we will not engage in this argument.<sup>80</sup>

### 5.1.1. Characterizing Emergence

The history of emergence in philosophy is varied and interesting in its own right,<sup>81</sup> but the current literature focuses on a conceptual form that can be applied to both epistemological and ontological or metaphysical aspects, the first being related to the unpredictability of an emergent property, and the second, to the bringing about of new causal powers that did not exist previous to it (Kim 2010: 13). This distinction has also been called weak for epistemological emergence, and strong for the ontological or metaphysical one (Kim 2010: 86). Chalmers defines these two concepts more specifically by stating that “a high-level phenomenon is strongly emergent with respect to a low-level domain when the high-level phenomenon arises from the low-level domain, but truths concerning that phenomenon are not deducible even in principle from truths in the low-level domain” (Chalmers 2006: 244),<sup>82</sup> whereas “a high-level phenomenon is weakly emergent with respect to a low-level domain when the high-level phenomenon arises from the low-level domain, but truths concerning

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<sup>79</sup> It is important to note that this same description has been referred to in Brier (2010: 369) and Martinelli (2010: 194). Kull (2007: 4) also includes it among different approaches to biosemiotics. I will not try to document all possible perspectives, as it is beyond the scope of this research. The idea is, in any case, that the emergentist foundation of biosemiotics seems to be unproblematic except in its actual implementation, as we will later see.

<sup>80</sup> The arguments against the epiphenomenalism of mental properties could be reworked into arguments against the epiphenomenalism of semiosis stating, for instance, the relevance of sign processes for living systems, as opposed to the qualitative irrelevance needed to make the epiphenomenal argument work. This, however, is a different discussion altogether.

<sup>81</sup> See Stephan 2002 (25–26) for a historical survey of its stages in philosophy.

<sup>82</sup> While the language used by Chalmers in this initial definition talks about ‘phenomena’, the concept of emergence deals more often with properties.

that phenomenon are unexpected given the principles governing the low-level domain” (Chalmers 2006: 244, emphasis in the original).

This points to the fact that the two different varieties of emergence will play a certain role in defining what exactly it is we are dealing with when referring to the emergence of semiosis. Emergence should inform our views on what semiosis is and how it comes to be, and at the same time, the standing of our previous definitions of semiosis will also have a role in how we begin to frame emergence within biosemiotics. This is so because in postulating a conceptual apparatus for biosemiotics, we can revisit our initial assumptions in order to explore their validity, leading thus to the possibility of reformulating both concepts and assumptions in the theories we espouse.

In making a finer distinction between both weak and strong emergence, we can see how they diverge in a number of important areas, and what their implications may be for biosemiotics. In the case of strong emergence, we can further add that, at least in standard accounts, properties are said to be strongly emergent if they supervene on basal properties, that is, "if the same basal conditions recur, the emergent property will recur as well" (Kim 2010: 88).<sup>83</sup> While supervenience on its own may sound like a platitude, its effect in the argument is of strong importance. Say, the property of being round may supervene on the property of being a ball, this being a trivial form of the argument. When we refer to supervenience in the context of strong emergence, we mean that in an ontological sense. Mental properties, seen under strong emergence, would not be explainable to any degree even with a complete physical description of the brain. Strong emergence then would present an interesting philosophical option for biosemiotics when dealing, for instance, with meaning and its obtaining in the biological world if we can work an argument for that.

Weak emergence, in expanding the distinction between both the strong and weak versions, presents a more moderate case for speaking of emergent properties. This is so because we are only limited by the amount of knowledge we have about the potential properties that may emerge from a system, and with enough knowledge we could deduce the emergence of these properties based on their basal conditions. The main difference is that there are no deep ontological commitments as the ones that come with strong emergence. Weakly emergent properties may play a number of roles in biosemiotics linked with the study of complex systems, as we will see later on.

As this is not intended as a full exposition of the philosophy of emergence,<sup>84</sup> we will only focus on the main possible tenets of emergence for biosemiotics, their development and the possibilities they offer.

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<sup>83</sup> Supervenience itself, also called *upwards determination*, appears commonly divided in three different types, weak, strong and global, related to possible worlds (Kim 1984: 157). We will limit our talk on different types of supervenience to the common usage in standard discussions of emergence.

<sup>84</sup> A better place to look for such an exposition can be found in Kim (2010), Deacon (2011), or from a more general semiotic perspective, Szívós (2008).

### 5.1.2. What is a semiotic emergent?

Given that the current discussion lies on the context of biosemiotics, the question of what should be an emergent must be limited to the scope of semiosis. But can semiosis be an emergent, or should we focus on the particulars of a semiotic relation as individually emergent? Both possibilities must be explored in this case. What's more, both cases can be presented under the scope of strong and weak emergence.

In a systematic exploration of what semiotics deals with, starting from the Peircean perspective, one may be reminded how the semiotic endeavor is based on the study of the nature of semiosis and its varieties (C.P. 5.488), and that semiosis is the equivalent of the triadic action of the sign (C.P. 5.472). This much is made clear from a historical perspective by Nöth (1994). Peirce is essential for biosemiotics in that his conceptions of representation and meaning provide a robust background for the study of significative phenomena in the biological world that could otherwise not be attained by, say, considering chemotaxis as the ultimate indicator of mechanical action that *resembles* meaning. The idea that sign action comes into play even at the low levels of life is of the utmost relevance for the project of a naturalized semiotics – of which biosemiotics by definition takes part –, piecing together the main tenets for a more extended and robust philosophical background for general semiotics. To fit emergence in this picture, we have to analyze what elements would exactly be emergents and to what extent, ontologically speaking. Of note is Peirce's belief that "the problem of how genuine triadic relationships arose in the world is a better [...] formulation of the problem of how life first came about" (C.P. 1909, quoted in Romanini and Fernández 2014: 2), setting a strong precedent for the enquiry into the emergence of semiosis.<sup>85</sup> The concern regarding the possible point of origin of semiotic phenomena is embedded in the idea that we can apply our theories on signs to different levels of biological action<sup>86</sup> to the degree that we can inquire into the reasons behind the study of signs itself. Peirce himself considers at one point that universal laws have an evolutionary origin (C.P. 6.13) which leads to their lack of an absolute character. Kiblinger (2007) argues that this view on laws has an immediate convergence in a view of biological emergence<sup>87</sup> in that mechanical laws can only explain homogeneity, with the biological world abundant in heterogeneity (195). In this sense, emergence can aid us with finding specificity in some relevant topics for biosemiotics such as the differentiation between species and the value of meaning beyond basic mechanisms.

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<sup>85</sup> While it appears that Peirce considers chance as the best possible explanation, there is no reason in principle to stop there, as his remarks on evolution may suggest other possibilities.

<sup>86</sup> A notable contribution in this respect has been carried by El-Hani et al. (2009).

<sup>87</sup> The author refers to Kauffman's view on emergence, but these claims can be generalized without much trouble. It is important to note, however, that Kauffman is associated with weak emergence.

We may assume then, in general, that the idea of a semiotic emergent may have to do with either the elements of the sign relation being emergent to some degree, or to some conception of meaning as emerging from sign action. In both cases, there are interesting ramifications and implications to consider. In this chapter we will mainly treat the sign relation (object-representamen-interpretant) in order to analyze the usefulness of emergence for biosemiotics. Let us then first consider the triadic relation of the sign as a general account of meaning.<sup>88</sup> Strong emergence may reformulate it in such terms as to state that the terms of a sign relation may supervene on a lower domain, that is, objects (in the sign relation) would supervene on some (possibly physical) properties without itself being derivable from them. We will examine this possibility later on.

When framing the sign relation in terms of weak emergence, the treatment we have to give it will depend on whether we think that meaning emerges from sign relations (requiring us to give a separate account of meaning) or that sign relations *qua* meaning weakly emerge from a lower level domain and that we are missing some possibly physical details about how the terms of the sign relation come to form a relation in the first place.

A theory of emergence may help us explain how either a relation or the objects of the relation come to be, whether they can be explained independently and if they form a domain of their own. In the rest of the chapter we will refer to semiosis as both a strong and a weakly emergent phenomenon and see how these claims can be cashed out for potentially competing views in biosemiotics. In what follows we will take semiosis as the prime candidate for an emergentist account and respectively examine the plausibility of strong and weak emergence for it.

### 5.1.3. Semiosis as a strongly emergent phenomenon

If we are to consider semiosis as a strongly emergent phenomenon, then we must find how it is not deducible from the initial conditions. Now, the issue here is assuming what the initial conditions could be. The Sebeok axiom works as a guideline in at least making the case that semiosis must have started at the same time life did, but this is certainly not enough. Why should we accept that principle? It could have been the case that semiosis existed well before the first living things ever came to be, as theories of physiosemissis argue. However, if we want a prebiotic semiosis, we need to argue for the sustainability of a relation, which hits the key issue: being that semiosis is a relational phenomenon, we need to find how the elements fit the picture. For the sake of clarity, we may simply try to analyze the possibility of an abiotic sign, understood as a full triadic relation. With Champagne, we see though that “for a sign to be truly abiotic, confirmation that a sign-vehicle and object are abiotic does not suffice,

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<sup>88</sup> We will avoid the issue of representation and reference altogether to skip extra complexities in the argument. These aspects can, however, play a role in more developed accounts of cognition within an emergentist framework.

as the interpretant which such a pair produces must likewise not depend on a living entity” (Champagne 2013: 286).

The Sebeok axiom seems then safe enough an assumption for the sake of the argument. The point of making it a question of emergence still remains: How do we begin to deduce that with life comes semiosis? If we tweak the question to ask if it is possible to have a living agent without semiosis, the negative answer seems intuitively clear.<sup>89</sup> If there is a perceptive agent, it seems unlikely that it would perceive without the instantiation of any sort of relation. But we can exemplify this with, say, the chemotaxis of *Escherichia coli* swimming towards glucose. Stjernfelt argues that “the cell’s behavior forms a primitive, if full-fledged example of von Uexküll’s functional circle [...] connecting specific perception signs and action signs. Functional circle behavior is thus no privilege for animals equipped with central nervous systems” (Stjernfelt 2007: 207).<sup>90</sup> This points to the fact that semiotic relations can be determined by the composition of elements in the semiotic system, i.e., the perceiver and its environment.

If we move to the elements that conform a sign, there seems to be nothing about, say, a rock, that would imply its future becoming of an object. We may then ask whether there is such a thing as semiotic properties and if they are emergent. If we decide to shift the argument to properties, then we have to be clear about the possible properties we may want to postulate, and the clearest indicator would simply be the property of being an object, a representamen or an interpretant. Since we are dealing with the strong sense of emergence, we are most likely dealing with a set of phenomena that require new fundamental laws for their explanation (Chalmers 2002: 245) given the impossibility to use only the base level for their deduction. While some supervenient relations supervene with logical necessity, such as for instance being round metaphysically supervening on being a ball, others may be contingent, as supervening on a nomological law does not make the supervenience relation metaphysically necessary, for one may conceive of a law that is metaphysically contingent (McLaughlin; Bennett 2014). We may make a modal distinction in how we analyze the sign relation and say that semiosis holds with logical necessity, that is, it is necessarily true by definition. This would leave emergence out of the picture if we assume that the terms of the relation do not map into specific properties of the elements that may come into it. However, we can assume that the elements in the relation cannot be basally necessary but contingent in that they are not determined. Instead, they are heterogeneous and open to difference, which would mean that even if we can have a relation hold without emergence, we

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<sup>89</sup> At this point it is important to remark that, while inextricably related, the question of the emergence of life is not the same question about the emergence of semiosis.

<sup>90</sup> Stjernfelt carries out the rest of the analysis of chemotaxis through biosemiotic terminology, reaching the striking, yet not unexpected conclusion that “in the perception-action circle of a bacterium, we find some of the minimum requirements for semiotic processes: the self-regulatory stability of a metabolism involving categorized signal and action involvement with the surroundings.” (Stjernfelt 2007: 209)

could still have an open possibility to examine its elements as strongly emergent. Can we say that an object in a sign relation is strongly emergent? Taking into account that an object in a sign relation does not need to be a *physical thing* as long as it is part of an instantiation of said relation, and considering that in Peircean terminology the object is “that for which [the sign] stands” (C.P. 1.339), we may have to give some thought to the possibility that objects may be accounted for as abstract entities independent of any psychological power enabling the relation. The problem we face with postulating a strongly emergent object independently of the sign relation lies in that the object depends on the relation to be an object itself. It goes beyond the issue of accounting for an abstract object. If we wish to preserve objects as strongly emergent, our research must lead towards establishing certain properties that may be unique to objects. However, it would seem that the being of the object is always accidental in the sign relation,<sup>91</sup> that is, it is possible for things to be objects, but this is not due to their *objectness* so to speak, but to factors that come into play from a multitude of other sources. It would seem that arguing for a strongly emergent object<sup>92</sup> presents hardships that go beyond the scope of this chapter, however there’s a possibility of salvaging it via certain specific properties such as topology that *could* map into object-like properties, at least in an initial stage.

The case of the representamen may show a different picture, and so it also deserves some examination. The representamen, that “horrid long word” (SS 193), defined as something having the “character of a thing by virtue of which, for the production of a certain mental effect, it may stand in place of another thing” (C.P. 1.564), presents a special problem on its own. Being defined partly by the properties of the object and of the perceiver, we have a representamen that comes to be because of the instantiated relation. If we use a simple physical instantiation of the object, it will be both the topological properties of the object and the constraints in the observer that will give rise to the representamen. The property of being a representamen then falls into the possibility of other things in place. If taken like that, is it strongly emergent with respect to the sign relation? If we want to argue for that we would need to make a case for a specific way to account for the representamen not as determined by the other terms of the relation. As such, it seems a strongly emergent representamen should supervene on the sign relation, but this seems rather unconvincing in that the sign relation would be then basally a dyad. Perhaps a supervenience claim should be avoided in this case as it may easily be dismissed as a type of trivial logical necessity. However, a strongly emergent representamen could also carry a special emerging ontology if we can assign it to a certain class of representa-

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<sup>91</sup> Yet, once the object is part of the relation, we see that the relation, while not determined simply by it, needs it to exist.

<sup>92</sup> The difference between dynamical and immediate object does not have an impact on this conclusion as both are taken in the same relation.



mina,<sup>93</sup> most likely by also providing a ground for different ontologies in the rest of the sign relation.

As for the interpretant, that is, the “significate outcome of a sign” (C.P. 5.473),<sup>94</sup> its being remains determined by the conditions of the representamen and constraints in the perceiver, but also, one could argue, to other factors that may play a role in the conditioning of the perceiver as a secondary type of determination. That is, the interpretant is not independent, but presupposes a twofold organization with the sign relation and the history of the perceiver. The abstraction of the interpretant in the logic of relations does not do away with the need of a certain history of the system. This point is reinforced by Kull when he states that an “important property of semiosis, which makes it different from physical processes, is its historicity together with the ability for learning” (Kull 1998: 303).<sup>95</sup> The interpretant is defined by the relation, but the relation is not defined by the interpretant, at least from a point of view of its basic constitution. The task of a taxonomical approach towards semiosis and its possible types will not concern us for the time being, but suffice it to say the program of potential taxonomies is very much open to both its development and criticism.

The interpretant can be expressed in a number of forms without requiring a mental concept, making the term an abstraction for referring to the grounding of a semiotic relation. This is an elementary point to biosemiotics (Stjernfelt 2014: 13) and it is met with a need for complementarity referring to the description of the system instantiating the interpretant. Again, arguing for specific properties in the sign relation can be done, but it seems that these elements taken separa-

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<sup>93</sup> The option for physical representamina is explored by Deely (2001) a different philosophical perspective, but it is worth noting that the language used is perfectly valid in this particular formulation.

<sup>94</sup> This quotation is far from straightforward. Peirce goes on to state that “the example of the imperative command shows that it need not be of a mental mode of being.” (C.P. 5.473) This passage, in any case, discusses causation in different levels, starting with microscopic animals and continuing with verbal military commands, from where the reference to imperative commands comes. While naive in his psychological interpretation, it seems Peirce points to the fact that the interpretant is wider than the concept of a mental image or idea. A discussion on this passage can be found in Hulswith (2002: 140–143).

<sup>95</sup> An important passage from the same text states that

Semiosis, more shortly, could be defined as the appearance of a connection between things, which do not have a priori anything in common, in the sense that they do not interact or convert each other through direct physical or chemical processes. However, as far as the relation between them, once established (by a subject), is nevertheless intermediated by physical or chemical processes, this infers that the relation is semiotic as long as it is established through learning (Kull 1998: 303–304).

This is something to keep in mind when dealing with the possible properties of semiosis as an emergent phenomenon. The hierarchy between the elements of semiosis is not equal, despite the necessity of every element once the relation has been established.

tely bring more issues to the ontology of semiosis by apparently requiring multiple differential ontologies. If there can be a cohesive ontology for different types of strongly emergent properties, there is a chance such a view can take off as a more robust ontology for semiosis.

Perhaps, however, a more viable strategy is to argue that the sign relation altogether is strongly emergent from a set of conditions, not just in its co-extension with life but as part of the non-biotic world too. This is rather vague, so if we wish to preserve semiosis as strongly emergent, we need to make our case more specific. El-Hani et al. (2009) argue in one of the few instances of a defense of strong emergence of semiosis that, given an evolutionary set of natural laws – following Peirce – everything can be explained away in evolutionary terms containing a certain degree of indeterminacy. This is construed within a hierarchical structure for describing modal states of affairs, where emergents are “explained as the product of an interaction taking places at lower and higher levels” (140). Some of the further problems to be tackled in such propositions can be summed up in a robust ontological categorization of hierarchies, a demonstrability of non-trivial non-deducibility with regards to semiotic phenomena and a reevaluation of axiomatic premises derived from Peircean cosmology.

A final option, and perhaps the most controversial one within this specific section, could be the idea that natural laws *may* strongly emerge on sign relations, as hinted by Romanini and Fernández (2014).<sup>96</sup> While interesting, such an inversion of terms would go beyond the scope of this chapter, but it is still worth mentioning as an alternative to explore in further research. After having reviewed strong emergence,<sup>97</sup> we will now examine the possibility of weak emergence for biosemiotics.

#### 5.1.4. Semiotics and complexity

As Bedau notes, weak emergence “is now a commonplace in a thriving interdisciplinary nexus of scientific activity (sometimes called the “the sciences of complexity”)” (Bedau 1997: 375), and this claim has some bearing on some of the research programs involving biosemiotics. The connection between biosemiotics and complexity science has grown into the integration of specific paradigms and their application to theoretical biosemiotics as it can be seen from Deacon’s influential work (2011) and the more recent approach of Kauffman to semiotics (2012), to name only some of the more relevant sources.

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<sup>96</sup> The original quote states that “the laws of nature, which are all expressible by differential equations, might be semeiotic at the bottom, although of a degenerated kind” (Romanini; Fernández 2014: 3).

<sup>97</sup> J. H. van Hateren (2015) also proposes what he calls “a strong form of emergence” (403) of meaningful phenomena, but the argument proposed only seems to require weak emergence to hold.

This connection is far from being fortuitous, as the different research programs in biosemiotics include topics that are cross-disciplinary by nature. In Faria's overview, "our understanding of biological meaning, complexity and contingency is intimately linked to the theory of organic codes in Biosemiotics by one hand, and to some account of multiscale emergence formulated by sciences of complexity and philosophy of sciences by the other hand" (Faria 2007: 352). This link between biosemiotics and the sciences of complexity in their many flavors corresponds to the exploration over emergent phenomena without the common problems associated to strong emergence in the philosophical literature.<sup>98</sup>

Among the biosemiotic literature explicitly related to or taking from the sciences of complexity, cybernetics and systems sciences, notable examples include Wheeler (2006) and Brier (2008), and it has been thoroughly documented in Cannizzaro (2012). Since this is not a historical overview, this account should by no means be taken as comprehensive, as many efforts regarding complexity and cybernetics are being undertaken from different biosemiotic perspectives. The point I am trying to make here is that there is a very palpable interest in weak emergence from biosemiotics, even if it is not explicitly stated as such. For instance, Markoš has recently stated that "Emergence is a process creating complex systems spontaneously, 'out of nothing', from a singularity in some unstructured homogeneous system, and repeatedly under specific conditions" (Markoš 2014: 495) in the context of describing living systems as semiotic systems. This specific case sets some important conditions for the analysis of the possibility of emergence in living systems, and I believe it is firmly footed in the 'weak emergence' camp. We may recall that weak emergence "refers to the aggregate global behavior of certain systems [which] derives just from the operation of micro-level processes, but the micro-level interactions are interwoven in such a complicated network that the global behavior has no simple explanation" (Bedau 2002: 11–12). When we deal with repeatable, 'specific' conditions, we are already committed to at least the possibility of a principle of deduction<sup>99</sup> and thus our emergents will come in a weaker form.

It is important to note that weak emergence "does not yield the same sort of radical metaphysical expansion in our concept of the world as strong emergence" (Chalmers 2006: 250). A landmark example of weak emergence comes from the Game of Life, a cellular automaton model originally devised by John

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<sup>98</sup> In brief, Bedau maintains that "although strong emergence is logically possible, it is uncomfortably like magic [...]. But the most disappointing aspect of strong emergence is its apparent scientific irrelevance." (Bedau 1997: 377) On the contrary, "science apparently does need weak emergence." (Bedau 1997: 377)

<sup>99</sup> This may not turn out to be true if we hold that repeatable specific conditions do not need to have any explanatory value for emergents in that the property would not be deducible even if we are aware of what it takes for it to emerge. However, the fact that the specific initial conditions can be understood and even derived indicates that there may be a chance to reduce the possible emergents to monadic properties of some sort.

Conway (Gardner 1970) which makes an interesting case for unexpected and hard-to-deduce outcomes in a simple system.<sup>100</sup> How much of this applies to semiosis is nevertheless a matter of discussion, as the apparent differences between a rule-based simulation of cellular automata and the elements of semiosis may have very different outcomes and require slightly different approaches in their analysis. The point, in any case, is that evolutionary patterns in cellular automata may display a high degree of complexity in contrast to their simple underlying laws (Berto; Tagliaube 2012: 5), but this does not imply an over-and-above distinction of properties. The ‘rules’ of semiosis being established in the need for its elements provide a case for an immense variety of outcomes, something that can be attested to by the different attempts at sign typologies,<sup>101</sup> showing that at least in principle, the abstraction of sign elements does not need an extraordinary ontology to produce an ample repertoire of possibilities.

The important question here is then, how do we frame semiosis as a weakly emergent phenomenon? If the assumption that some background conditions are necessary for semiosis to exist – namely, a type of interpreter, an environment and habits *inter alia* – there is not much to add: Semiosis would be an emergent process by virtue of the predetermined conditions. I think, however, that this misses the point of the abstraction itself, not because it cannot be a weakly emergent process (or because it may be a strongly emergent process), but rather because it is conceptually true to the terms in the whole system where semiosis can exist. This, however, constitutes a different paradigm from the emergentist account of semiosis, and one that should be taken into account when dealing with the ontology of semiosis.

Another matter to consider is whether there is any form of causal power from sign action towards the lower levels. The concept of *downward causation* has been of ample relevance for the discussion of weak emergence, being defined as the idea that emergent properties may “be able to exercise their causal powers “downwards” – that is, with respect to processes at lower-levels, levels from which they emerge” (Kim 2010: 25). This conceptualization should drive home the need to postulate emergent properties to begin with as the point is that their interest lies in them not being trivial or non-causal.<sup>102</sup> Taken as such, downward causation has been postulated in biosemiotics through concepts like Hoffmeyer’s *semiotic causation*, the kind of causation “of *bringing about effects through interpretation*” (Hoffmeyer 2007: 152). Here the resultant effect of a sign relation would read as there being something that can presumably act

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<sup>100</sup> Conway’s Game of Life has some important traction in the discussion of determinism (Dennett 1991), but this must be set aside for the time being, though it can have some interesting and serious implications for biosemiotics.

<sup>101</sup> A good introduction to this type of research can be seen in Nöth (1990: 107–114), however, there are many specific variations and elucidations on the Peircean theme and its extension, such as the ones in Farias and Queiroz (2007) and Borges (2010).

<sup>102</sup> Similarly, there’s a conceptual difference between *resultant* and *emergent* properties, with the former being predictable unlike the latter. Regarding the extent to which downward causation is actual causation, a review can be found in Hulswit (2006).

upon the physical world after a sign relation has taken place. Giving a constitution to such causal powers is not trivial as it depends on overcoming the challenge of the causal closure of the physical, where every cause can be derived exclusively from physical causes. Either one must reject this causal closure or explain how certain causal powers that are not physical can be compatible with it (Macdonald; Macdonald 2010: 148). Downward causation can, however, bring enough explanatory power to biosemiotics that its strengths can outweigh these problems if they can be worked out. Emerging sign causality centered on a premise of complementarity of the physical with sign relations without reducing one to the other nor postulating a different base ontology has been defended in certain programmatic approaches to biosemiotics (Pattee 2005; Hoffmeyer 2007), but it remains to be seen if these so-called causal powers can be explained further in postulating a weakly emergent account of some sort of semiotic properties.

In any case, the view that semiosis is causally relevant for biological processes is one that has been held as productive in the exploration of the emergence of meaningful phenomena. Downward causation plays a formal role in defining then how emergent properties may have a causal role, however it does not explain exactly how they get there. The issue with non-reductive materialism, while still standing, has to be addressed head-on for a weak emergence framework to move forward within biosemiotics.

## 5.2. Reaching Semiosis

Both types of emergence present their own cases for exploration while also being faced with important philosophical obstacles. We have reviewed the main tenets of a potential emergent framework in its strong and weak flavors applied to semiosis. Strong emergence, being ontologically anomalous, confronts a hard problem in providing concrete cases,<sup>103</sup> but its semiotic application may allow us to provide a wide account of multiple semiotic phenomena by exacting a mechanism of ontological difference. The propositions in this area must still face scrutiny in the biosemiotic literature, ideally through a wider understanding of the implications of strong emergence for the ontology of semiosis.

The case of weak emergence, seemingly the more common avenue for proposing an emergent account of semiosis, doesn't present the ontological problems of strong emergence by its being construed epistemologically. However, the problems delineated above must be overcome to reach a more concrete, non-trivial view of emergent meaningful phenomena.

While it is important to note that there are ways to make arguments from both sides of the divide, it seems that biosemiotics lends itself more naturally to weak emergence, itself appearing compatible with notions of weak emergence

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<sup>103</sup> Chalmers sees consciousness as the only case of strong emergence (Chalmers 2006: 246).

of meaning without any special ontologies, that is, without further complicating the main metaphysical assumptions of a biosemiotic theory. Though this doesn't mean it is not possible to give a strongly emergent account of semiosis, the problems faced when taking that route have to be weighted in regarding its plausibility and principles for validation.

Despite the interest in and explanatory power of emergent accounts of semiosis, as it was mentioned before, there are non-emergentist options as well. Semiosis, taken outside of an emergentist framework, could be held as a logical truth characterized in the following way: The elements of the sign relation are real abstracts pertaining to a secondary level of analysis that can only be brought about with some underlying preconditions. This secondary level of analysis is logical in that its constructions and consequences are immediately deduced from the conditions established in the premises, at least at the abstract level. The point is that it should be logically impossible for a perceiver to exist without semiosis if we define signs through the abstraction of their elements. But for this logical relation to hold, there is a necessary semantic precondition, the actuality of the perceiver. The perceiver here is still to be taken *lato sensu*, but the logical picture still holds. One way to think about it is by drawing a comparison to tautologies. There is no logical possibility of a married bachelor, and in the same way, though less straightforward, the elements of the sign are true by virtue of the fact that they are the natural composition of perception at its most abstract.<sup>104</sup> Could we argue for contingency in the sign relation itself as opposed to talking about the contingency of the elements in the relation? The idea that we could have a representamen without an interpretant should intuitively be answered in the negative, but that doesn't preclude the possibility of an argument in its favor.

The options of strong, weak and non-emergence can all provide competing accounts of semiotic phenomena, yet all of them are grounded in metaphysical assumptions. In examining and characterizing those assumptions, we can reinforce our theories of biosemiotics to have a critical philosophical understanding of their implications and points of contingency, while also making a dialogue between poles clearer with conceptual distinctions taking a central role in how we frame the basic elements of sign action. This opens several avenues of research that can have a lasting impact in both the philosophical arena of biosemiotics and its potential modeling of sign relations in the biological world. The different examples in emergentist accounts of significance in the biological world, such as Deacon's work on autocells or autogens (Deacon; Sherman 2008; Deacon 2011) or El-Hani et al.'s conception of a hierarchical strongly emergent semiosis (2009), provide us with a great deal of research with a strong

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<sup>104</sup> There is a different issue altogether with whether we should characterize all semiosis as perception. This will not be treated here, but in principle I do not wish to characterize all forms of sign usage, especially at the higher levels of cognition, to be based on the same principle. See Marcus (2001).

philosophical dimension that can play a role in further articulating theories and models of biosemiosis.

In the next chapter we will treat the concept of modeling, making use of a concept of minimality to analyze what it takes to give a parsimonious account of semiosis, how to deal with the object of modeling and how this is treated within biosemiotics. The issue of models is an essential topic across the different branches of semiotics, and one that has a deep impact in the way we present our theories.

## 6. MINIMAL MODELS AND MINIMAL OBJECTS<sup>105</sup>

Models deal with the abstraction of objects – of a specific science, for the most part – in order to bring analyzable elements to the forefront and constrain the possibilities data gives in order to present a congruent picture of the object and the theory behind it. Note that objects are not defined in specificity or materiality, but rather as the phenomena that can be investigated through certain means. What this means is that the objects of our models will not necessarily be grounded in specific material objects such as vacuum cleaners or footballs. This chapter will attempt to give an overview of what a *minimal model* can say about its object while retaining the character of a model. But as there is no talk of models without their respective objects to a certain degree, I will occupy myself with the conceptual divide between a *minimal model* and a *minimal object*, both of which occupy a very different philosophical space but that must come into play in a relation that we must account for in our theories. Doing so will make philosophical commitments clearer and open new avenues for considering both consequences and applications of said theories.

The relevance of questioning, discussing and applying minimality is part of a larger debate on the principle of parsimony applied to different sciences. As we are concerned with semiotics, the issue will address the concepts of model and object from this particular standpoint, that is, without entering the realm of scientific models in physics and so on. With this in mind, there is a number of things to be discussed on the general relation of scientific models and semiotic models that can do much good to our understanding of models and objects, and that perhaps will help us in considering whether minimal aspects are of any relevance to semiotic theory.

### 6.1. The Meaning of Minimality

The first question that may arise from these concepts is the proper definition of minimality. What do we mean when we say that something is a *minimal* something with respect to something else? The concept of minimality is intuitive enough that we can imagine a minimal model to be *the least complex bundle of elements possible capable of accounting for the object or objects of our theories*, and while this basic definition will be what works in practice for the remainder of the text, we first must clarify some of the nuances implied in its formulation.

For starters, *minimality* will be informed by the mode in which we are operating. That is, when dealing with models, we invariably refer to the

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<sup>105</sup> A version of this chapter has been published as Rodríguez Higuera, Claudio J. 2016. Minimal models and minimal objects. In: Rodríguez Higuera, Claudio J.; Bennett, Tyler J. (eds.), *Concepts for Semiotics*. (Tartu Semiotics Library 16.) Tartu: University of Tartu Press, 234–248.



epistemological ground on which we are making certain mereological assumptions about the object (in the sense of how we frame and divide this object in itself). This in turn is not independent of some previous conception of the object, but what we think of as the objects of our theories – something that can be modeled by them – will require a different mode of characterization, the ontological one, no matter what our specific commitments to their ontology is. This point should be basic: That objects and models are not one and the same. While the questions pertaining the characters of models and objects will be taken up in the following sections, it is important to understand what the limits to each can be in order to know how both can be undertaken adequately by our theories.

Certainly, minimality is not a *necessary* condition for either, but it is a desirable element in a constitutive approach to any discipline for more than just elegance (without discounting the role this plays). The desirability of minimality is directly related to the mereology allowed by our theories. That is, to what degree we are allowed to create sets of different elements without running into internal contradictions, for minimal aspects bring about some core issues and questions regarding that which we talk about. Take, for example, an imaginary science about, say, pointy objects. We could be persuaded to include in our analysis a set containing the Eiffel Tower, a drawn triangle and a bee sting. The question then is what we do with such objects in our theory. Let's imagine that this science about pointy objects, or SAPO for short, only cares about the ontological property of something being a pointy object. Then we would need a definition of a pointy object, and this is where we see minimality in operation. Defining the core issue of the science at hand will lead to a number of constraints that make the operation of theories effective. So if we define 'pointy object' as 'anything that could cause a stinging pain if you touch it', we would have a base model for SAPO. This base model would then allow us to investigate the elements in the set we defined previously, and we would find that the set could possibly be invalid due to the Eiffel tower not necessarily causing a stinging pain if you touch it around its legs. But is the set we chose invalid for SAPO or is the base definition we gave in SAPO invalid? This apparent contradiction leads to an opening of the base ground that requires more definitions based on a number of questions. But then again, we could partially resolve this issue by providing a number of answers to questions regarding who is the perceiver of said stinging pain and what shape would be needed for considering something to be pointy. An answer to both requires some degree of consensus, but it is evident at this point that only having one positive result in one will not yield enough information for the model to be valid.

### **6.1.1. Validity of minimal aspects**

How do we reach a value of minimal validity then? What does it take for some theory or model to be minimally valid? For one, definitions set the main constraints, so validity has a semantic component to it. That is not to say

validity is *set* purely by the semantic values of the definitions in our specific science. Instead, there is an added component that goes without articulation in the definitions of our sciences. So in the case of SAPO, the questions we previously raised will yield specific answers that at the same time will have some previous constraint to them in the way we define the questions as well. When we talk about the ‘pointy objects’ of SAPO, we evidently refer to a previous definition that aims to open its own investigation. However, these terms are rather fuzzy and give way to conceptual puzzles. Fuzzy initial definitions must be coupled with questions of applicability and coverage then, and even at that point, if we are dealing with partial concepts, we will incur more potential contradictions. If this is so, then it seems minimality is nowhere to be found, as most of the questions will give way to a different question. However, minimal aspects, contrary to the previous idea, are available as part of the ontological commitments of the theories, including the definitions and the questions we ask about them. To expand on this, the sciences present their domains as limited to a certain *range* of questions. It would be unusual to ask about, say, the study of vacuum cleaners and ask questions about its minimality in recursion to the point of reaching a discussion on fundamental physics. The question of regression, however, is one of the fuzziest areas of the endeavor and we will return to it later.

How valid would it be to establish a minimal character for SAPO, and what would that do to the rest of the theory and its models? If we state that for something to be a pointy object, its tip must cause stinging pain on beings with reportability capacities, then we have a category ample enough to cover some of the most important aspects of the things SAPO wants to deal with. This in turn will have some long-term consequences, for it will be hard for our previous set to include the Eiffel tower and remain valid. Yet, minimality is not necessarily determined without the possibility of change. Instead, minimality provides the means to investigate further and provide later amendments through new models that can be consolidated with the previous ones.

## 6.2. The Character of a Model

Admittedly, the concept of minimality as we have used it right now only really applies to what we refer to as models. In the case of SAPO, it seems fair to consider that the questions we asked should yield enough information in order to come up with some minimal aspect to the theory. But we still have not characterized the way SAPO investigates its objects as defined previously. Instead of continuing blindly with the application of definitions, there is a need to come up with some form to tackle the objects in our science. For both SAPO and other types of inquiry, this will be theories and models.

### 6.2.1. Model versus theory

Importantly, model and theory are not exactly equal, but they overlap on a number of things. If we imagine a ‘domain of facts’ of which no theory is known, we can replace the domain of facts with a similar domain of facts for which theory is known to use a model and develop our knowledge of the domain of facts for which no theory is known (Apostel 1960: 125). What we can take from this view is that models may perform as theory for certain facts or phenomena. A second possibility is that our theories may be so complex in their totality that we may require a model simplifying some of its aspects to make the problems in the science soluble (Apostel 1960: 126). These two possibilities (among nine others given by Apostel) point to the fact that models may act as theories and act on behalf of theories, depending on the needs of our specific perusal, particularly in the case of the empirical sciences as Apostel characterizes them<sup>106</sup>. It seems to be the case, however, that theories can be set in two different extremes, either as syntactic or semantic (Frigg 2006; Frigg; Hartmann 2012), the first defined as “a set of sentences in an axiomatized system of first order logic” (Frigg; Hartmann 2012: 23) and the second as “a family of models” (24) without any formal calculus. While both can be analyzed in their own right, what I want to point out with this is that models are integral to the formulation of the science, no matter if we consider them univocal or as part of a family. As I do not intend to make this a discussion on the conceptual issues that arise from our conception of theories but limit myself to the application of minimal models and what they require, the point to take home here will simply be that models and theories are necessarily interconnected, with one and the other informing their own developments. Models, taking from Cartwright, may well mediate between theories and reality (that is, *representative models*) instead of being a system of axioms, or they may be concrete principles that bridge the abstract terms of the theory with another model (*interpretative models*) (Bailer-Jones 2008). With the possibility of making such differentiations, we may depend on what our standpoint regarding modeling is in order to reach a rather personal conclusion about the status of models versus theories, but for now we do not need to go that far.

### 6.2.2. Modeling models

The creation of scientific models is not a straightforward task and it is adjusted to certain parameters that will vary according to the needs of the theory or lack thereof. This does not exactly mean that all models are *ad-hoc*, however, since a model may take the form of a precondition before being established.

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<sup>106</sup> Apostel makes the point that the empirical sciences do not deal with the same type of axiomatizable formalizations that may be adjudicated to semantics or syntax, but this does not mean that it cannot be met with certain generalizing demands (1960: 159).

With that said, we should be aware of the fact that models can take many different forms when referring to scientific inquiry. Briefly, we may divide models into the grounds they cover or the purpose of their existence, but we may also talk about what it means for something to be a model and wonder about its ontology. As the latter question does not hold an important role for this particular chapter, I will avoid it almost entirely. Still, we may mark a differentiation between *material models*, that is, concrete objects that represent something in our scientific theories, such as a scale DNA model (Contessa 2010:217), largely uninteresting and irrelevant for the topic at hand, and other types of models, either *mathematical models*, which do not cover the whole spectrum of possible scientific models (Contessa 2010: 217), and *fictional models*, which “are typically ascribed to concrete objects and yet, unlike concrete objects, they do not exist” (Contessa 2010: 218). Beyond the question of potential paradoxes that arise from this particular typology, we find that scientific models are not limited to one specific form of representation.<sup>107</sup>

Briefly then, when it comes to functionality, models in science can either represent a way to deal with missing theory for certain facts; a simplification of the already complex theory; an interpretative bridge between theories; the means to fulfill some missing part of our theories; a method of confirmation of the previous theory according to new findings; a method for explaining certain facts that appear in our theories; a way to experiment on objects that are out of reach and obtain information about them; a structural description of our theories; or as a bridge between theory and observation (Apostel 1960: 125–127). This will be contrasted with the semiotic understanding of models, as we will see now.

### 6.2.3. Semiotic modeling and semiotic models

The concept of modeling in semiotics takes, however, a completely different form, which, while related to the conception of models in science, does not share the same definitions and moves away from the more formal model theory. That is not to say they are conceptually incompatible, but rather that they take from different theoretical backgrounds to work in their own metatheories. In fact, semiotics has a particular history when it comes to the concept of model and that of modeling, for “in semiotics models are based on a relation of similarity or isomorphism and are therefore associated to the iconic sign as understood by Peirce.” (Ponzio 2010: 267) This difference in scope makes the specificity of the concept clear when used in the context of semiotics. To make matters more interesting, the Tartu-Moscow school proposes a more committed definition for so-called *modeling systems*. In this case, J. Lotman defines model as “an analogue of an object of perception that substitutes it in the process of perception” (J. Lotman 2011: 250). This is expanded to the conception of

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<sup>107</sup> Frigg and Hartmann (2012) expand this typology to set-theoretic structures, descriptions and mixed ontologies.

modeling systems, both in their primary and secondary levels. A modeling system is defined by J. Lotman as “a structure of elements and rules of their combination, existing in a state of fixed analogy to the whole sphere of the object of perception, cognition, or organization” (J. Lotman 2011: 250), with the primary variety being first thought of as natural language but later extended by Sebeok (1989) to encompass communicational phenomena in non-humans (Kull 2010: 55). Secondary modeling systems would then first “describe the functioning mechanisms of systems using natural language as material” (Torop 1999: 10), but with the extended definition of a primary modeling system then we can settle for the assumption that “a secondary sign system is secondary only in respect of a given primary system” (M. Lotman 2012: 21).<sup>108</sup>

One important question that I will not take up here is whether language is a primary modeling system. This question has been treated repeatedly (Sebeok 1989; Chang 2003), but neither its positive nor negative answer will have an impact on the topic at hand. What I want to focus on at this point is the important differences and relations between both conceptions of model we have reviewed so far. So far, a salient aspect of the semiotic concept of model and its derivatives is that they are purely epistemological. A first thing that comes to mind is that the concept of modeling from the semiotic perspective is wider than what we have seen before as scientific models, and this much should be obvious. But to make it clear, a model in the semiotic sense (or at least from the perspective of the Tartu school) is grounded in empirical notions. It is interesting however to note that we cannot have all scientific models be based on empirical notions, as that would lead to a number of contradictions regarding some of the possible definitions for a scientific model, particularly those that use models themselves as theory. You could model some facts into something that has never been perceived and come up with a reasonable thesis about said facts. There is a number of possible ways to mend this claim. One would have to do with the fact that we can model the elements that derive from perception in a long chain of referents. In this case we could speak of scientific models that cover the facts that we have deduced over a different set of facts and so on. A second way to mend it would be to accept that the semiotic concept of model does not suffice for making scientific claims, though it can still suffice in making claims about the models we use to make scientific claims. Both options seem rather heavy-handed, making the difference between the concepts from each side steeper than what we could have imagined at first.<sup>109</sup> Perhaps a way to evade this possible debate is to consider that semiotic modeling in an ample sense must be prior to scientific models in at least the abstract conception of

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<sup>108</sup> That is, if we can assume sign systems are indeed synonymous with modeling systems.

<sup>109</sup> Fischer-Lichte hints at this when she says that art as a secondary modeling system ‘is substantially different from a scientific model. For the making of a scientific model is always preceded by an analytical act: first, the object is analyzed and recognized, then a model of it is formed. The artist, on the other hand, has a closed idea of the whole perceived and/or imagined object to be reproduced, and it is this whole that will be modeled.’ (Fischer-Lichte 1997: 309) The problem, however, runs much deeper.

both, for we may assume that, if the concept of semiotic modeling holds, it has to be achieved prior to the possibility of modeling other phenomena, empirical or otherwise.

Expanding on this, a terminological precision derived from Sebeok's take on modeling systems comes from the inclusion of the biosemiotic perspective – more exactly, the integration of Jakob von Uexküll's work on the *Umwelt* – to the premises already established by J. Lotman and the extension of the sense of primary and secondary modeling systems. Instead of going to repetitive definitions, we may point out that the reason for including the concept of *Umwelt* here is because we can assume it to be semantically related to the concept of model. And if that is so, then the *Umwelt* of an organism is a model or 'mapping' of the world with its meaningful elements (Kull 2010: 43). A later consequence of this thought is that all sign processes are acts of modeling by including "an organism's experience" (Kull 2010: 48) and the relation of the objects with that experience. Semiotic modeling provides modeling for models in the sense of assigning meaning to the elements as constrained by the models.

#### 6.2.4. Middle ground

We may still find a conceptual middle ground between the seeming disparity of the concepts used for models and their area of applicability. J. Lotman's concept of model is wide enough that it does not require an important or specific commitment – and this much is made clear by him (J. Lotman 2011: 250) –, but rather a general understanding that models are, to some degree, epistemological *representations*. We may remember as well that the object of a scientific model does not necessarily entail a *material object* – we may create scientific models positing existences that will turn out to be wrong – and in a (partially) Peircean fashion, we may then define models as abstract relation-types, a wide enough claim to provide a bridge between the multiple definitions of scientific models and those of semiotic models and semiotic modeling. In no case do we have to assume anything about the problem of the ontology of models, and so we can remain in the epistemological field. This is very good news for the conceptual work on models and how these can be thought of in different contexts. Contrary to the posited isomorphism or iconicity posited by Ponzio,<sup>110</sup> we do not even need to be committed to a type of similarity for the relation to hold. Again, the problem of positing an object that may turn out not to exist gives us enough to understand how the premise holds.

Completion and coherence of ontological assumptions aside, the fact that semiotics provides us with some tools for analyzing the elements of models does give us a big impulse in providing a conceptual schematization of what commitments theories make when positing models. That is, even if we cannot consolidate both sides of the concept, we can provide specific roles for them. If

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<sup>110</sup> This iconic reading has also been defended by Hauser (1991).

anything, given the varied nature of scientific models, semiotics can provide us with a way to regard the elements of theories from a general perspective. But more than just labeling parts of scientific models, when introducing an epistemologically robust set of concepts in the form of signs, and coupled with the existent possibility and variety of scientific models, we can come up with semiotically sound models to talk about semiotically interesting phenomena.<sup>111</sup>

This metatheoretical claim has, I think, an important value to be found when considering how we extend our models or constrain them in order to find out things about semiotic phenomena. Scientific models of semiotic phenomena can perform reductions and expansions depending on whether we have taken a bottom-up or a top-down approach to the object of research. Models, in any case, can be constrained to their minimality in order to study the essential assumptions of the elements in our ontology over which we can expand. It goes without saying that a minimal model will not be able to do the same tricks an expanded model can. We will return to SAPO to explore these claims.

### 6.2.5. Minimal models

At this point we can go back to the original definition given to minimal models as *the least complex bundle of elements possible capable of accounting for the object or objects of our theories*. Though it captures the essentials, we may not be exactly sure about how to tweak a model to reduce it to its minimal aspects. In the case of SAPO, how do we exactly declare the minimal model for exploring our Pointy Objects? The answer to that is that the minimal model would have, in its most basic iteration, to operate on the basis of the definition of the Pointy Object. What is it about a Pointy Object that makes it *at least* a pointy object? This question already sets enough of a constraint to generalize the activity of the model. If we are to examine the main claim, that there are pointy objects in the world, then we have to accept that pointy objects have, as a definition, a sharp tip and come in shapes that can cause aichmophobia. In other words, we depend on a verification claim that something can cause us pain because of their sharp end. Let's say that SAPO, as a science, wants to find out what is the exact property of being a pointy object. This would then constrain our model of analysis to solving the question of 'what is a pointy thing and how can we tell if it is.'<sup>112</sup> It is easy to notice then that the constraints lie first on the object of our model. The object itself – abstract or not – provides, via its definition, a set of rules for considering when creating a model. If we obviate this fact, we may end up with mereological sets that offer no apparent contradiction

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<sup>111</sup> While I am not making the claim that semiotics makes scientific claims, it is important to consider that it *may* do so.

<sup>112</sup> Note here that this is not the ultimate question, but rather a basal question that can be expanded upon without restriction. We could ask of SAPO to provide us with the most adequate way to maximize sharpness for creating new and sophisticated pointy objects, for instance.

but that are not tightly bound together or consistent within the set of definitions for the model itself. As previously, our example of including the Eiffel Tower in our set becomes problematic, so the answer to that is either recanting our position on definitions or simply removing the element from our set. This process *is* part of the concept of minimality when applied to a model.

A minimal model must then be robust enough to prevent it from being inapplicable. Instead of a feeble basic description, a minimal model must not be so wide as to be applicable to absolutely any mereological set we can come up with that has some syntactic similarity to the formalization of our theories. In addition, a minimal model must still represent the question of *what* with the idea of *not that*, that is, under the knowledge that the object of the theory is partly substantiated by the questions asked by it.<sup>113</sup>

We can expand models and create new models that have little apparent connection with it, as we have seen before. What is necessary to include in building our theories, however, is a core of assumptions that can be spelled out and that create the elements of the model, which can be described much like in a sign relation, based on definitions and implied variables for the object, its consequences and analytical possibilities.

### 6.3. The Character of an Object

As mentioned before, objects play an essential role in our theories, no matter what sort of existence we grant them. Objects in both described arenas of models and modeling are easy to apprehend and intuitive enough, but we may expand on them first and later think about the issue of reduction of the object in the light of a minimal model.

#### 6.3.1 Ontology, or not

The claim attributed to Peirce that objects do not need to be concrete in order to stand in the sign relation is perhaps the most powerful way to avoid the discussion on the ontology of objects here, for we may be committed to existences that may be proven false via the same models we construct, and the whole point is that the process of creating and updating models has as a condition that we can talk about our premises and see if they hold.<sup>114</sup>

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<sup>113</sup> This is a complicated matter and there is not enough room to take it here, but models and theories are not idealized in a vacuum with an object that is specified and singular from the onset. Instead, as I point out, it gets revisited and reconstructed along with the theories and models themselves.

<sup>114</sup> The distinction between *observables* and *names*, put together in the biosemiotic context by Barbieri (2015: 23–24), can present a similar argument when dealing with scientific models. The conclusions of adopting such metatheoretical model could, however, imply different results.



It is thus better to set aside ontological claims in the model, but interestingly enough, the model will do the work of carving out an ontological panorama of our theory.

### **6.3.2. Object in the sign relation**

The object of a model is not exactly the same as the object that we have come to know from the Peircean paradigm, but it is nevertheless related to our conceptual concerns. Quickly defined, an object in the sign relation is the thing for which a sign stands (CP 1.339). Evidently this definition is not sufficient in the development of semiotic theory, but it is necessary as one of the its building blocks. Given that we can frame scientific models as relation-types with objects in representation, we can make a wide ascription of analyzability to models as signs. The fact that the object of the sign relation is abstract opens up this particular metatheoretical avenue, because again, we do not need to commit ourselves to the existence of the object for the theory to be right or wrong, but we will need to use the theory to understand whether the posited entity holds up to scrutiny.<sup>115</sup> Importantly, models are not separate from our learning about them (Schlimm 2009), that is, our models are subject to update. Does this however apply to the model of the sign relation? This tricky question depends on whether we claim that all models can be updated or not. The answer is not straightforward, but if I were to venture an admittedly simplistic answer, I would say that even if we claim the sign relation to hold logically, logic notation and variables can and have been expanded upon, revealing differences in how the elements in logic operate with said new variables. Therefore, even the metatheoretical model of the sign can be updated as we learn from it, expanding on the object as well – elements in sets that would not fit previous models could find new clauses for them to be part of new sets. It may be the case that changes and updates are not crucial, and perhaps when it comes to certain issues on morality there is a rockier road of possible changes ahead. This question, while valuable and interesting in its own right, must be skipped for the time being.

### **6.3.3. Minimal objects**

Finally, we may wonder how to establish the concept of the object with respect to the concept of a minimal model. A minimal model does not need to imply a minimal object, and a minimal object does not call for a minimal model. But a minimal model makes claims about its object, and given the previous definition of a minimal model, an object becomes reduced to a certain degree because by necessity some of the claims of an expanded model are not possible with a minimal model. A minimal model is always minimal with respect to something, so the object of the parent discipline will, even if fuzzy by definition, be

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<sup>115</sup> This, however, is not a simple decision, and in order to accept it we need to give way for integrative paradigms. In other words, no theory works alone.

reduced by the minimal model to a certain account. This new object, if we are willing to call it new, is not independent of the expanded models. What this means is that a minimal model calls for a *minimized* object, and provided we are dealing with a minimal model regarding the core assumptions of our research, then we will have a minimal object, as far as its minimization can go.

#### **6.3.4. Reduction**

Surely we may feel uneasy at the thought of reductionism, as we could open the door to wide assumptions regarding the instability of models and the possibility to reduce the objects of our theories. But this concern is unfounded. As we have already established, models take on the epistemological side of things and minimal models are not an exception to this principle. Our accounts of reduction in this sense can only be explanatory, as opposed to ontological and methodological (Sarkar 1992), and this claim itself is already weak. We may not be committed to one particular form of explanatory reduction, but our assumptions about the abstract object prevents us from making specific ontological claims in the construction of the model. The ontological claims come in conjunction with the model, when both syntactic and semantic poles have been put together. That is, the constitution of our models may allow for reduction, but if we are concerned with parsimony as actually reducing the objects in their ontology, we may as well remember that expanding complexity is not parsed in the model, but rather given as a possibility to be further developed.

### **6.4. Semiosis and Minimality**

SAPO offers us a way to understand these concepts without investing much in definitions, but when it comes to the elements of semiotics, there may be some much more complex issues to address. Semiosis and the sign are the central claims of semiotics, no matter what our commitment to their ontology is, and it is this precise core of assumptions that can be investigated. If we claim that semiotics investigates semiosis or signs, or types of signs, we can make assumptions about these. Our models of the sign will comprehend a vast array of ramifications, such as all the specific prefixed varieties of semiotics. Yet, the core assumptions can be investigated in the removal of expanded assumptions and elements. Why would we be interested, however, in the construal of a minimal theory of semiotics? It seems the answer is quite simple: The way we treat our core assumptions on the sign will have an impact in the way we deal with the more developed branches of semiotics. As models are not detached from wider research, they will find some internal cohesion with other, expanded accounts of the tenets of semiotics. If our core assumptions on the sign are that it is a relation of a sign-type, and that said relation is irreducible, and that it has a beginning, we can explore questions about the nature of the relation, the exploration of whether it truly is irreducible and what its opposite would yield,

and what the conditions for a beginning are, if any. This in turn expands the situation to considering the clear metaphysical premises of the arguments – that semiosis is logically irreducible, that it may be an emergent, that it is a special relation.

#### **6.4.1. Specific accounts of semiotics**

An important issue that will not be considered here is that certain accounts of semiotics do not deal exactly with the same theories others do. Can there be unity in semiotics – either through assumptions in minimality or in terminological coalescence – with these differences in mind? The issue of prefixed semiotics is quite complex because to basal assumptions there is an addition of questions regarding certain applicability. Biosemiotics, for instance, is born out of potential applicability and coalescence of terminology, but the process of naturalization in semiotics reaffirms or reconstructs possibilities in its other prefixed varieties. To be clear, we are positing a theory by talking about semiotics in this same manner, and that can be spelled out in the notion that signs are only analyzable given the recognition that signs *necessitate* a background of implementation. That is, the position requires us to distinguish between a reference fleshed out as correspondence and a sign as a relation understood under (some) Peircean terminology. There is no metaphysical neutrality to be had when opening up the notions behind a theory, even if these are not strong enough to do much work as final realizations of the theory itself.

If, in any case, semiosis turns out to be what our assumptions make of it, then we will have a layer of confirmation for some branches of semiotics that can use it. If it turns out that these assumptions were wrong when poking the object of the minimal model, then it means there are either assumptions that are missing or conclusions that are wrong.

### **6.5. Conclusions of the chapter**

The discussion on minimality is twofold: We can acknowledge that semiotic inquiry makes metaphysical assumptions about signs and their role in the world, and with that we can also observe that sign relations as expressed by (mostly Peircean) semiotics can be analyzed to a certain degree of parsimony.

I have tried to give a brief account of the difference between a scientific notion of model and the semiotic notion of modeling while illustrating the role of minimality through the proposed thought experiment of SAPO within the discussion of semiotics. The role SAPO plays in this illustration is that of construing an intuitive appeal to questions of ontology that derive in methodological divisions of what is available for a theory. Semiotics may, in principle, not need to ask questions of ontology in the pretension of being a metaphysically neutral science, but this position seems hardly tenable when referring to the kernel of specific definitions requested by certain analytical

perusals. Minimality as expressed here fleshes out core assumptions and characterizes them while also opening the possibility of reworking certain beliefs within the system to which a parsimonious account is applied.

There is a number of issues that stem from this though, many of which cannot be dealt with in this space. Such issues, like the regression of questions in a definitional system, the validation of a theory by begging the question, or the differentiation between formal and informal scientific inquiries resulting in completely different theoretical views on the issue of setting methodology and definitions, all bring important issues, but these appear to be in line with the specificities of theory building rather than negating parsimony as a theoretical driver for definitions and change. In this sense, the challenges posed by such problems can only cause precision in this particular view, with the more complex issues being related to questions of metaphysical values within specific types of research. Semiotics, and biosemiotics in particular, can only benefit from such a discussion in approaching living systems and sign usage through a modeling of relations that responds to naturalization and basal organization of its questions. Minimality can create either a competing or complementing view of semiotic elements available to a basal account of semiosis in living organisms.

In the next chapter we will lay the more specific groundwork for coining a minimal semiosis. Having a stronger notion on modeling as it pertains to semiotics, but informed by the scientific concerns of biosemiotics, we can see that when it comes to sign action in organisms, there are certain elements that we must account for, not in the least the role of the organism within its environment. Modeling will thus retain its place as a semiotic tool in the way we have described it earlier, with the caveat that it will still be subject to the attempted claims of minimality.

## 7. SEMANTIC IMPLEMENTATION IN A MODEL ORGANISM

The role of a model organism is deeply rooted in the semiotic approach itself: beyond the general and correct notion that models are the essence of semiotics<sup>116</sup>, a biosemiotic view on organismic use of signs depends on grounding relations in organisms and environment. This much is clear in the Umwelt ‘methodology’. By establishing a systematicity to the semiotic classification of organism-environment relation (even if it seems rather one-sided from the point of view of the organism) we are directly dealing with a number of constraints of salient features assigned to the organism. And it is through that same act that we map the salient features of the environment *for* the organism. In this chapter we will examine the constitution of a model organism for biosemiotics and see what role the special notion of semantics can take in this context. For this, we will also consider the ontological underpinnings of the coming about of signs and the divide between the physical world and meaning, taking from H. H. Pattee’s work on the matter-symbol complementarity problem, complemented by K. Kull’s concept of choice. Finally, we will also refer to semiosis implementation and the possibility of semiosis considered as a multiply realized phenomenon.

### 7.1. Model organisms in a biosemiotic context

Model organisms are, for all intents and purposes, part of the parlance of biology: organisms that have been studied for considering certain biological phenomena. As it stands, the concept is not exactly given to the theoretical aspects of biosemiotics, not because it is inapplicable,<sup>117</sup> but because the concept of model resonates with different technical meanings, as we have seen before. We need to arrive to a proper distinction when referring to a model organism in the biological sense and, perhaps, a semiotic model of an organism. When I refer to a model organism here, I do it with the intention of referring to an “implementational model of semiosis”, that is, a model whereby semiosis can be ascribed in action according to a specific number of features that have to be assumed for sign usage to be effective. I will develop this particular concept throughout this chapter, explaining its necessity for a theory of minimal semiosis, its terminological background and the implementation of a semantic aspect following Pattee’s ‘semiotic closure’ (2010). This concept will be dealt with later in the chapter, but it will play an essential role nevertheless.

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<sup>116</sup> This is especially true for Tartu semiotics.

<sup>117</sup> It is to the degree that naturalized empirical semiotics can use it.

### 7.1.1. Biosemiotics and model organisms

The study of sign action in organisms is dependent on what we consider as the validity of the organism to implement said action. This much is clear throughout the history of biosemiotics, with Uexküll foreseeing “the study of “model organisms” and their qualitative changes, which are equivalent in both the animals and human beings” (Chien 2004: 1).<sup>118</sup> But Uexküllian modeling of cycles and functions – and their exemplification through model organisms in the biological sense – begets only a partial realization of the conditions for semiosis. Depending on how we position ourselves within the ontology of semiosis, our semiotic model of an organism will require a certain specificity for implementing a meaningful sign function. Then again, we could object to this semiotic model on the grounds of mechanicism, because having a specific set of axioms can only provide a mechanistic picture of what seems to be an anti-mechanistic phenomenon. Salthe (2007) voices the concern against mechanicism stating that it “generates deep metaphysical and even conceptual problems that are made liminal when, for example, we try to model organisms” (210). Nature is not clean like our models want it to be, so why bother? But the heuristics of such semiotic models<sup>119</sup> do not just rely on their capacity to teach us something, nor on their success at predicting future outcomes – if they ever do –, but in opening up new considerations for units of analysis and furthering a specific research program, despite the potential problems we may find on the way. Biosemiotics has been at odds with mechanicism throughout its history (cf. Barbieri 2007a: 106), and the relation between the both has been thoroughly documented across historical accounts of biosemiotics. For that reason, there is no need to delve deeper in this divide.

There is a number of more accurate divisions to make at this point with regards to models, in any case. Biosemiotics has made use of model organisms in the biological sense since its very beginnings (or since it was protosemiotics, perhaps). On parallel developments in biology, there have been a growing number of models of organisms, computational or otherwise, that attempt to implement functions and physiological specificities of certain organisms.<sup>120</sup> Such models, however, have a hard time implementing any potential semiotic function, whatever those may be, because by definition it is not possible to implement them without an extra *something* that actualizes sign usage. In a more semiotic parlance, we can understand this issue by assuming that “[t]he difficult problem to solve in any theory of the origin of agency and life is how to unify two normally quite separate of dynamics: a dynamics of chemical

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<sup>118</sup> This reference to model organisms in Uexküll has also been taken up by Tønnessen (2015).

<sup>119</sup> I do not want this to be taken in its *moral* sense, that is, as a crusade against mechanicism, but rather in its traditional *relational* sense.

<sup>120</sup> As, for instance, (Karr et al. 2012) and (Roberts et al. 2011) to name a few works on *E. coli*. However, there are multiple other attempts to create models of neurons and organs as well.

interaction patterns and a dynamics of signification and semiosis” (Hoffmeyer 2010: 193). A semiotic model organism must attempt to first circumvent this issue. For something to be a semiotic model organism then, much like a computational model of the *C. Elegans*, it must *implement* semiosis to a certain degree. This is the crux of the issue, and the major problem to solve.

### 7.1.2. Defining a semiotic model organism

A semiotic model organism will then refer, in my usage, to *the illustration of functions implemented by an organism in relation to its environment that bring forth the action of signs*. As such, and in agreement with Salthe, this definition depends heavily on our metaphysical position with regards to the constitution of semiosis qua relation. This particular definition utilizes the concepts of *function* and *implementation*, which need further development. In the first case, a *function* in this sense takes from the idea of functional cycles: repetitive active behavior that obtains given certain conditions. Functional cycles are not comprised of singular entities causing the behavior, but rather lie in individual processes that take part in the action (Kull 1998). As such, a semiotic function can only be implemented by an organism given a certain array of possibilities in interacting with the environment.<sup>121</sup> The physiological aspects of such conditions are not simple in their involvement: The physiological aspect of a semiotic system is not detached from the conditions of the existence of the semiotic function. In other words, there are no semiotic functions to speak of without a physiological aspect to them.

Semiotic functions, by definition, cannot be static. They have loose endings and are constructed according to specific needs. That in turn implies that something must precede functions, either because of needs or a learning that creates them. This is how *implementation* comes to the scene. Implementing a function necessitates physiological constraints. Evidently, this sense of implementation is less transitive than the term would make us think – the implementation occurs by virtue of the existence of the whole system. In other words, it is physiology plus environment that are needed for its actuality. This will, however, be treated later on.

### 7.1.3. Semantic and semiotic closure

After dealing with these terminological nuances, we must focus on the more relevant aspect of how a relation can ever be established given the described system. This problem has been expressed as the issue of “matter-symbol

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<sup>121</sup> Sonesson derives a concept of semiotic function from Piaget articulated as “an intercalated variable between stimulus and response” (2006: 158). This is a useful, non-Peircean description of a meaningful possibility, despite the acknowledgement of its speculative nature. This will be treated further in 7.2.2.

complementarity” (Pattee 2012),<sup>122</sup> seen as essential in the construal of living systems. The concept of *semantic closure*, later replaced in his own work by *semiotic closure*, is of the essence for understanding the issue at stake. The original definition given by Pattee involves a self-reference “that has an open-ended evolutionary potential” being “an autonomous closure between the dynamics (physical laws) of the material aspects and the constraints (syntactic rules) of the symbolic aspects of a physical organization” (Pattee 2012: 211–212). Self-reference is, however, tautological in its definition, in that it “applies to a closure relation between both the material and the symbolic aspects of organisms” (Pattee 2012: 211) to the effect that one concept is correspondingly necessary with the other. Now, the metaphorical style of such definitions may add to our understanding of systems as such, with constraints and rules and the whole make up of an organized disunity. As a matter of fact, it must be clear from the onset that the concept of symbol used by Pattee does not map correctly to the more technical definition of symbol within semiotics. While the usage of symbol by Pattee is defensible (Pattee 2008: 158), it is the case that his usage is highly idiosyncratic and less fruitful than the Peircean definition (Kull et al. 2009: 172). This incompatibility can be explained in that Pattee considers symbols to be “a material constraint not determined by physical laws that controls specific physical dynamics of a self-replicating system” (2008: 158), but this definition stays short of the more complex Peircean symbol, and it can be equated to a more abstract concept of sign relation at the level of the indexical and the iconic.<sup>123</sup> What we must take from Pattee’s notions though is that the base problem to treat is that of how *some* form of reference can exist in living organisms at all. The Sebeok axiom, while a good guideline, needs its basis in the solution to this problem.

What Pattee tries to address is extremely useful in what we assume to be the core functions of a semiosic organism, in any case, and it is a good turning point to consider that the problem we are faced with requires indeed a complementary approach.

## 7.2. The meaning of closure

Semantics, in a wide sense, is essential to the biosemiotic endeavor. For Pattee, the biosemiotic option is still grounded on “material embodiment” (Pattee 2012: 214) in what can be defined as a form of non-reductive materialism, which will be treated later on in this chapter. Is this a plausible philosophical option for biosemiotics? And is it even fair to deem Pattee’s position as such?

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<sup>122</sup> This sense of symbol should not be taken to mean *symbol* in the Peircean terminology. Instead, it should be treated as ‘semantic’ (cf. Pattee 2010: 524).

<sup>123</sup> The concept of symbol as used by Pattee will not, then, play a role in his own terminology, understood here better as a general meaningful sign or, more widely, as meaning. Symbolism can be better referred to as semanticity, a general sense of meaningful phenomena for an organism.



Pattee sees both material embodiment and meaning as material phenomena, but thinks of meaning as *more than* just matter, stating that complete physical descriptions are unable to “tell us all we know about their symbolic function” (Pattee 2012: 214). Semantcity (or symbolism in his own parlance) is a function that doesn’t correspond to law-based properties, much like other biological functions. The world cannot be reduced to its physical properties; it very much depends on a less describable form of functions that does not fully correspond to physical laws. We have already treated this form of descriptions in chapter 5, so the point to develop here is, how do we represent the meta-physical aspect of this thesis to make sense of it?

So far, physicality and complementarity are two aspects we can agree with to a large degree, but the different dimensions of this non-reductive materialism have to be examined properly.

### 7.2.1. Descriptions and measurements

One of the problems we have to face is that of descriptions as the fundamental term for the discussion. If the issue is purely epistemological, then descriptions are indeed what will trouble us. Pattee states that his view requires “that theories of life be epistemologically consistent not only with logic but with fundamental physical principles” (Pattee 2012: 224). Complementarity is exemplified by measurement, for “it is possible to describe a measuring device in its material detail” (Pattee 2012: 214), but at the same time, in order to achieve its function, the device must be limited in its “*semantically relevant* symbolic degrees of freedom” (Pattee 2012: 215).

More precisely, the measurement problem is described in the following way: “Measurement is a physical process, but the *function* of measurement, recording specific initial conditions, is beyond physical laws to describe” (Pattee 2010: 526). The polarization of the world of biological beings, with its speculated origins at the point of departure between the physical act of measurement and the semantcity of measuring, leads to a recursive problem by itself, in that the distinction cannot be made epistemological if it lies in the nature of things. Pattee defends himself against this by postulating that the issue at hand is not meta-physical, but rather a “pragmatic fact” (Pattee 2012: 215), because, we can surmise, measuring is not the same as presenting the thing that is being measured. Yet, the problem does comprise an issue for ontology in the question of what it is that’s beyond physicality and physical description that is actually relevant for our theory of biosemiotics. Perhaps the problem is purely epistemological in that it is only a matter of solving further problems of measurement in order to get a complete picture of the possibilities of description. That wouldn’t solve the issue of the *functions* of descriptions, and in fact, it intensifies the point of the division. But then again we can claim some sort of epiphenomenalism as the main cause and leave it at that. The epistemological claim is not useful in the end because it opposes the principle of the division: By assuming the problems of measurement

can be solved by further measurements, we accept that the aspect that cannot be reduced to physicality can, in fact, be reduced.

Removing this option leaves us with a less clear standing. The *semantically relevant* aspect that lies at the heart of the problem must be treated in such a way that we can have a proper understanding of its entailment.

### 7.2.2. Semanticity

One thing that is clear is that semanticity as used here is not quite the same as what its common usage refers to.<sup>124</sup> Its usage in biosemiotics, while not completely determinate, refers to ascribed meaning – that is, relevance and informational derivation – for organisms.<sup>125</sup> In Pattee's treatment of semantics, this notion is connected to 'value', 'information' and 'symbolic results', being, however, more limited in the genetic sense than it is in natural language (Pattee 2001). The idea is intuitive enough: We are working with some sense of meaning that is far more abstract than a dual conception of content, but that seems to work just in the same way. This is how signs come into the spotlight, and that much should be clear already. But the problem we are facing is how to make sense of semanticity in a way that is philosophically consistent with what we have discussed. Perhaps the main way to avoid the pitfall of regression is by reworking semanticity into relational possibility and the concurrent Peircean sign types. To the degree that we can talk about meaning, we need to have it grounded in a sign relation, but in order for relations to be functional, we need some agentive notion together with it. The abstraction of the sign is necessary insofar as we need to talk about meaningful relations, but we cannot depend solely on it because it doesn't solve the issues of meaning in the biological world.

So then, what can we say about sign types and biological meaning in order to find a more concrete standing? The matter-symbol complementarity issue cannot be decisively solved in that we need to add propositions to it in order to make it work in our theories, but we may be parsimonious in our inclusion of propositions. That is, our ontology needs to be as clear as possible. Beyond description or acquiescence that for signs to work, they must be relational, we would do much better in taking 'cuts' and 'closures' to test, figuring out if they are either possible or consistent within this framework. The fact that we have a distinction between semanticity and materiality is already grounded in materiality. Either we have meaning supervene on the material or both of them occupy parallel ontological spaces. There does not seem to be a middle ground between

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<sup>124</sup> Of note is the fact that semantics and semanticity can be used interchangeably in this context. In most cases, when we refer to semantics we will refer to the ascription of meaning in the biological world.

<sup>125</sup> In the research program of code biology, the notion of semanticity is inextricably linked to that of *organic meaning*, which refers to a correspondence between objects such as nucleotides and amino acids (Barbieri 2015: 26). This formulation, however, is not exactly useful except in the terms of its own theory, and as such it will only be treated laterally.

these two possibilities, and disregarding the issue with pragmatism as our maxim is not exactly an answer. We will now examine both possibilities.

### **7.2.3. Ontological parallelism of meaning and matter**

The idea that both meaning and matter occupy two ontologically distinct spaces, and that as a consequence we cannot reduce one to the other, resonates profoundly with all sorts of dualisms sanctioned by most in biosemiotics. The number of problems we face in this situation is insurmountable by its sheer quantity. This is the issue of physiosemeiosis with a difference in vocabulary. In renouncing this possible universe of meaning-objects, we renounce the ontological dualism of meaning. There are ways around this though: That meaning *is* material in a way that does not operate in the scale of physicalism. Rather like vibration, meaning could be considered relative and fully operational, consistent with physicality and yet not exactly physical: A result of the physical without having a properly physical aspect. This is an attractive prospect if we can work it out. However, the results are not quite stellar. Using the example of sounds we can get a clearer picture of what this view on meaning would entail. That sounds exist should not surprise us. A non-physicalist account of sound requires us to think of sound without reference to their physical causes (Scruton 2009: 58), but up to this point, we are stranded in the same issue: Are we actually giving meaning a distinct ontological constitution or are we simply assuming that the distinction between object and reference yields different ontological objects? In trapping our notion of meaning into an object of its own we are splitting the sign relation into a multimodal operation. Not only would we need a relation to exist, but we would need it to exist across substances, so to speak. This is much too expensive and hard to assess.

### **7.2.4. Emergence**

Returning to the issues of emergence and supervenience is never quite gratifying. As I have already written, I do not believe the option of emergence is readily available for signs. Pattee's proposition of non-reductive materialism is not easily tractable and it falls prey to some heavy criticism, but it is worth considering it as a potential option, if we can work out its kinks. Chapter 5 on Emergence explores this concept more thoroughly, and as such it is not necessary to explain it further at this point.

### **7.2.5. Non-reductive materialism and supervenience**

How can we come to terms with the idea that there are some material, yet irreducible aspects to meaning if we submit to a form of base materialism? When we mentioned the causal closure of the physical (chapter 2), what was at

stake was the exemplification of the odd ontological status of semiosis. Now we must deal with the issue head-on. Kim (1989) attacks non-reductive materialism with regards to mental causation on different grounds. By considering the mental “as a legitimate domain of entities” (1989: 43), and understanding entities as events that exhibit the property of *mentality*, where non-reductive materialism is not an eliminativist view, one must assume that “mental properties must be *causal properties* – properties in virtue of which an event enters into causal relations it would otherwise not have entered into” (Kim 1989: 43). This, however, seems to be in conflict with the causal closure of the physical.<sup>126</sup> As we have seen, the issue with the complementarity of symbols and matter brings in a similar issue, one that has been discussed by biosemioticians to a different degree,<sup>127</sup> but that keeps finding a way of sliding through our well-intentioned proposals. Meaning and sign action do find themselves overlapping terminologically, but they must be treated separately. In meaning *lato sensu* we do not need more than so-called signals – as long as meaning is considered in its dimension of action/reaction, there’s no need for it to be more than a pre-established function –, but that leads us nowhere, for such meaning does not entail the meaning of meaning. Meaning, appended to sign action, would be subservient to interaction, that is, in consequent relations.<sup>128</sup> To defend this view, we need to incorporate the criticisms levied against non-reductive materialism, applied to the metaphysics of biosemiotics.

We may assume, in principle, that all sign properties are accidental. But relations themselves can have a specific constitution as entities that do not necessitate a different realm of objects. Still, there is a big problem in front of us, for postulating the *existence* of relations is a minefield of its own. Processual relations, that is, relations established in the process of cognition, can be taken to form the core ontological proposition: As long as there is a type of cognitive activity, there is a relation that does not exist in independence. By establishing the precondition of cognitive activity we are doing a double play. First we assume a couple of things before the entailment of a relation, a subject (that is capable of cognitive activity) and a world to which it relates. Then we assume the sign relation to always be positive in that if there’s cognition, there is semiosis. In a way, this is the closest we can get to pragmatist hand-waving, but the difference is that we do not outright deny the existence of preconditions, these take an essential role as building blocks.

The argument is thus that semiosis is only entailed by mental properties of any sort. We may have property dualism at the core of our mental theory, or we could be epiphenomenalists, but the fact of relations can only be established by securing a way of subjective interaction. The distinction between relation and interaction that has been mentioned earlier (chapters 1 and 3) can be understood

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<sup>126</sup> This has been partially treated already in chapter 2.

<sup>127</sup> Take, for instance, the notion of semiotic causation espoused by Hoffmeyer (2008:64).

<sup>128</sup> This as long as we remember the notion of relation that we have used throughout the text.

here in this way: an interaction is unrelated to mental properties of any sort, whereas a relation depends on it. All forms of relations from cognition entail meaning in a subdued sense.<sup>129</sup>

Is the semantic aspect truly irreducible while also remaining in the same universe as that of physical aspects? That is certainly the line Pattee suggests, and the line I have tried to follow here. But in order to *have* it that way in our understanding of semiosis, the concession we have to make is that the descriptions that come from it depend on a physical basis, and that while the description of semanticity is not reducible to physical notions, it is more than just complementary: it is situated in the world of physical aspect because it is entailed by relations, which can only be accomplished by the existence of regulated processes of interaction in an environment. I have already argued about the counterpoint from semiotics, that the relations can predate or be separated from the physical at the ontological level, so what needs to be developed further is the idea of an affirmative ontology for signs without recurring to more than entailed relations.

### 7.3. Semiosis, autopoiesis and implementation

Cowley (2008) brings to light an issue between different traditions and their basal concepts, namely biosemiotics and biomechanics, the first operating with semiosis while the second needs self-organization (89). Interestingly, both concepts can be used as interpretative devices for chemotaxis. Cowley, however, states that “signal recognition is unlikely to be the basis of either communication or cognition” (2008: 91) in that the evolution of biological systems towards complex cognition cannot be accounted for by merely invoking the notion of semiosis – action and reaction can be present, but they do not lead to complex thinking or linguistic universals or anything of the sort. To this he adds that “if meaning is natural, there is more to life than natural selection, self-organization and adaptive systems” (Cowley 2008: 96), in that *feeling* as a form of cognition *lato sensu* “may use simpler forms of agency (and world-modelling)” (Cowley 2008: 96). However, in his view, biosemiosis does not do the work of showing how meaning comes from the natural world. The point is that, while the claim that physics and semiotics “are just two different ways of seeing the same world” (Kull 2007a: 171) seems to be correct if we desire not to posit extraneous ontologies, it is still a potentially basal assumption more than it is a product of the semiotic enquiry. That meaning is natural seems to be evident except when you consider what concept of meaning is used, and signs, in this case, bring a wide-scale problem in how we characterize them, as we have seen. Now, however, the fact that we cannot reduce signs to their physicality does not mean we cannot have them, but rather that we need to allow *relations* to have a more robust constitution. But do we need to argue for

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<sup>129</sup> Again, not in a one-on-one form that an arbitrary sign would seem to take.

unlikely identity claims when assuming that triadic relations are irreducible? This, treated in Chapters 3 and 4, keeps coming up because it is a threat to the naturalistic ambition of biosemiotics. The divide shown by Cowley between biosemiosis and self-organization can be compensated, at least metaphysically, with a multiple realizability argument from the bottom-up perspective, and a special sciences view of semiotics from the top-down. While these are traditional arguments used to defend non-reductive materialism (Baker 2009), their application can find a home in the discussion of semiosis, as hopefully it will transpire from this discussion.

### 7.3.1. The multiple-realizability of semiotic implementation

The idea of multiple-realizability entails that a property X is realized by a certain property W only if the realized property X supervenes on that certain property W. Baker uses the example of hunger to illustrate the point, for hunger happens in mammals and octopi, but they are ‘achieved’ by different physical states that may not be correlated (Baker 2009: 112). This, translated to biosemiotics, implies that in order for a semiotic relation to commence, we do not need a specific grounded mechanism of interaction between agent and environment, but we need the interaction to be *at least* based on these premises. Perhaps a simpler way to put it can be devised under the idea that for meaning to happen, we do not need one specific organismic constitution, it can come in different packages. The point that Rosen tries to make when stating that the problem of a metabolism-repair relation is of realization with the relation following from organization alone (2000: 263), can be interpreted here as following the same line we are trying to follow. There is no need to have sign relations be entailed only by the existence of a *specific* biological constitution, but rather, there is a way to have semiotic implementation across different forms.<sup>130</sup>

### 7.3.2. Relations and implementation

The idea is that relations hold logically, that is, the sign relation is conceptually true in that any act of cognition depends on an abstract object that is attained somehow and produces an abstract representation. The meaning of *abstract* here is set as a placeholder for a variety of options, whereas *representation* is simply a means of stating a form of reaction, that is, not referring to *images* of any sort. The terms of the relation are still contingent. Semiosis is a cross-domain relation that obtains despite qualitative differences in its parts, that is, the properties of the parts in the relation do not need to be the same in all respects in order for semiosis to hold.

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<sup>130</sup> It would be disingenuous not to allow, however, a negative interpretation to this point, stating that the formality of organization implies that realization is singular in its constitution. However, this seems contrary to the idea that we can have, at least theoretically, multiple semiotic systems developed from different resources, as Rosen would have it.

Distinguishing the features that allow something to *relate* to its environment, as opposed to properties that *interact* in some way with it, is still quite tricky. And that is because the boundaries of chemistry show themselves to be at the vastly problematic area of distinguishing the living from the non-living. The point is then not of distinguishing what is equated to a living being and what is left alone, without even the need to refer to synechism, but what is necessary for the sign relation to be considered such. In any case, semiosis implementation is not set to a single mechanism of necessity. On the contrary, achieving a relation with the environment doesn't depend on one particular physiology to obtain. As long as a mechanism of *choice* is possible, semiosis is effective. Kull (2015) theorizes that "choice requires the simultaneity (synchronicity) of options" (226) encased in the possibility of logical conflict (from the side of the interpreter). This point works in our theory in that the implementation of a relation, while consistent in form, doesn't require actual consistency in behavioral results. We can agree with Queiroz and El-Hani in that semiotic systems are physically embodied and semiosis must be physically instantiated (Queiroz; El-Hani 2006: 189), and that at the core of semiosis there must be an element of choice, understanding choice, following Kull, as a mode of selection that depends on a multiplicity of synchronic options which cannot be accounted for as a general *if-then* rule that doesn't allow for contradictions. In order for a physical system to implement a relation then we need it to have a mechanism of such selection, but before that we also need it to possess a mechanism of relating to its environment. The actual physiological characteristics will necessarily vary across organisms, but the abstraction can be modeled as such.

Is semiosis implemented and multiply realized? This seems to be the only available option, first because the alternatives do not lead us anywhere as I have tried to show, and second because it is the simpler way to account for semiosis within a naturalized framework, even if the accounting for is only done through abstractions.

## 7.4. Layering semanticity

So what is the place of semanticity in all this? In the use we gave it before, it cannot be considered as the initial foundation for semiosis, but rather, it needs to be appended to a layered order in the implementation of semiosis. For semanticity to happen, there needs to be the possibility of a relation in a material setting, as we saw in section 3.2. In the next chapter, and taking the theory we have built so far, we will put forward a model for this layering when considering its minimal possible expression as a way to abstract the sign relation into its minimal conditions for biosemiotics.

## 8. MINIMAL SEMIOSIS

This chapter will explore a tentative model for the minimal expression of semiosis, its minimal conditions expressed in the unity of the model subsumed under the theory we have examined so far. The starting point for this, as it was established in the previous chapter, is that of semanticity under its special notion. The first point to explore thus is the layering of semanticity, as we will see next.

### 8.1. Building in layers

The precondition for semanticity should lie on the possibility of relations. That is, a material setting is necessary for the existence of any form of semanticity, but this is certainly not enough for it to happen. Taking from Pattee then, matter-symbol complementarity is a presupposition we cannot do away with, with the caveat that we understand the nuance of symbol as used by him. However, in order to explain it further, we can postulate that the material aspect must in some way precede the symbolic aspect (understood as semanticity), and that the symbolic aspect is attached to behavioral output. As mentioned before, semanticity cannot be the initial foundation for semiosis. Under this conception, we need a layered scheme of interactions in order to bring about the actuality of semiosis. There's no semanticity without the possibility of a material aspect, but the possibility itself cannot be cashed out adequately individually. In other words, possibility does not entail any actuality of necessity. This issue of contingency is quite simple if we consider that one *could* be named differently, but is not. That there existed a possibility of my name being Norbert does not necessitate its actuality. This takes care of some basic objections about the implementation of *virtual relations* that give rise to physiosemosis (as we saw in chapter 3). As the possible semantic value of something is directly related to the physiological constraints set in the organism will thus give us a starting point, as this sort of percepts do not imply a set of all possible meanings, but only those that are possible within certain limitations.

As much as life and semiosis are coextensive, we must try and observe to what degree they are immediately concurrent. Instead of thinking of this as an egg or chicken kind of problem, we may assume that the distinction is rather useless, for it doesn't add to our knowledge as much as it gives us an analytical hint as to where we can look for sign usage. And although the threshold issues stand, we have an analytical distinction between sign implementation and non-implementation in broad strokes. This, I feel, is enough to first subscribe to the idea of sign action as weakly emergent, and second, to leave the specifics of its emergence to a different sort of terminological issue.

The abstraction thus is this: If semiosis is implemented in any form, and if it depends on a perceptual apparatus, unless we are able to either find a perceptual apparatus on a rock or assign it a protophenomenal value, we will not be able to either determine the implementation of semiosis in that particular system nor



will we be able to refer to the same thing when using the term ‘sign’ in dealing with it.

And so, let us first give some specific ground to the idea of building in layers. There’s two questions we need to take into account if we want to follow the sense of parsimony behind this endeavor. The first is ‘Can we live *without* this element?’ and the second, ‘What is the *payoff*?’. In other words, sufficiency and causality. Importantly, the layers do have some metaphysical implications, but these will be made clearer as we proceed. We have also preferred the usage of the concept of ‘layer’ to that of ‘level’ to distinguish ourselves from the hierarchical vision of Salthe. However, it must be noted that the concept of layer is as loaded as that of level (Kim 2010: 54–65), with the hierarchical assumption of the levels made patent in the usage of the word. With layers, however, we mean to have a sense of complementary buildup instead of an absolute piling up level over level. The layers are thus differentiated and, to a certain degree, vertical, but the idea is avoiding the strong assumption that one lies on top of the other towards a *directed* end. Each of the layers circle specific surrounded areas, as we will see now.

### 8.1.1. Physical layer

I have suggested using Pattee’s notion of semanticity as relational possibility within sign types, and with that it is necessary to build off matter-symbol complementarity. This means that there is at least a need to set a physical layer, even if we are not dead set on a hard hierarchy. The physical layer as basal can be cashed out in two different forms, one through Peirce’s continuity thesis as a metaphysical clause in our theory; or by allowing the ‘complementarity’ of symbols to be an emergent. Let’s examine both possibilities.

### Synechism and tychism

We have mentioned synechism as a metaphysical proposition for biosemiotics, and it is against this backdrop that continuity can assume a simple account of our layering. However, continuity as such doesn’t add much to our specificity. It may well be that matter and symbol are continuous, but the problem lies really in the gradient. Synechism does enough work for a categorial subsumption of phenomenal realization for Peirce, but we hit a wall against it. Either we assume synechism to be correct and state that between point  $x$  and  $y$  there’s a point that is half  $x$  and half  $y$ . The directedness of this view subtly incorporates a guiding arrow from  $x$  to  $y$  that can be characterized as an incremental addition of properties and a tendency *towards*  $y$ . While this must not be understood as any form of determinism, for it is coupled with *tychism* – chance –, it augments the need for principles that determine the metaphysical outcomes while still following a single line. That the line hits some bumps in our imaginary arrow is not exactly an issue. A simpler take on this implies the reduction of principles: Continuity is

only necessary insofar as it determines that a property we currently have could have been an aim at a previous point in time. Chance is necessary insofar as we need to assume that a present property is contingent. If we reframe synechism and tychism as the contingency of some properties in time, we have already a simpler epistemological account of Peirce's view.<sup>131</sup> We do not have any determination of, say, mental properties, but the fact we have them should at least account for their possibility. This is a rather controversial point to make, but the idea is that possibility does not need to have a special ontological characterization. More importantly though, a strong ontology for possibility is unnecessary for a biosemiotic characterization of signs. One may try to use tychism as the 'engine' to get both an argument against mechanicism and a metaphysical claim about the reality of possibilities, but it is hardly necessary to go through such hoops. First take tychism in the form of a law that states that for any other law  $x$ , that law may change into law  $x+1$ . But that form of the argument necessitates a secondary form of tychism, that law  $x$  entails that there is always a law  $x+n$ . And that at a certain point in time the regularities of  $x+n$  can be given by the fact that  $x+n$  is a law at that point in time. That tychism governs Peircean metaphysics doesn't necessarily lead us to believe that chance *must* necessarily take the form of an indeterminate property at all given times; rather, simply, we can minimize it to say that properties are contingent without having to be entailed by both an  $x$  law and its necessary 'sublaw'  $x+n$ . Laws are taken as primitive, whether they change or not, and contingency of properties is enough to avoid expanding the ontology we are dealing with.

### Complementarity of symbols

A weaker proposition is that of weak emergence for Pattee's proposed complementarity. One issue we find here is that of irreducibility, for a weakly emergent complementarity can mean the reduction of symbolic reference to its physical constituents. Can semiotic implementation be reduced to the fact that there is a physical aspect to it? The answer to this is negative. Now, complementarity is taken by Pattee to be a 'symbolic description of reality' (Pattee 2001: 343), which doesn't amount to much. However, complementarity must be irreducible when applied to descriptions in a hierarchical view of semiotic emergence. To paraphrase, Pattee assumes epistemological complementarity when we refer to organismic models. This poses more of a problem than a solution, for the recursion to descriptions amounts finally to a metaphysical proposition that Pattee doesn't want to refer to. But I believe we can salvage the spirit of the proposition by retooling it into an argument regarding the indeterminate status of referential instantiation.<sup>132</sup> The point is not leading to the specific principle

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<sup>131</sup> It is arguable whether Peirce would have accepted any form of non-contingent property following the synechism/tychism coupling, but most likely he already accepted that both synechism and tychism were non-contingents of their own.

<sup>132</sup> An argument for solving the symbol grounding problem has been proposed by Steels (2008) that will play a heuristic role in my argument later on.

that *caused* signs from the physical, but to the principle that states that signs are not reducible to the physical. A weakly emergent account of signs gives us the chance to do so by not affirming either that signs are merely reducible to their physical constituents (which are only partial), but that they nevertheless depend on the physical aspect to exist. This is in line with Peircean realism while doing away with some of its metaphysical claims.

The situation, however, is not so simple. We cannot just append complementarity without having a form of doing so. At this point, we have to be rooted in a physical layer in order to have anything of the sort of claims biosemiotics can make about signs, but we need more than just that. The second proposed layer should then aim at the implementation of possible sign relations. The line we will follow, however, depends on complementarity to work, and as such it is taken as a primitive of the argument.

For now, if we review our original questions, we can stipulate that a physical layer is necessary for any semiosis to be actual, with the payoff being that of having an actual ground where to establish semiosis. It is not an expensive element for us to have as long as we are aware that it depends on a simplified form of realism.

### 8.1.2. Implementational layer

The problem left in the previous layer is that of allowing complementarity. As it stands, a physical layer is *insufficient* for semiosis. We need a bridge between it and actual relations. Implementing relations requires an apparatus capable of doing so, and this apparatus must be grounded in the physical layer. The implementational layer would thus correspond to a complementarity function, a set of constraints for informational input and output, without assigning specific value to that concept of information. That is, information here is only heuristic and not characterized as a *type* of information. With that in mind, the necessity for an implementational layer is characterized in this way: For a sign relation to hold, it needs to be mapped to an object initially. In reducing the types of objects we need as a basic necessity, we may do away with abstract objects in characterizing our argument as essentially evolutionary. Assuming simple biological forms do not require complex abstract objects to entail a relation, or rather that complex abstract objects are only possible in complex systems, we do not need to account for them, at least for now. However, given that physicality is not a sufficient condition for a relation to hold, we need to have an organized form within the physical world we have established. The quirks of this part are hard to work out, but not impossible.

An implementational layer already makes a couple of extra propositions that are not in the physical layer: (i) that some elements in the physical layer are not fully contiguous, and (ii) that some of those non-contiguous elements can be structured in a specific way.

## Non-contiguity

The idea is that there must be relevant topological differences out there, that semiotic systems can be differentiated from non-semiotic systems at least to the point where a difference is noticeable between them, even in a trivial sense. This shouldn't come as a surprise, for the contiguity thesis of synechism doesn't imply that everything that has been individuated entails the same identity as everything else. The gradualism of synechism goes to the point that there's *some* contiguity between the layers, and that is as much as one can say about it. It is important to know though that this assumption is, however, not trivial. The fact that there is non-contiguity is also partly relevant in the physical layer in that the physical layer can be composed of multiple properties. For now though, what matters is that non-contiguity brings out the necessity for differential structures for relations to obtain.

### Differential structures in non-contiguity

This in turn means a specific arrangement within the physical layer, for if anything, semiotic systems are grounded on it. In order for implementation to occur, we need to have a conception of systematic input-output relations, where input is dictated by the physical layer and constrained by the implementational layer. But what is exactly the structural arrangement that we are talking about? Much like the physical layer, it is an abstraction of the potential mechanisms that take place in simple behavioral control. As actual chemotaxis presents divergence across species (Szurmant; Ordal 2004), it is relevant for our position to assume that relation-entailing mechanisms can be given across different structural possibilities. That, however, doesn't mean that *all* possible structures also entail relations. We can limit the layer to signal transduction from an element rooted in the physical layer, but not in the non-contiguous implementational layer, deriving in excitation of the same layer. Here we do need yet another bridge, because excitation is not enough to call a relation semiotic.

In chemotaxis, we can distinguish both metabolism-dependence and independence for behavioral output. In metabolism-independent chemotaxis "behavior is not sensitive to changes in the metabolism" in the short term (Egbert et al. 2010: 1) and that seems to be the case for *E. coli*; however, there is evidence for metabolism-dependent chemotaxis involving "an ongoing influence of the metabolism upon the chemotaxis mechanism" (Egbert et al. 2010: 2). This presents a problem for us in that we must take both possibilities and see how dependent our models can be on such distinction, or rather, to what degree the existence of such a difference can be of relevance for a minimal model of biosemiosis. Take for instance the assertion that "The semiotic quality of life is grounded [in] the organization of the cell's metabolism" (Emmeche et al. 2002: 16). However, in a chemotaxis that bypasses metabolism, we would have no behavioral output *unless* this behavioral output were to be absolutely insignificant. The question would then be, is all chemotaxis involved in sign

processes? To tackle this issue head-on, let's assume that metabolism-independent chemotaxis does not pose a problem for relation entailment: Relations can obtain even with an implementation that does not fulfill a metabolic role. We will need to cauterize this theoretical wound later on by assuming some consequences to this assumption, but this will suffice for having implementation in a simplified fashion.

Interestingly, Hoffmeyer addresses Kauffman's less recent attempts at understanding minimal complexity regarding the emergence of life. Kauffman believes that the key lies in 'collective catalytic closure', that is,

that every molecule in the system either is supplied from the outside as "food" or is itself synthesized by reactions catalyzed by molecular species within the autocatalytic system. Catalytic closure is not mysterious. But it is not a property of any single molecule; it is a property of a system of molecules. It is an emergent property. (Kauffman 1995: 275)

Hoffmeyer, however, believes this not to be enough:

From the biosemiotic point of view, Kauffman's idea about the generation of autocatalytic self-sufficiency is only a necessary first step on the way from a chemical system to a living system [...]. Beyond this, we must add a second step, which is the establishment of the very conditions that could make semiosis possible in the first place – i.e., the generation of a closed membrane around such an autocatalytically closed system of chemical components and thereby the creation of a basic asymmetry between an inside and an outside, making the membrane a potential interface structure through which the autocatalytic mix on the inside might learn to adjust cleverly to conditions outside. (Hoffmeyer 2008: 34)

The relevance of this for us lies in that both Kauffman and Hoffmeyer point to a structural need for relation entailment, but this is certainly not enough. We see in Kauffman's original view that complexity is a requirement for certain actions that sustain the existence of certain semiotic organisms. Hoffmeyer complements that with the need for this complexity to pertain to a significant difference between the structure that enables semiosis and that which lies beyond this structure. We can identify this division with the layers we have so far, with the caveat that what Hoffmeyer thinks is the second and final step for semiosis is not, in fact, the full story. Now, we will not take care of the problem of origins (of life), for that is certainly beyond the scope of this work, so some of these assumptions may play out differently in also adding that idea to our examination of layers. With that said, the issues of semiogenesis may certainly seem related, but this is not an issue that can be solved purely through modeling. However, hopefully modeling can assist in theoretical assumptions with regards to the Sebeok axiom.

That aside, the point here is that implementation does not fulfill the role of entailing the relation, only to ground the possibility into a structure that will make it actual. The specificities of the differential structures, however, will be

reviewed later. For now, its differentiation is simply not enough. What's necessary to entail sign relations is a dynamic enactive system joining the output with behavior.

### 8.1.3. Enactive layer

Bridging output with behavior is crucial to entail a proper sign relation. This asks us, however, to assume that an interpretant requires some form of reportability (*lato sensu*, evidently), and that it is not an abstract at its simplest in an entailed relation. The reason to assume that is grounded in the conception that an entailed sign relation at its bottom can only be assumed to exist if it takes place in behavior. The more complex a system, the ampler the possibilities to entail complex relations. From a top-down approach, take symbolic representation. A symbolic representation is aspective (that is, not univocal) and its interpretant is branched into abstractions and complex reactions. A basic system *may* have multiple, non-univocal interpretants, but if ever-growing complexity is the basis of symbolic growth, then we may also accept as a corollary that less complexity yields simpler forms of reference.

The implication is simply that more basic semiotic systems possess simpler behavioral cues than those of more complex ones.<sup>133</sup> There does not seem to be anything particularly hard in accepting this position, and for now that much suffices for our purposes, as we are not interested in making sweeping claims about semiogenesis.

This particular layer makes already a different assumption, as the concept of an *enactive* layer says something about the expected implications. *Enactivism* is already a loaded topic, but it is relevant to the degree that it allows us to have a way for implementation to pan out.

### Enactivism

The idea is to take enactivism as an ostensible theoretical background that is necessary not only as a side note for a biosemiotic model based on complexity, but as a methodological principle to account for the unit of analysis that the model requires. As such, we will need to briefly define it within the scope of this work. While the concept of enactivism is usually set as a theory on human cognition (Kirchhoff; Hutto 2016), and as such is a view on mental phenomena, the principle is that of combining theories of embodied and embedded cognition (Silberstein 2008). Let's characterize this further.

Cursory definitions for embodied and embedded cognition begin with the relation between the organism and its environment. Embodied cognition usually sees cognition as situated, that is, taking place "in the context of a real-world

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<sup>133</sup> A similar point is made by Maran and Kleisner when they state that organisms are characterized biosemiotically as "actively participating in semiosis" and thus being "the shapers of their own life and future" (2010: 190).

environment, and it inherently involves perception and action” (Wilson 2002: 626). More specifically,

situated cognition is cognition that takes place in the context of task-relevant inputs and outputs. That is, while a cognitive process is being carried out, perceptual information continues to come in that affects processing, and motor activity is executed that affects the environment in task-relevant ways (Wilson 2002: 626)

This is not applicable, however, to semiosis in a basal condition in that we are talking about a difference of several orders of magnitude. First, for the concept we are trying to develop, semiosis does not equate with cognition. Second, applying concepts of human cognition to simple organisms smacks of anthropomorphism without offering much else. If anything, such a view can only be a metaphorical reference. In order to get out of this problem, we need to develop a theoretical view of embodied cognition that applies only to semiosis at its most fundamental.

### **Minimal cognition**

At this point we can make use of some terminological technology coming from the concept of minimal cognition. If we consider cognition as “a biological phenomenon [...] that exhibits itself as a capability to manipulate the environment in ways that systematically benefit a living organism” (Calvo Garzón; Keijzer 2011: 161–162) in the context of non-human cognition, we can start seeing how we can link the principles of embodied cognition to those of semiosis. In fact, Calvo Garzón and Keijzer provide us with just an example:

Consider chemotaxis in *E. coli*. These free-moving bacteria use flagella to move around and can travel up or down gradients of several substances that they can ingest or that they need to avoid. All of the basic ingredients for a minimal form of cognition are already present here: manipulating the external environment at larger scales to enable or enhance metabolic functioning. (Calvo Garzón; Keijzer 2011: 162)

Minimal cognition thus considered provides us with the most grounded rule for using an embodied approach to semiosis, for the entailment of relations necessitates at its most basic level a way to instantiate relations between the organism and the world that surrounds it. Again, following the principles of minimal cognition, “Setting up an adequate sensorimotor organization requires a particular physical embodiment of an organism, be it bacterium or monkey” (Calvo Garzón; Keijzer 2011: 162). Here we bridge the implementational layer with the enactive one, because sensorimotor organization cannot entail anything in a vacuum. The point here is that relations, as our theoretical desiderata for biosemiotics, cannot be entailed simply by the existence of the physical world and a sensorimotor structure. We need the combination of both in order to have actual, initial relations.

The problem we face here is that one may argue that if structures and the world are not sufficient on their own to entail relations, all we are left with is a vitalist account of action. We can immediately argue against such a claim by stating that claims about sensorimotor structure simply do not argue for its action, and that it is in action that we find the completed entailment of a sign relation. But if minimal cognition is dependent on metabolism, then we need to deal with this contradiction (pointed out in 2.2.2). But as we saw, minimal cognition is not *instantiated* by metabolism, rather, it affects it. Now, we seem to be clinging on to a technicality in order to salvage this point, but the structural aspect of the implementational layer is not independent, so what matters to us is that what is called minimal cognition reflects specifics related to an organism's needs *and* possibilities. Introducing semiosis to this scheme gives us a way to specify the metaphysical aspects of the sign relation within the scope of biosemiotics. We can then be in agreement that "Metabolism is based in chemistry while cognition is based in sensorimotor coordination, which modulates the conditions of metabolic processes" (van Dujin; Keijzer; Franken 2006: 165), but at the same time, we are referring to a different sort of theoretical object. Where there is cognition in the sense lined up by the proponents of minimal cognition, there is semiosis, or sign-relation entailment.<sup>134</sup>

As we mentioned before, enactivism requires cognition to be embodied and embedded. We have taken care of the embodied aspect at least partially, but it is important to also take into account that embeddedness gives us action in the system.<sup>135</sup> Normally, embedded cognition "highlights the role of external structures in supporting and scaffolding cognitive activity" (Fenici 2012: 279), which can be differentiated from the principle of embodied cognition in that embodiment implies the relevance of physical structures of the organism for their cognitive activity.<sup>136</sup> It is in their combination that we can have a basic form of the enactive layer, and yet their combination would seemingly need to be radical in this model. The guiding principle is that it is in the combination of both aspects that we can have a relevant account of semiosis, one that can be corroborated by behavior, but that is not to be frames as mechanism. In fact, it would seem that "an embedded system is never purely reactive" in that

Agents modify their position with respect to other objects in the environment and, thus, partially determine the sensory patterns they will receive in the next time-step, thereby providing a concrete example of an agent creating the form of the stimulus by its manner of offering itself to actions from the outside (Izquierdo-Torres; Di Paolo 2005: 260)

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<sup>134</sup> This argument reminds of *Sebeok's thesis* (Kull et al. 2008), but under the stipulation that semiosis can only be attested to given certain conditions of what we call *living*.

<sup>135</sup> While vague for now, we will take care of the concept in the following pages.

<sup>136</sup> I will not address the relevance of *situatedness* for enactivism as it doesn't pertain properly to the problem of entailing sign-relations beyond what is already addressed by embodied and embedded views.



leading us to posit the necessity of the combination of embodied with embeddedness to have a functional account of semiosis.

### A note on behaviorism

The enactive layer is, at it may seem, action-oriented. This opens up some potential criticisms regarding the validity of a behavioristic approach. The idea of such criticism would be to point out that so far the layers only indicate that if there's a physical input, there is an output, and that if we allow that to be the whole story, we are simply stuck with mechanism. Our view, however, allows us to answer that it is not the case. By having the enactive layer be combinatorial in the way we have already described, but also conjoined to the previous layers, we can make our case about sign action not only limited to a *reactive* model. In fact, we are arguing here for the enclosing of perception and effectors in the way that was postulated by Uexküll. While the terminology and means are different, it is this aspect of biosemiotics that grounds our possibility of referring to an enactive later altogether. In the same line, the fact that *autopoiesis* remains a relevant piece for the enactive approach (Froese; Di Paolo 2011: 6) is indicative of the convergence between a semiotic approach and an enactive one.<sup>137</sup> In this, we oppose mechanism as the sole enabler of behavior, but we will develop this idea later in this chapter.

## 8.2. The role of the layers

We have proposed three layers in our view. These are what we can assume to be the minimal constituents for talking about *the possibility* of semiosis in the first two layers, and its *actuality* in the third one. While it is possible to conceive a world in which these three layers do not exist, we can agree on the layers hinging on each other vertically, to some extent. This means, we need to subscribe to a form of emergence in order to talk about both the enabling structures and the action that comes about within semiosis. In other words, we have only done half the work. What we need next is to give a more detailed explanation on what sort of emergence is necessary and what are the minimal requirements and specificities for sign-action to take place given the constraints set by the layers. At this point, it is important to refer to a competing view of a hierarchical structurization for the emergence of semiosis. This I call 'Salthe hierarchies'.

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<sup>137</sup> Take, for instance, the assertion that "Viewing causality, purpose, function, and "meaning" of living systems in both their internal organization and their relationship to their environments implies a semiotic view" (Weber 2009: 354). While I do not think that this statement is uncontroversial, it serves to illustrate the point.

### 8.2.1. Salthe hierarchies

Stanley Salthe develops his own system of categorization in the frame of Hierarchy Theory (1985).<sup>138</sup> His view, however, is highly specific, divided in two categories for hierarchies, scalar hierarchies and specification hierarchies. Presented as a metatheoretical account, it also starts with ontological assumptions, such as the unlimited complexity of the world (Salthe 1985: vii). But as it goes, hierarchization becomes more complex in that it attempts to bring about causality, complexity, stability and boundary conditions (9). And in order to bring about such a hierarchy (or hierarchies), we derive it from “our array of basic qualities, primary activities, and theoretical concepts” (11), but to that is also added the aesthetic judgment of applicability of such hierarchies – an intuition based on fascination –, which Salthe explains as “resonance between one part of the world (our minds) and other parts, all embodying the same basic structure” (11). While this explanation is not quite precise, the point to Salthe is that judgments about possible universal structures can be attained in a similar fashion as what we see in Peircean categorical thought. Whether this is right is a matter of debate, however, the metaphysical assumption that goes there becomes clearer. In explaining his position further, Salthe explains that his view depends on *processes*, *entities* and *boundaries*, all of them radical in his view (17).

The difference between levels is given, in Salthe’s view, in an evolutionary scale. Where there’s causal processes of relevance to the focus level (in our case, that of humans), these processes will be stored as perceptually relevant throughout genetic history to the extent that perceivers can detect these processes and differentiate them (59–60).<sup>139</sup> These are the basic conditions set in thinking about hierarchies proposed by Salthe, and it expands in a number of specific consequences, the most important of which is the expanding, linear interpretation of continuity between basal biological processes towards cultural ones in organic evolution (189–248). These claims are avoided by the layers proposed earlier because they only apply to minimal mechanisms. The argument for parsimony does not *entail* its expansion as a univocal thrust in evolution. Instead, it only serves to illustrate the specific point about minimal requirements for a conceptualization of semiosis.

A Salthe hierarchy allows its constituents to come about via intuitions without having a final ontological say about their status. The two types of hierarchies mentioned in the beginning are metatheoretically construed (Salthe 2004: 331). These Salthe exemplifies as those hierarchies that nest subsystems within supersystems, in the case of scalar hierarchies, and as a specific interpretation for specificity of elements within the set described by the full hierarchy, in the case of specification hierarchies (Salthe 1991). Now this descriptive attempt at observing hierarchies is, ultimately, also set against a metaphysical backdrop as we have seen. And in fact, it is productive enough in

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<sup>138</sup> A summary can be accessed at [http://www.nbi.dk/natphil/salthe/Summary\\_of\\_the\\_Principles\\_o.pdf](http://www.nbi.dk/natphil/salthe/Summary_of_the_Principles_o.pdf).

<sup>139</sup> We return here to the ‘resonance’ explanation Salthe uses initially.

this way in that it opens the possibility of referring to newly crafted hierarchies while also criticizing them. We will limit our understanding of Salthe hierarchies as those that take a descriptive role on reality<sup>140</sup> and that allow the research of the levels that they posit (mostly related to scalar hierarchies, but the boundaries are never as clear). As such, however, our layered description does not comply with Salthe hierarchies in that the layers we have used depend on the conceptualization of semiosis and not on the intuitions of the world that may be brought about by signs that may or may not be mapped to specific objects ‘out there’.

### **A Salthe-hierarchical emergentist account of semiosis**

In order to see how a Salthe hierarchy operates in the same realm of analysis, the main example in the biosemiotic literature is the strong emergentist account of semiosis from El-Hani et al. (2009). As explained by the authors

to describe the fundamental interactions of a given entity or process in a hierarchy, we need (i) to consider it at the level where we observe it (‘focal level’); (ii) to investigate it in terms of its relations with the parts described at a lower level (usually [...] the next lower level); and (iii) to take into account entities or processes at a higher level (also usually [...] the next higher level), in which the entities or processes observed at the focal level are embedded. (El Hani et al. 2009: 139).

Such a hierarchy allows them to give a strongly emergentist account of semiosis. However, as we have seen before, in order to have a strongly emergent account we need to accept that these hierarchies are firmly rooted ontological characterizations of the world. The emergent properties can be seen as strongly emergent if they cannot be deduced (section 5.1.3), and overall, the metaphysical account of the hierarchies lies in their own description. If anything, a Salthe hierarchy in a strongly emergent biosemiotic account of semiosis cannot be only heuristic, it is cashed out in at least a partial ontology. The argument proposed by El-Hani et al. is derived in the following way: By assuming the *focal* level to be the level “in which a selected semiotic process is observed” (El Hani et al. 2009: 141), with semiotic processes being defined as sign triads of the Representamen-Object-Interpretant order, we can derive both a lower and a higher level. The lower level is defined as micro-semiotic, and the higher level is taken to be macro-semiotic. The micro-semiotic level involves “the relations of determination within each [semiotic] triad” (142),<sup>141</sup> whereas the macro-semiotic level involves “networks of chains of triads, in which each individual chain is embedded” (142). Considering the stipulations of Salthe hierarchies, the micro-semiotic level is defined by the observed semiotic triad.

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<sup>140</sup> Or in nature as the defining concept for World in Salthe’s view (1985: 12).

<sup>141</sup> This considering that sign relations are only possible in a chain with more than one sign relation.

El-Hani et al. jump to the assumption that this micro-semiotic level *sets* the initial conditions for the focal level (143), and that an object<sup>142</sup> in the sign relation is thus defined by the conditions on this level. Here the authors attempt at distinguishing *potential* and *actual* elements in the sign relation. Finally, the micro-semiotic level is considered to be where *potentialities* lie for all elements of the sign relation. The macro-semiotic level regulates what *potentialities* can become *actualities* (again, for all elements of the sign relation), and the focal level witnesses the emergence of semiotic processes. They explain that the emergence of semiotic processes happens here due to the interaction between micro- and macro-semiotic processes, between “the potentialities established by the micro-semiotic level and the selective, regulatory influence of the macro-semiotic level” (144).

The obscure ontological status of *potentialities* in this account is indicative of the mark of a strongly emergentist account that the authors try to defend. The argument is nuanced by the assumption that the irreducibility of a Peircean sign relation must be taken as indicative of non-deducibility (176), and by the idea that semiotic processes are unpredictable with tychism as the backbone of the assumption (178). These, I think, are very expensive ways to have semiosis as a strong emergent, because the argument depends on having correct intuitions from the structure of the Salthe hierarchy – if our intuitions are correct because they are natural, then intuitions about aether could be cashed out empirically, for instance – with said structures causally connected to each other, the micro-semiotic level being somehow recognizable despite its consisting in possibilities of, we may assume, the ontological flavor, but even if it is not the case, the point that stands is that possibilities can only be taken as feasible given prior epistemological constraints, without having to consist of a separate level. It may well be the case that what is ‘micro-semiotic’ here is simply the same as the focal level, making the emergence argument harder to place.

If anything, the point I am trying to make is not that Salthe hierarchies are flawed, but rather that their applicability must be scaled down and reworked. An argument for a strongly emergent semiosis from a Salthe hierarchy adds a number of clauses to our ontology and these clauses are only posited as theoretical desiderata to correspond to Peircean metaphysics (take the case of *tychism*, for instance).

### 8.2.2. The layers and weak emergence

The difference to make here is that the conception of the layers tries to avoid the complications of strong emergence. As mentioned before, we can only fit a weakly emergent conception of semiosis if we take the layered model. Taking the physical layer as radical, and this is only insofar as the other layers are

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<sup>142</sup> More specifically a *dynamic* object, that is, an initial object that generates further sign relations.

dependent on it, the following layers can be recognized in the sense that they are discernible in their difference, not in that they are reducible. In fact – and this in general lines –, “a model of the world as layered can be independent of reductionism” and the denial of reduction can be explained “because the properties of higher layer (constituted) objects seem to be different from the properties of their lower layer (constituting) sums of objects” (Paul 2007: 266), but while this implies important ontological differences across the layers, and thus creates some relevant problems for the picture we are painting (such as causal overdetermination), a weakly emergent account of semiosis within a constrained context can bring a better explanatory position here.

As we have set the physical layer as radical, we are committed to some form of materialism. This is not necessarily a problem as implementation and enaction are differentiated for a reason: that they are specific constraints for semiosis and that they are not the same as a disperse physical layer. That we translate into a nonreductive account of semiosis. However, instead of using the argument from El-Hani et al. based on their (and in general, of most bio-semioticians’) confidence on Peircean irreducibles, we may slightly retract from strong ontological formulations and assume that we are not forced to accept causally emergent processes of the strong kind (Pereboom 2002: 511). In fact, reducibility does not seem to be all that relevant for a weakly emergent account of semiosis,<sup>143</sup> but the point still stands.

As the implementational layer suggests, mechanisms for environment interaction are not singular in that they can come in a variety of forms. We depend on having a notional characterization of these, but what matters is that its complement in the enactive layer allows for an ample variety of settings for sign action to take place. This reinforces the point of multiple realizability from the previous chapter. There is, however, one element missing here besides all the fuss about the layers, and that is the actual semantic implementation. It is this what I claim is weakly emergent from the conception of the layers. In what follows we will explore the other hand of the argument.

### 8.3. Layered P-Semanticity

We can finally integrate semantics to our view. However, this semantics, as we’ve already discussed, is a special type of concept in that it is more through resemblance that we reach it (for we want to avoid imposing a sense of semantics in language to our special semantics here). The layers are both necessary, yet insufficient for us to talk about fully-fledged semiosis. The principle we laid out earlier states that Pattee’s notion of semantics depends on matter-symbol complementarity. Now, what we can usually call sign action

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<sup>143</sup> This from Chalmers’s view differentiating phenomena characterized as weakly emergent that can be reducible to physical laws and phenomena that is not *prima facie* emergent at all, such as the functioning of a telephone (Chalmers 2006).

depends on all three functioning layers, but we are left with the threshold of complementarity. That we have the layers does not functionally entail semiosis if we assume there will be some form of semantic value in it. What they do, however, is give us the conceptual apparatus through which we can have this special sense of semantics. Pattee's semantic closure principle (from now on P-Semantics) is an *interdependence* between symbol, matter and function (Pattee 2012 [1982]: 172). More explicitly, what Pattee proposes is "a generalization of this primeval fact to higher levels of evolution, including cognitive systems", and through which complementarity occurs due to "physical embodiments for recognizing the symbol tokens and dynamically executing the rules. The synthesis of these physical embodiments must be constrained through the processing of these symbols" (172).

In order to unpack these statements further, we need to understand that this view is dependent on similar constraints as the ones we have set in layers, but P-Semantics on its own cannot be responsible for the division of perception and meaning assignment, so to speak. P-Semantics are called semantics (or semiotics, later in the works of Pattee), because their realization includes physical, syntactical and pragmatic aspects. However, in deflating this claim – or at least removing the hard terminological imposition –, P-Semantics still contributes in making a clear distinction between what is fundamentally mechanistic and what can be seen as meaningful within the realm of basic sign usage in simple organisms. The point to make is that for something to be meaningful at this level, it needs to be mapped to specific instances of behavior. What it does not fully solve, however, is the directedness of the action in specific instances of behavior. Now, this can be explained away by stating that for something to be meaningful in the biological world, it needs to entail some form of causation. I agree with this, but we must qualify this assertion.

Within biosemiotics, accounts of semiosis in simple organisms are usually cashed out in terms of finality (as in Aristotelian final causes) or teleodynamics (Hoffmeyer 2008; Deacon 2011). So far we have avoided going into Aristotelian language because it brings forward more complications than it solves problems,<sup>144</sup> but teleodynamics offers a different view, championing the property of selfhood and its phenomenology (Deacon 2011: 468). Additionally, in a clearer way, teleodynamics is dependent on morphodynamics – the processes of change in morphology –, and more precisely, in autocatalysis and "self-assembly" (Logan 2012: 295). Both of these, claims Deacon, provide the right mix for teleodynamics. But teleodynamics is, ultimately, outcome-oriented action with a certain amount of choice. The difference between teleodynamics and teleonomy is a matter of putting choice in the forefront or as a seemingly indifferent possibility. Now I would not argue that teleodynamics is conceptually wrong, but rather, that a viable philosophical alternative exists in teleonomy itself, and this teleonomy is the effect of P-Semantics. An important

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<sup>144</sup> Ontological status of causes, independent law-like regularities and denaturalization are just some of them.

philosophical point that Deacon tries to make is that when dealing with meaningful processes in nature, unless we consider the constituents of the world as processes, we will end up with a dualist picture (Deacon 2012: 44–45). Finality or oriented processes, *entention* in the very specific Deaconian terminology, adds another element to teleodynamics under the condition that we build from a processual ontology. The consequences to this, however, are not completely clear, but the intention is coherent in the same manner that *synechism* attempts to break off dualism for Peirce. In Logan’s view, Deacon’s position falls in the camp of property dualism and triadism (Logan 2012: 297). However, following Logan’s interpretation, this property *n*-aryism is of the weak kind. Briefly, property dualism claims, in this weaker variety, that it “applies to any domain in which the properties are not themselves properties invoked by physics” (Chalmers 1996: 123).<sup>145</sup> So we may well be speaking of such weak property *n*-aryism, but it is fundamentally not a strong claim. Rather, it is an observation of weakly emergent properties at systemic levels. The problem is then that the odd ontological implications cannot exactly obtain unless we clear up whether we are making strong or weak assumptions about how semiosis may emerge. Again, while the Sebeok thesis works, it does not exactly say that life *is* semiosis, but that they are co-dependent.

P-Semantics is the domain of teleonomy in the same sense that teleodynamics needs morphology, but our account tackles the issue from a different perspective. As we establish ‘boundary conditions’, value assignment realization becomes harder to grasp in our theoretical models because of the added concept of agency. Agency, however, when defined as a phenomenal quality of self-control and environmental action,<sup>146</sup> becomes a metaphorical model for the apparent sense of agency in less complex organisms. I argue that P-Semantics does not require a *sense* of agency to realize value assignment.<sup>147</sup>

### 8.3.1. Value realization

What is exactly then P-Semantics? What do we talk about when we talk about semantic or semiotic closure? Let’s return to the concept of agency. A top-down view of agency will not do if we wish to avoid anthropomorphic accounts of semiosis at a basal level. *Autopoietic Enactivism* considers agency as the “phenomenological subjective dimension of organisms” (De Jesus 2016: 133), which conceptually may or may not be causally relevant for our explanations.

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<sup>145</sup> As a contrast, the strong formulation of property dualism “involves fundamentally new features of the world” (Chalmers 1996: 123), with said properties not being logically supervenient and nonphysical in a strong sense.

<sup>146</sup> Take the simple definition that agency refers “to the experience of controlling one’s own actions, and, through them, events in the outside world” (Haggard; Chambon 2012: R390).

<sup>147</sup> This does not mean that agency is unimportant for biosemiotics, and that is not the point I wish to make. Rather, I’d say that concepts of agency can be only used in a more metaphorical sense at this level.

The key, however, is in deciding whether perception and sign action entail a phenomenological world. This may well be the case, but here ‘phenomenological’ refers to ‘sense-making’ (De Jesus 2016: 133), which deflates phenomenal claims to semantic claims. Whether these two are inextricably connected or not can eventually be pursued, but for now we will consider this a problem of concepts. But how can we have P-Semantics in our model?

In creating this model we are switching to a different unit of analysis, one I think is requested by a semiotic approach. This unit of analysis, as hinted at by the previous layering, *depends* on the composition of an organism-environment unit for semiosis to be a relevant point in our discussions of semiosis. In removing individuality for sign relations, we can come up with explanations that both require less commitments and that can account for the same elements we want in our theories of biosemiotics. P-Semantics is closure insofar as it provides the final element for a model of semiosis to work.

### Fuzzy choice

The idea is, however, that P-Semantics is not dependent on one-on-one connections between elements outside the organism and reception of said elements by the organism. The fact that Pattee’s semantic closure states that “by virtue of the freely selected symbolic aspects of matter do the law-determined physical aspects of matter become functional” (2012 [1995]: 212) allows the layered perspective to operate, but it is this sense of *freedom* that we must take charge of. The problem we faced earlier has to do with the fact that meaning cannot be characterized as completely outside of the physical,<sup>148</sup> but the formulations we make of it will invariably end in commitments that we may not wish to explore. With this *freedom* then, we need to establish some limits as to what it could possibly mean for simple organisms. In this regard, we can define *freedom* as a *non-deterministic coupling of reception mediated by implementation from the physical to the enactive*. The non-determinism of this coupling should be construed as the lack of a single input-output mechanism that entails a repeated, singular action. That is, in case of physical instance that can be perceived by an organism, its consequent reaction will not be predetermined in all cases. The idea is that *choice* is part and parcel of perception, even at this level, as long as we understand it as the fact that for semiosis to happen there must be more than a singular element in the organisms ‘world’, there must be some sense of background against which elements can come up.

This idea of *freedom* is, I believe, fully compatible with the notion of ‘logical conflict’ recently espoused by Kull (2015). Here, we see that an organism “can only have the freedom to make a decision if several possibilities are presented and available at the same time” (226), leading to decision making, which is construed by Kull as *choice* “in the situation where operations are

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<sup>148</sup> One is reminded of the problem of the ‘causal closure of the physical’ we have already explored in chapter 2.



incompatible” (216), such as going forward and backward at the same time. However, instead of incorporating phenomenological simples to this picture, we have a background that brings enough traction to semantic closure as the driving mechanism for the concept of choice.

P-Semantics, thus, is conceptually *the non-deterministic implemented mapping of relevance for an organism within a given environment*. P-Semantics closes the loop of value realization, but this closure is not of a fixed value. That is, as meaning is not proposed as a unambiguous one to one correspondence between objects and concepts, we are left with what could be characterized as stochastic processes of selection between elements that integrate actions towards or against them.<sup>149</sup>

The way this value is realized is, however, *fuzzy* in the sense that value realization does not depend on crisp values. If logical incompatibility as described before is part and parcel of choice at the most basic level of semiosis, we are not exactly talking about truth or falsity of propositions as handled by the organism. Instead, the choices that are not clear and without seemingly relevant specific practical value can be construed as fuzzy – and it is at this point that we have a conceptualization of what it takes for some organism to use signs at the most general level. The enactive layer, already embedded in the other layers, allows the talk of P-Semantics in that the concept of reaction that comes with it is the actual form of an interpretant taking place. We are not talking about representations, but rather about identification (of some sort) and action upon it. Now, mechanical identification based on organismic necessities is basic in understanding any sort of behavior, and fuzzy choices seems to represent a higher order of internalized functions. These, however, can be put together within the same mechanism.

### Necessities and choice

When we divide the elements of necessity and choice (in the sense we have underlined before), we are usually making two distinct claims: that the mechanisms for fulfilling necessities are independent from mechanisms of choice, and that choice does not need to be related to necessities. Both of these claims are related in that they present a higher characterization of possible behavior in an organism. The point I am trying to make, however, makes a single mechanism enough for both. A condition of choice is already related to behavior, and organismic necessities, understood as elements necessary for sustenance, are the basic drivers of behavior. Choice is not inherently different from necessity, it is simply a different side of the coin. The necessity is internalized (or normalized), and the choice is the actual output. In a way, necessities are expressed in implementation, whereas choices are expressed in enaction. Fuzzy choices are the form of choice where there’s no implicit necessity over two different options.

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<sup>149</sup> I will not make an argument for stochastic functions here as I believe the road to take is much longer to get there.

Logical conflict or not, a fuzzy choice doesn't map to a full value that mandates its realization. Instead, in the choice – stochastic or not – there is a point in which there can be no *absolute* value, with its realization depending on complementary factors.

### 8.3.2. Unit of analysis

With all that said, we can see how a different unit of analysis can be formulated within this framework. Drawing from Järvilehto's view on organism-environment systems (2009),<sup>150</sup> we can understand sign processes as realized subjective experience, but more importantly,

Key to this theory is the concept of *result* as what emerges from the history of experience and organization of the organism-environment system, not as a simple effect or consequence of behavior but a new possibility of action forming in the process of transition from one act to another on the basis of organization of the organism-environment system. (116)

In our case, however, limiting the scope of the notion of *result* leaves us with a less far-reaching claim, that the organism-environment system so conceived is ultimately the basic unit of analysis for biosemiotics. Even if we are able to partition the elements that lead to semiosis, a minimal conceptualization of semiosis requires us to address the fact that sign processes are not internally processed, they depend on the situatedness of the organism, its actions in the environment conceived as the sign processes themselves. Put in this way, “An organism as a skin bag is no functioning system; it may be such only together with the relevant environmental parts” (Järvilehto 2009: 119), at least when what is at stake is a conceptualization of the organism's usage of signs.

This then implies that the minimal model of semiosis we are trying to develop cannot do without a comprehensive constitution of analysis modeled as organism plus environment, but also metaphysically extended to include the necessities laid out by our conception of the layers. The system described by Järvilehto is a pretty good companion to our model in that it articulates similar points from a different perspective. It serves to illustrate the difference between organism individuation and environmental inclusion in the conceptualization of the sign.

### Individuation

Individuating organisms when conceptualizing semiosis provides an incomplete account of semiotic radicals. It is not that we are denying the existence of individual organisms or the possibility of partitioning things even further in their analysis, but when signs come into play, the way to make sense of a minimal claim for them is actually by including the elements outside of the

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<sup>150</sup> Which at the same time draws from Uexküll's work, an implicit influence across the present work.

‘building’ of the organism into the picture.<sup>151</sup> Now, when dealing with abstractions, we are capable of stating that a semiotic relation may hold in the form of object-representamen-interpretant and leave it at that. But this claim doesn’t paint the picture of a minimal claim for semiosis, a minimal model that gives us a functioning edifice for something we can call semiosis. That the logical definition of the sign implies the elements of the relation is, however, foundational. It is the recognition of its elements what allows us to understand the need to frame sign action within a more specific context.

At this point I would like to return to Steels proposed solution to the symbol grounding problem (2008). The idea is that first you need to have a “physically embodied autonomous agent” (236), with its own energy source and computing power, present in the world through its own body and capable of interacting with it, perceiving it and acting through it. Next, you need “a mechanism by which an (artificial) agent can autonomously generate its own meanings” (237). The agent in this context must come with a relevance parsing mechanism, putting some things in the forefront of its attention and others, behind it. Then you need a categorical mechanism “by which agents can internally represent and ground their relevant meanings” (237). And after that, it is required that “agents autonomously can establish and negotiate symbols to express the meaning that they need to express” (238). Meanings must be negotiated if there is to be any communication between agents. Coordination is of the utmost relevance here in that a specific coordination process “creates the right kind of semiotic dynamics so that the semiotic networks of the individual agents become sufficiently coordinated to form a relatively organized semiotic landscape” (238). With these steps, states Steels, we would have a functional solution to the symbol grounding problem. Grounding symbols in this sense is a processual affair, but interestingly, it is both an internal and external dependence. In a way, the basics are very similar to what we have proposed, but grounding symbols goes a step further because of affixed, negotiated semantic content to percepts of some sort. It may well be the case that symbol grounding can be solved in this way, and we would do well in paying attention to the process presented here, but there’s already a much higher level of usage than we are trying to reach. That is, the involvement of communication implies much more complex structures of sign usage. And the argument depends on a certain individuation of the agent, something that can come later on when semantic content is being negotiated, but the basis of P-Semantics allows us to talk of semiosis when the negotiation is a process of commonality. Still, we need to solve a relevant problem with regards to the continuity of specific percepts.

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<sup>151</sup> A more in-depth and current look on semiotic individuation can be found in Hoffmeyer (2015a) and Hoffmeyer and Stjernfelt (2016).

## Sign stability

The problem of continuity – or rather, of the stability of signs – is an interesting one to pose, but its solving is, I believe, not something that comes at a great expense for us. The problem, more clearly formulated, can be stated as ‘how is it possible for signs to remain consistent within a minimally construed system?’ This is a relevant question as signs are, it has been surmised, in constant growth (Merrell 1996; Kull 1999; Collier 2014; Nöth 2014), and this growth must be grounded on a basis of some sort. The connection between growth and stability is inextricable in the same way we saw for symbol grounding: the process through which signs (in usage) grow is related to the possibility of having said signs be stable across time. Without sign stability, on the other hand, growth is not possible in that there’s nothing you could call growth if all your signs are simply variations of the same. But this stability needs to be obtained from somewhere. P-Semantics as we have defined it is non-deterministic, meaning that the obtention of meaning does not entail a fixed value realization. While this may be in apparent contradiction with stability (if we consider it as the notion that a sign becomes determinate with usage), this is not exactly the case. As P-Semantics is *constrained* by the constitution of the layers, that is, both by morphology and situatedness, the non-determinism we have referred to can be made more explicit by understanding that meaningful action is not a singular external reaction, but rather it functionally responds to specific needs. Instead of treating it as a key for one door, P-Semantics allows *fuzzy* options *within* a range of possibility. The stability of signs in this case is not to be taken as the maintenance of certain sign types, and in fact this proves to be a rather hard argument to make, for the point of dividing between potential indexicals or icons is already axiomatic: whether we believe the most basic type of sign is the index because basal perception, so to speak, can only lead to grasping causes or proximities (such as nutritional objects), or that it is the icon, because of some supposed similarity between the properties of the objects beyond the boundaries of the organism and the means of perceiving them, we’ll have to rely on certain arguments that ultimately do not change the standing of sign usage in its minimal expression. Not that this discussion is useless. However, the point is that sign stability will not be defined by sign types, but rather, it is part of the whole unit. It may well be that P-Semantics is non-deterministic, but that does not mean it is *indeterminable*. Stability is determined by the same constitution of the layers, it is an effect of them as much as it is a feature of semiosis.

## 8.4. A non-exclusionary model for analysis

In the discussion of parsimonious applicability of models, one thing that may be lost is that within its constraints, the model we have developed here is not exclusive of other possibilities, especially of those that could be thought of as incremental changes. That is, our view on how to model minimal semiosis is not a way to refuse the possibility of sign growth, as we have stated before. Instead,

the model does call our attention to this fact and allows a more robust constitution of its elements, including those that are not directly predictable from the idea of minimal semiosis. These include complex communication networks, agentic organization and hopefully the basic semiotic ideas in the prefixed varieties of semiotic research. At the same time, however, it has not been the intention of this research to provide a solitary groundwork on which other, specific expressions of sign action can be derived. This is an ongoing project for general semiotics and its institutionalization. Still, this model does not require exclusivity of methods, it asks for complements that can be appended to it.

This being the case, one relevant notion that we have to deal with is the applicability of the model. The heuristics of the modeling task are surely evident as far as its conceptual aspect goes, but the reframing of our objects will give us a specific picture to use in our understanding of semiotic phenomena. The fact is, however, that as far as semiotic simples go, our model must be hinged on organisms that are already more than sufficiently complex as it is. However, semiotic analyses of some order over model organisms (in a biological sense) do some explanatory work that we can observe from our model. In the case of the previously mentioned *E. coli* analysis by Stjernfelt,<sup>152</sup> we see that there's a semiotic implementation centered around the Uexküllian notion of functional cycle. Stjernfelt distinguishes here self-regulatory stability of metabolism "involving categorized signal and action involvement with the surroundings" (Stjernfelt 2007: 209), and we can agree with this view. When later unpacking his view, we see that for Peircean semiotics, meaning and inference are what produces interpretants (Stjernfelt 2014: 117), understanding inferences to be "action habits" (119). This view is fully compatible with what we have developed so far, but there are some terminological quirks that stand in the way. Dicisigns, defined as "signs which may be assigned a truth value – without providing, themselves, reasons for that value" (Stjernfelt 2014: 55), can be partially equated with a P-Semantic interpretation in that they both give rise to behavior of some sort. The difference, however, is that a P-Semantic claim does not hinge on a propositional form inasmuch as it is a condensed action within the system defined by the organism and its environment. The difference may seem subtle, but it is a relevant one: P-Semantics are inclusive of the environment without limiting the sign function (of, say, the dicisign) solely to the organism making inferences about the world. While true that the Peircean sign ultimately involves the relation between the environment and the organism (including its actions), the expression of such a sign is differential in that a proposition is entailed subjectively, expressed individually and based on the internal organization of the organism. Layered P-Semantics conforms to a different unit of analysis without proscribing semiosis. Meaning obtains in semantic closure not as an ultimate result of inferences, but in the coupling of a possible choice and the total action directed in the environment. While both

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<sup>152</sup> In section 5.1.3.

forms of expression are possible, because they are not mental and environmentally relative, the nuances are dependent on different metaphysical standings, and compatibilizing them would take some work that goes beyond the scope of this work. Nevertheless, this points to the difference in analysis that one can make with different models that follow a similar conceptual path. More importantly though, the difference between the approach from the dicisign and our minimal model lies in that the claims on minimality are only as strong as the boundaries we can set for them, and while our claims are evolutionary to a certain degree, they compete only the basal functions in semiosis. A minimal model of semiosis will not include its own evolution, only its minimal conditions on which its evolution can be deduced.

In the example set by van Dujin et al. (2006), *E. coli* is used to show the tenets of minimal cognition in a way that makes sense regarding their conceptualization of cognition. The appeal that cognition does not necessitate a nervous system is well allowed in the biosemiotic dimension, as well as the suggestion that sensorimotor coordination provides “a more basic, more general and conceptually clearer starting point for minimal cognition” (van Dujin et al. 2006: 164). That the *E. coli*’s Two-Component Signal Transduction System (TCST) of *E. coli* acts as a “molecular form of memory” (162) provides one of the most important keys here as it gives us an implementational setting for action. That mapping signs to physical objects may turn out to be hard to assume under some conditions is no problem for us at this level. Semiosis is in fact constrained by the sum of elements within our analysis, and we cannot use assumed interpretations beyond what can be derived from action itself. In this way, we can assume that a simple organism needs, first, an environment on which its actions are hinged and that cause said actions. The implementation of behavior in the environment is dependent on structures that range from receptors to motility, but these are certainly not enough to produce an account of semiosis. We want to rule out tropism in *E. coli* as a type of semiosis because it doesn’t present the directedness of taxis. Tropism may well lack the expression of sign action because it cannot be defined as enactive. Ruling it out, however, may only follow the concern of ruling out all chemical interactions that cannot be attested to be of an organismic nature.<sup>153</sup> For now we can assume taxis to be fully in the domain of semiosis, but tropism cannot be fully excluded as the impact of stimuli can be consequential, though much more restricted.<sup>154</sup>

With that said, the point is that *E. coli* is grounded and its behavior can only happen within its physical space and through its TCST, which consists of receptors, a transmitter and a response regulator (van Dujin et al. 2006: 162), the machinery for *E. coli* to interact with its environment. As van Dujin et al. put it,

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<sup>153</sup> The problem of viruses is a hard one to crack from semiotics not least because metabolism does not provide us with a full, exclusive indicator of sign action.

<sup>154</sup> Nöth presents an analysis of tropism contextualized as spatial opposition within bio-semiosis (1994: 37–60).

the transient feedback that is sustained by the slow-paced methylation pathway provides *E. coli* with a dynamic, molecular form of memory which allows it to perform what has been dubbed “robust integral feedback control”. That is, by filtering out external noise and internal variations, and enhancing tiny variations in populated receptor density, the output of the system becomes independent of the input level in steady-state, enabling perfect adaptation to a stimulus

As we mentioned, this ‘form of memory’ seems to be of the utmost importance when referring to the way the organism interacts with its environment because it allows the organism to ground its action on certain non-random factors. That this memory is not a retrievable language-like repository should not come as a surprise, and as a more metaphorical view on what this memory is supposed to mean, we find ourselves with a determinative factor for Kull’s concept of *choice*, which we have co-opted as *fuzzy*. But as we have seen, choice is determined by its enaction, and enaction depends on the correlation of its semantic closure. However, we do not use the specific concept of memory in our model because of its transitive nature. That is, the corrective nature of such a metaphorical memory is subsumed in implementation, but in order for behavior to be cashed out within semiosis, we cannot assume that everything in the realm of the organism is semiotic. Taxis’s orientation is metabolically constrained and so it presents an easier case for claims of meaningful sign action. In the more Uexküllian, sense, the form of semantic closure comes about by constrained relevance that is acted upon, or as van Dujin et al. put it regarding the constitution of minimal cognition, it “is not so much a centralized property of the biological hardware of an organism, or a set of internally computed algorithms, but instead denotes an abstraction of organism-environment reciprocity” (2006: 165). So the similarities of the concept of minimal cognition and minimal semiosis are quite relevant. As the point that has been made lies in the difference in units of analysis and philosophical elements we refer to, we cannot exactly say that the elements of minimal cognition will map to those of minimal semiosis, but the interconnection between them is conceptually relevant nevertheless.

#### 8.4.1. The model, summarized

The form that the model takes can be briefly summarized as follows:

1. **A physical layer:** The most general of the three, setting basal conditions for the materiality of relations, that is, a ground for semiosis. This, simply put, is equivalent to accepting that the physical precedes the meaningful (section 8.1.1).
2. **An implementational layer:** Assuming that not all of the elements within the physical layer are contiguous, we can see some differentiation and specificity, a functional structure that allows relations to be established, not merely the ground for them. In this case, we are talking

- of a set of perceptual structures of any sort in an organism, the constraints to informational input and output *lato sensu* (section 8.1.2).
3. **An enactive layer:** At this point we need to join output with behavior. A sensorimotor structure is not sufficient in that their existence does not imply actual output. That is, we have instantiated action at this level, closer to the sense of a Peircean interpretant (section 8.1.3).

With these defining our field of coverage, we need to add a notion of special (P) semanticity to make the layers work, for there is more to the story of semiosis than a description of posited structures that necessitate it. Semantic closure is an attempt at closing the loop by establishing that the principle we need comes from organizing our unit of analysis beyond the organism and towards its action within the environment, not solely at the inner molecular level. This, taken as a starting point for a constrained and local level of minimal semiotic capabilities, presents us with the opportunity to engage at the theoretical level with the meaning making processes of organisms in describing a fully-fledged semiosis. More precisely, the task of a biosemiotician concerned with the theoretical description of initial semiotic capacities may see in the model a way to tackle the problems from descriptions that hinge on the previously mentioned metaphysical commitments made by some theories in semiotics. In this case, with the task of naturalization in mind, the aim of making some of the metaphysical commitments explicit while also trying to simplify them can help the biosemiotician overcome some terminological issues regarding the status of semiosis. This in turn gives us a viable alternative to explore some of the pressing issues in biosemiotics, such as the modeling of the relation between the physical and the phenomenal, or the description of necessary mechanisms for semiotogenesis. While it is true that the model *will not* solve these problems by itself, the analytical perspective offered can open new options for considering what some of our current theories depend on to work, and whether committing to, say, a strong sense of finality in simple organisms, can be acceptable as a concern of biosemiotics.

Besides the example of *E. coli* in the previous section, we can try and apply our model more directly – knowing that the model itself does not exclude the possibility of a complementary approach – to some other biosemiotically interesting phenomena. As the most common case of a biosemiotic analysis of an organism is that of the cell as the minimally competent living unit (Hoffmeyer 2008; Kull 2015a), we can quickly examine scaffolding as one of the essential openings for an analysis of biosemiotic phenomena. Scaffolding in biosemiotics is treated as “structural couplings” that work within a living system (Hoffmeyer 2007: 152). Theoretically, semiotic scaffolding happens at the cellular level because of the possible inside-outside distinction brought about by the membrane surrounding the cytoplasm, which in turn allows for a sort of informational exchange depending on its internal codes (Emmeche et al. 2002: 16). This enabling of sign relations, informing our semiotic understanding of the cell, and perhaps we can enhance our understanding of scaffolding by



seeing how the evolutionary process described by Hoffmeyer (2007: 156–158) fits with our model and what the change in commitments can be. That scaffolding happens is not in question, but rather, what comes from it and what it allows us to say about evolutionary semiosis, for the description of scaffolding works constrained by time and the physical constitution of the organism, that is, semiotic competence calls for the development and definition of changes in the organism, building up towards a difference that produces newer functionality. The process of semiotic scaffolding is open-ended to the point that Hoffmeyer sees it available to the point of cultural change in complex organisms (Hoffmeyer 2015: 251–252), but we will limit ourselves to the more basic mechanism in simple organisms. In the case of, say, assuming that an interpretant forms given certain electrochemical change in the membrane of a cell – an example used by Hoffmeyer to describe the possibility of change and thus, scaffolding (2015: 148) –, what matters to us is that, given that these changes are, first of all, physically instantiated (that is, they happen in the physical layer), but are constrained to signify by the differential structures of the organism (the sensorimotor apparatus that we represent in the implementational layer) and create a behavioral condition that eventually derives in some change (that is, they are effective in the enactive layer). But this is not enough to have a form of interpretation. A P-Semantic approach required by the model allows us to indicate that gluing the layers together requires us to assume the interdependence of these elements in order to speak of semiosis, that is, the relationship is not to be characterized simply as the electrochemical change inciting the membrane to react, but rather, it describes the reaction within the environment and tracks for the material dependence and the fact that behavior is instantiated. The main difference here between the more mainstream biosemiotic approaches lies in that the semiotic activity as described within a certain time frame necessitates the invoking of special causes in order to lead change towards the scaffolding. While Hoffmeyer opposes the “taboo” of final causation in natural sciences,<sup>155</sup> the fact is that we can do away with it and use a more descriptive teleonomical account, as we have established before, because philosophically speaking we do not exactly see a reason to entail directed change. That is, the sense of agency here is not necessary for value assignment (in section 8.3.1). In a more extensive way, reducing this commitment means that we do not have to assume that the processes of change and evolution in simple organisms end up in the same semiotic processes at higher levels of complexity. This is because we have constrained the devices we use to simple formulations of organisms without the assumption that a strong directedness remains essentially unchanged towards the more complex semiotic systems we can account for in the world.<sup>156</sup>

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<sup>155</sup> This “taboo” can also be found, regarding Aristotelian teleology, in philosophy (Cameron 2003).

<sup>156</sup> I do not wish to imply that we cannot *find* similar mechanisms in such an evolutionary constitution as the one that follows from Hoffmeyer, because the consequences of bio-semiotics to general semiotics are of great relevance and can be carried out successfully

The model can lend itself to analyzing other semiotically interesting formulations, such as the autogen model (Deacon 2011) or the conceptualizations of artificial intelligence in the vein of Emmeche (1992), and can give us an interesting perspective on such thought experiments to strengthen our understanding of some of the philosophical implications entailed by these projects while also allowing us to continue in the development of a theory that can integrate the model to evolutionary claims. However, we will not treat those here beyond what has been already said.

#### 8.4.2. Internal objects and minimality

One of the relevant problems we may find has to do with internal objects in a sign relation, these being the internal regulatory processes in organisms that do not deal exactly with the environment, or that can at least be seen as interior radicals. Say, if we model internal control mechanisms, we may have to abide by some semiotic terminology as it has been done in some analyses of genetic information (Barbieri 2007; Queiroz et al. 2011: 106), and we can understand informational processes *through* semiotic concepts. As the analysis of Queiroz et al. goes, genes are taken as signs because they signify something else to the whole organism. Genetic information is taken here as “the whole process through which a gene acts as a sign in a given cell, mediating the reconstruction of a specific sequence of amino acids” (2011: 109), with internal mechanisms being of relevance for the interpretation. This scheme is apparently harder to make work with our model because of the presupposition that it is the external differences for the organism that make sign action possible. The concept of codes as rules or habits connecting different elements (Brier 2009: 39–40) has to be noted to some degree, but it is in the basal idea of a code that we have a hint: If the code is even partially defined internally, it means that implementation can be meaningful. Brier makes the point that

A sequence of differences such as the base pairs in DNA can be information for coding, but is not a code in itself. Peircean biosemiotics argues that codes are part of triadic sign processes where an interpretant makes the motivated connection between objects and representamens. Living systems function on the basis of self-constructed codes. (Brier 2009: 40)

The inclusion of *autopoiesis* as a relevant point for Peircean biosemiotics makes sense because of that, and while the project of *Cybersemiotics* deals with the specific problems of a more autopoiesis-centric approach,<sup>157</sup> our view tries to separate metabolism from cognition to a similar degree that van Dujin et al. do. If cognition is “based in sensorimotor coordination, which modulates the

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even with the checks I have proposed in place. For a review of such consequences from a perspective that follows Hoffmeyer, see Cobley (2016).

<sup>157</sup> Such as the problem of constructivistic idealism (Brier 2008).

conditions of metabolic processes” (van Dujin et al. 2006: 165), then semiosis needs not be attached to the internal informational mechanisms. If we go back to implementation, what we have is a partial key to the environment. What we cannot claim is that semiosis gives rise to morphology. That would make us go from the opposite side. What we can claim, however, is that codes as previously defined are proportional to implementation and enaction, and defined in both at least partially. Internal information processes may be interpreted by the whole organism, which would lead us to believe in internal abstract objects, a form of self-dialogue if we may,<sup>158</sup> but we can only follow this scheme insofar as it is not determinative as a whole and that it has results beyond internal organization.

Having said that, the difference we find in our approach can be focused on how we retain a specific unit of analysis that seems to be of value to bio-semiotics. Our unit of analysis is not solely internal, it comprises the internal but value is finally assigned in combination with the external. ‘Representation’, even if heuristic, is only of value if our semiotic processes are supposed to take relevance within the interactions of our encircled organism. Information processes – incomplete as they may be and thus requiring of some indeterminism – are taken as implementational because they give us only a partial setup for the investigation of sign action. Triads of some form present us always with arguments on how we limit the scope of potential mereological sums we may consider as triads, and we have tried to avoid this problem to the degree that we can say we are not utilizing representational mechanisms. Instead, our thought is that for semiosis to be actual, it will have to be treated as a co-occurring measurement of action and the theoretical account of choice that gives rise to the semantic closure.

As such, we can have both a minimal model of semiosis, that is, an overview of the least complex bundle of elements possible for accounting for sign action to its simplest degree – and characterized as sign enaction –, and a differential unit of analysis that is compatible with Peircean extensions to some degree and with augmentative models of semiosis in more complex systems.

The fact remains that even a simple formulation of semiosis requires a number of metaphysical commitments as well as an actual degree of complexity. The applicability of such a model depends on how much we are willing to assign to less teleonomic processes in organisms, but we depend, ultimately, on the external ‘measuring’ of their possibilities. We do not wish to account for internal states nor for internal forms of interpretations. In our view, we have interpretation as action, grounded and of relevance within the described system. That is, in positing our minimal model, we have tried to stay in as limited a framework as possible while allowing for our possible explanations to include the elements that comprise a semiotic theory of sign action in living systems.

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<sup>158</sup> A non-committed response would state that given that ‘object mapping’ is dealt within the physical and that informational expression is organizationally physical at least in its reference, then there’s no problem in accepting even internal regulation as behavioral assets that can pertain to P-Semantics.

Finally, we may have a word regarding the self-confirmation given in theoretical commitments when describing a model of analysis to a unit that it already pertains to its concepts. The point I wish to make here is that, while the minimal model is apparently applicable only to living systems that we have already observed and whose behavior has already been catalogued to some degree, the abstraction of the model does not rule out other potential applications it may have. That is, the minimality-type constraints are so for any possible system in which we may want to observe sign action. We cannot rule out certain systems because they do not exhibit the traits we have confirmed in our previous objects. This means that we cannot rule out *post-biotic physiosemiosis* altogether, but rather, we can approach the possibility through both a minimal and a robust model. What the model cannot tell us, though, is whether these processes we can describe as sign action have any form of internal effect beyond that of implemented fuzzy choice. Biosemiotics deals with biological organisms, certainly, but the relevance of a biosemiotic perspective should always have a central focus in General Semiotics.

## 9. CONCLUSIONS

In this work we have explored the entailment of semiosis from an openly philosophical perspective on biosemiotics. While the task is solely conceptual, it is taken in different dimensions necessary for an argument and model to work as a cohesive hypothesis. That modeling is a task of biosemiotics is the essential presupposition we have made, and as such there have been a number of things guiding us towards the specific model we have worked out in this work. The minimal expression of semiosis as we have tried to elucidate it depends on what we assume our concepts of semiosis need to deal with. That is, if we take semiosis to be a serious process of meaning creation throughout the biological world, we need to substantiate our models within both a specific threshold and a specific competence of our concepts for making our models of semiosis work out within the scope of a scientific semiotics.

### 9.1. Discussing minimality

Is such a notion of minimality desirable for biosemiotics? The task of finding the exact spot where the cluster of complexity is simple enough to allow semiosis while being complex enough to actually be semiotic is a problem that certainly shares boundaries with the discussion on semiotic thresholds (Eco 1979; Nöth 2000; Kull 2009), but what we have dealt with is articulated outside this issue. Instead, we have taken steps to hypothesize on specific conditions to be met rather than levels of complexity to be afforded. That is, it does not matter to our view that the specific complexity of a cell allows us to have the information talk, but rather, that semiosis can be accounted for within a number of parameters, and that the phenomenon of signification that we can describe within those parameters can be achieved by multiple means. But the idea of parsimony depends on how we frame these parameters. Much like the condition of irreducibility in Peircean theories of sign relations, our conditions of minimality have been set against the backdrop of conceptual necessity. That is, the conditions to be met are twofold, we need our intuitions on sign action to be grounded on a specific paradigm – the biosemiotic paradigm working within a realist framework and the attempts at naturalizing sign action – and we need our concepts to reflect that semiosis is an effective phenomenon that can be analyzed. But this analysis depends on how we frame our units of analysis as well. The attempt at modeling semiotic capabilities in their minimal aspect is dependent, clearly, on our background theory, but its expression has to end up in an analytical aspect, that is, by formulating the conditions in which the phenomenon we have described can be understood. In other words, the unit of analysis we have come to describe aims for consistency with its metaphysical assumptions.

### 9.1.1. Formality and expansion

Minimal semiotic capabilities in this way are not an attempt to exclude evolutionary theories of semiosis, but rather to put a frame to their development. Yet, we have tried to maintain an informal account of the elements in the model. The reason behind this decision has to do with the difficulties of coming up with a formalized framework to work within semiotics. Considering a semiotic calculus has been but a distant project without effective realization, and that the methods of reasoning within the borders of biosemiotics are held in constant conflict between verification and model assumption, an immediate formalization is undesirable as it does not have a clear basis for its standing. On the other hand, retaining an informal approach to the description, or as informal as we have allowed ourselves to be in the description of the model, allows us an important deal of flexibility. The less defined elements in our theory can have a robust constitution without assuming they have to present either a specific biological correspondence or a specific descriptor for a certain function. What I mean by this is that there is no fixed matrix for application and derivability. Instead, the model limits its applicability by means of initial assumptions.

Let us take, for instance, the specific case of a memory function in biological systems. While such a function plays a central role in certain analyses of potential semiotic activity (Barbieri 2008; Kull 2009a; Scalabrino 2013), we have not provided a descriptor for a proper *memory function*. However essential it may seem for providing a continuous referential apparatus, the expression of a memory function is subsumed by an implementational framework that doesn't require storage to have continuity. In fact, if we use the example of slime mold using spatial 'memory' for navigating in complex environments (Reid et al. 2012), we can only account for a memory function in a very vague manner. What could be conceivably called memory here is a spatial recognition system that does not draw from internal storage of information but from an extensional operation of the bodily constitution of the organism. That is, even if this externalized 'memory' can be seen as a precursor of internal memory as suggested by Reid et al., we do not need our model to include a fully realized memory function so much as we need to have a consistent organization.

When it comes to specifying functionality beyond the bare minimum of organization for mechanisms of interaction with the environment, the idea is to account for the fact that non-specific organization is necessary, but specific organization is variable. That being said, this particular framework for minimality displays robustness without function correspondences because it does present a limit to its applicability. These limits could be bypassed through an extension of sets to be considered semiotic, but it would still require some reworking. For say, if we were to attempt an analysis of physiosemiotic capabilities in a chemical system using this model of minimality, we could at first sight state that a chemical system defined as such has a structural conformation that allows its reaction towards the environment, and that in combination with its environment it could cause reactions of sorts. This would

be missing the point though, as implementation in the way we have described it rules out the sufficiency of physicality as it is. The discretion of a chemical system may extend the discussion, but we can object that even an input-output type of interaction does not entail any distinguishing enactive feature. It may well be that chemical systems *could* entail fuzzy choices, but these cannot be attested and as such would not only be conjectural, but also highly improbable. More importantly though is the fact that the possible enaction that we can observe is cashed out in a teleonomic view, thus requiring external confirmation of complexity while also explaining that a physically structured interaction system is simply not sufficient for sign action.

## 9.2. Constructing the argument

The fact that to reach that hypothesis we do need to have some background assumptions is not surprising. We started our exploration focusing on the interaction between metaphysics and biosemiotics, working out the main kinks of this complicated relation. The scientific endeavor of biosemiotics cannot be consolidated as such without the recognition that scientific enterprises take metaphysical stands, no matter if these are clear or not. The pragmatic answer to this discussion is simply not enough to apply semiotic concepts to biological phenomena. Even within a fiercely deflationary perspective on the metaphysics of biosemiotics, theory cohesion depends and eventually expresses metaphysical commitments.<sup>159</sup> In trying to clarify these, we can observe some of the crucial elements that can serve against our specific theories on semiosis. We identified some of these in the framework of physiosemiosis as it allows a form of semiosis that we can see as necessarily guided as a fully fledged precursor to biosemiosis. This is particularly concerning because the consequences to accepting physiosemiosis as the cornerstone of semiotics causes a differentiated metaphysics contrary to the accepted forms of scientific biosemiotics. And it is not that the arguments for physiosemiosis do not support an eventual biosemiotic addition, because they are easily extensible, but rather that they constitute a basal law that as such constitutes the most basic of semiotic potential. Instead of that, we have followed the line invested in the naturalization of semiotic concepts, even if in metaphysical thinking, something that does have some consequences for the way we look at semiotics as a special science.

We follow this idea trying to give some characterization to this description of semiotics, that with its naturalized flavor can provide strong definitions for application in the biological realm while finding some necessary limitations to how much it can say past such a threshold, and it is because of that that we can enter the discussion of emergence, a mainstay as it is in the discussion of semiogenesis. This is a point that requires some fine-grained distinctions in

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<sup>159</sup> A discussion on metaphysical commitments in the sciences can be found in Andersen and Becker (2016).

order to be applicable for semiotics. As shown in the division between strong and weak emergence, both ontological positions have important and interesting consequences for biosemiotics, but the viability of strong emergence is called into question. Weak emergence, tacitly the most prevalent view in current biosemiotic research, is seen as a more feasible solution to find a basal account of semiotic capabilities, creating a robust set of constraints while being flexible enough for the tenets of biosemiotics.

The metaphysical discussion on emergence was complemented with a discussion on what it means for a naturalized biosemiotics to deal with scientific models, their relation to semiotic models and the guiding aspects of parsimony for coining a hypothetical minimal model of semiotic capabilities. Modeling semiosis to reflect minimal requirements for its constitution depends on what we can say about models as much as what our ontology allows us to say about semiosis. More generally, when dealing with the modeling of semiotic capabilities we still need to inquire as to what are the conditions for minimality in models.

Past that we set the constraints necessary for talking about the organismic inclusion in our view of semiosis, introducing the concepts believed to be necessary to take semiosis seriously. This lays the groundwork for developing an individual model of minimal semiotic capabilities in the vein that we have already discussed in the conclusions.

### **9.2.1. Is semiotics metaphysically disinterested?**

A question that is worth asking, after dabbling in the problems of constructing a minimal model of semiotic capabilities, is whether semiotics as a discipline is metaphysically disinterested. That is, can we truly have a metaphysically neutral sign relation, and is that even desirable? If anything, the coining of the sign as part of our analytical view leads us to establish certain metaphysical assumptions about the world, and even the most pragmatic view of sign application can recognize that our theories make background assumptions. One may wish to declare the neutrality of the sign relation and defend this within a Peircean framework where it can be argued that the sign relation is a logical consequence of some sort. The eliminativism, however, of background assumptions can only act in that way if we provide robust options that are already naturalized. This, I believe, is an ongoing work for biosemiotics that may follow the spirit of pragmatism, but which cannot be applied by the sheer axiomatization of pragmatic maxims of any sort.



### 9.3. Semiosis, after all

We have tried bringing a consistent view of semiotic capabilities from the bottom, that is, by qualifying the modeling practice of semiotics with our assumptions on the ontology of semiosis and what we can appreciate as possible candidates for the minimal requirements for semiosis. The results are not, as is the case with musings of a philosophical nature, univocal, but the perspective presented here is, I believe, a contribution to the conceptualization of the basic units of analysis for biosemiotics from a philosophical perspective. This is of some relevance as the constitution of the field and its constant change depends on making certain philosophical positions clear and accountable, with the current work being an attempt at modeling semiosis without relying on a strong Peircean framework while feeding from its concepts. In this, I hope, we have cleared a path for an alternative for naturalized biosemiotics that can still be understood as relying on biosemiotic premises instead of separating from the field altogether.

The claims our model can make about biosemiosis in a general, yet simple level can be seen, following the idea that semiotic models present a more general form of scientific models, as an attempt to make scientific claims, or at least nuanced claims that aim for naturalization, regarding the standing of sign action in simple organisms. The specificity we have presented certainly requires metaphysical claims, but we do not shy away from them. Instead, we have tried to make the point that the constitution of a semiotic paradigm makes very specific claims about the standing of relations and signification, but these do not need to be limited to the scope of relational ontologies inasmuch as we can try to observe a more reduced emergent view on sign relations via the modeling of specific systems.<sup>160</sup>

#### 9.3.1. Remaining questions and prospects

While we have remained outside of formalized systems, the idea of developing a more strict formalization of P-Semantics could open a number of research avenues regarding sign types to some degree. While the accounting for signs does not, in our view, depend on sign types – as they cannot be specified externally at this level –, there can be a systematization to the expression of signs within the described system. This would be an arduous task in the same line of a semiotic calculus, that is, a pretension that seems contrary to the expectations of biosemiotic descriptions (considering for instance the value of logical contradiction for biosemiotics).

The explicit application and development of tight units of analysis will also demand a more thorough observation of the compatibility of current biosemiotic terminology with that of our view. In fact, the (assumed) incompatibility

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<sup>160</sup> In a Peircean vein, a processual view of ontology can be found in Gustafsson (2015).

between internal coding and behavioral expression as basic units of analysis implies a divide between the usability of semiotic terminology within the different positions in the field. If there is a middle ground, it remains to be found.

Finally, one of the most prominent elements to be developed is that of compatibilizing the different branches of semiotics within the naturalistic framework of biosemiotics. While this is a more general discussion belonging to general semiotics, However, I wish with the present work to have at least provided a limiting account of the scope of biosemiosis as well as a small contribution to the issues related to the evolution of semiosis at different levels or organization and complexity. For if we wish to preserve the idea of a naturalized semiosis and its conceptual compatibility throughout the endeavors called 'semiotic', we may of necessity have to complement our analyses with the assumptions made at the most basic level of semiotic interaction with, eventually, those that underlie the activities of complex sign systems, cultural activity or mental functions as many of the branched semiotics have tried to describe with the particular tone of this particular discipline. It is here thus that we can hope to achieve a more balanced relation between the biosemiotic aspects of the whole of semiotics and the rest of the field, resulting in a more concrete expression of general semiotics towards its own systematic, ever-evolving development.

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## SUMMARY OF THE THESIS

The present work opens a discussion on the prospects of modeling minimal semiosis following a naturalized biosemiotic perspective. Setting hypothetical assumptions from the metaphysical problems given in the treatment of semiosis from biosemiotics, the thesis tries to account for the relevance of a constrained ontology when developing theories of semiosis. This leads to a discussion on what the role of modeling is within biosemiotics as a scientific discipline and the implementation of a parsimonious view on semiosis as it may potentially be modeled.

We start by asking what exactly metaphysics does in biosemiotics. The scientific disposition of biosemiotics as a general research endeavor appears to sanction all possible metaphysical musings, seen as either not informative for theories that deal with biological processes, or as appended definitions without causal roles in biosemiotic explanations. There is a number of things that we must first take into consideration, in any case. While the potential role of semiotic explanations should, in theory, have a strong basis in naturalized, scientific assumptions, biosemiotic theories hinge on their metaphysical backgrounds. The metaphysical background of a theory is comprised of the assumptions made by the theory that are not spelled out except as the initial definitions and assumed elements that do background work at the larger scale. That is, metaphysical assumptions in theories of biosemiotics deal with the nature of signs, relations and the fact that we can use them in our theories of semiotics.

Peircean concepts do, in fact, a good deal of work in biosemiotic theories, with the concept of *semiosis* taking primacy as the main (conceptual) reason for the usage of a semiotic approach. The emergence of semiosis, universal evolutionary scales, semiosis as a base level law – these are all forms in which the more philosophical inclination of biosemiotics appears patently, despite its more scientific view of semiosis. In order to make these aspects form a more coherent perspective, we need to understand that the role of metaphysical explanations serves as a way to ground our concepts of the sign. In the case of Peircean semiotics, we have a number of possibilities that may result in different settings for semiotic phenomena, such as assigning a causal role in the form of universal law to semiotic triads. In order to prevent our metaphysical background from expanding and monopolizing explanations, we need to set some specific constraints based on our understanding of the role of semiosis, its definitions and the relation of semiotics to other scientific explanations. The naturalization of semiotics, that is, the process of coalescing theories of semiotics with scientific explanations outside of the field, provides us with a way to consider how we may set ontological constraints to our explanations in semiotics.

Having a parsimonious view of the causal role of semiosis helps us in avoiding a theory of semiotics with too many elements determining the outcome of other theories. The constitution of semiosis must strike a balance between

being causally effective and not covering all possible bases of scientific research. For we may be able to explain (assumed) non-semiotic phenomena through triadic explanations, but that may simply incur in a haphazard organization of elements in order to provide semiotic explanations where there is no need for them. We prefer a deflationary view of ontology, that is, removing as many elements from our ontology as possible while still asserting that metaphysics has a valuable place in biosemiotics, gluing our theories together. In this way we can account for some minimal elements in our view of semiosis and model them accordingly.

One example of what we assume to be an ontologically expansive perspective that causes argumentative problems for a naturalized biosemiotics is the idea that sign relations can be entailed by physical systems without any form of cognitive intervention, even if our concept of cognition here is wide enough to include behavioral reaction instead of symbol manipulation. This is the idea of physiosemiosis, where object, representamen and interpretant can take a physical expression in one assumed causal triad.

The reason to consider this problematic is twofold: First, if semiosis can be implemented by purely physical systems – under a loose definition of system – our theories on the minimal requirements to have semiosis as a working concept become dependent on a prebiotic understanding of the sign. Second, if we assert that semiosis acts as a causal power before the emergence of cognition we can construe our theories of semiotics as a case of a basal universal law. The first aspect we mentioned is problematic because it allows the setting of triads as if they were proper signs without any specific distinction to make them so except as a putative role assignment for each element of the sign relation within the physical system we have decided to describe with semiotic terminology. The second aspect is problematic because it moves the goalpost of semiotics in general, making the requirements for semiosis predetermined in the physical constraints of the universe while also making the same phenomenon a universal law, much like physical laws. This, however, is hard to argue for and requires an extensive ontological machinery that seems extremely expensive to afford in theories of semiosis.

With this in mind, we move on to discuss the role of naturalization in semiotic descriptions. While semiotic terminology is rather idiosyncratic in the way concepts are used, the core assumptions of biosemiotics – that living organisms use signs and that meaning is a relevant factor for biological processes – are generalized in their anti-reductive perspective and call for some form of complementarity in order to account for biological meaning. We argue here, however, that the scope of biosemiotics must be limited to generalizations about meaning instead of fully-fledged universal laws, as we have seen in the opposition of the example coming from theories of prebiotic physiosemiosis. At the same time, committing to biosemiotic views can also have a positive impact in general theories of semiotics, as naturalizing semiotic functions of any general sort will inform views of branched semiotics further about the underpinnings of the theory.

This leads to the question of the basic principles on which we can talk about semiosis. If we assume that the basic form of sign action comes from a biological ground, then it is relevant to ask to what degree it *emerges* from physical or biological systems. The concept of emergence is quite fruitful in the philosophical dimension in that it gives us terminology to analyze the degree in which we can account for emergence. Here we make the common distinction between strong and weak emergence. Strong emergence refers to the non-deducibility of an emergent and its potential bringing about of new causal powers. Weak emergence, on the other hand, refers to the unpredictability or unexpectedness of the emergent while still being subject to the principles that govern the level from which it emerges. Now, both characterizations of emergence can tell us something about semiosis, but it depends on how we can characterize it as an emergent with respect to some specific level. Both possibilities can be developed, but in order to move this discussion forward we must surmise what exactly it means for semiosis to be an emergent. A semiotic emergent can thus be thought of as either the emergence of the process of semiosis or of any of the specific elements of the sign relation.

When thinking of semiosis as a strongly emergent phenomenon, we characterize it as not deducible from the assumed initial conditions. As we have tried to stray away from the argument that signs can be entailed by purely physical means, we need to see how a complex biological system – following the Sebeok thesis – can have sign relations. In this, however, we characterize semiosis as at least partially entailed by the elements in the relation, such as an object and its perceiver. If we try to assume the elements of the sign relation as individually emergent, we cannot see anything special about, say, an object having the property of being an object in a way that it would not be deducible from the rest of the elements we have at our disposal. We can repeat this observation on the other elements of the sign relation without reaching any certainty about the status of these elements as strongly emergent.

By moving to weak emergence, we have a different characterization of a possible semiotic emergent. Weak emergence is closer to the study of complexity, a field that has had a relevant impact on biosemiotics. Biological meaning, by allowing semiosis, can be seen as weakly emergent in that the complexity of biological systems and their environmental interactions do not need to cause a limited number of interpretant-like reactions. On the contrary, we assume that meaning is not limited to simple correspondences. Another important thing to note is that weak emergence does not expand our metaphysical assumptions in the same way that strong emergence does.

Weak emergence seems to provide a clearer form of establishing a metaphysical background for biosemiotics without resorting to more complex ontologies while giving a more concrete picture of the elements necessary to make semiosis “work”. This being the case, we can try and model semiotic phenomena with a more limited scope and background assumptions that may have a specific impact in our modeling methodology. This specific impact can be



spelled out as a more constrained ontology, a desirable outcome as we have proposed earlier, and a frame for our possible descriptions of semiosis.

After this, we proceed to analyze the concept of minimality – the parsimonious approach that we have targeted from the beginning – in both the conceptualization of our objects of study and semiotic methodology, that is, modeling. In our view, this is a relevant thing as coming up with a form of understanding of the basic components of biologically grounded semiosis depends on how we frame our modeling practices and understand the pre-conditions for avoiding an expansion of objects that must be covered in the basic structure of our theory. In understanding modeling practices we can observe differences in the treatment of scientific and semiotic models, but ultimately we may find a middle ground in order to make relevant claims about the world through semiotic models when framing some of the possible senses of scientific models under some semiotic terminology.

The objects of our theories of semiotics, when avoiding the expansion of concepts, can be treated with certain sense of parsimony. We try to reinforce this point by appealing to the naturalization of semiotic concepts as an essential task of biosemiotics. This view is further developed in trying to account for the actuality of semiosis in simple organisms. Having a concept of model at hand allows us to see the necessary structure for our theories to be implemented. We further expand on the idea of model organisms in order to exemplify the earlier talk on models and try to account for a first concept of semanticity and its implementation. As issues of semiosis and semantics are intertwined, we cannot exactly separate one from the other. However, we can distinguish that semanticity is a process *of* semiosis and not the other way around, as our concept of semiosis deals with organism interaction and its environment.

However, the assumption of both semiosis and semanticity in simple organisms has to be made more concrete in how we build our own hypothesis on minimal semiotic capabilities. In order to do that, we propose a simplified layered model. We wish to account for semanticity as the final part of the meaning generating operation *within* semiosis. In order to do that, we set the layered model in a way that would give rise to this semanticity by taking into account the most basic elements needed to ground a sign relation.

As we are reminded that for meaning to arise there must be a sort of complementarity between *matter and symbol*, as it has been described, we need to find the elements that comprise this complementarity to begin with. The idea of complementarity here is essential as a manner of summing up the fact that our naturalized view depends on a realist view of physicality as a basis on which we can build other elements, even if we allow the idea that higher order elements cannot be reduced to their physical aspects. The way this is encapsulated in the idea of complementarity helps us in understanding how to make a model work if we want to address the minimal components necessary for sign action.

We set the model in layers in order to have a more precise view of complementarity. First we start with a *physical* layer, part of the complementarity required for meaning to arise – the world out there, as a manner of speaking –,

but insufficient in that having only a physical topology in our model cannot do enough to create meaning. Instead, complementarity must depend on a combining factor, and as it stands, physicality is certainly insufficient. For semiosis to be effective, we need a way to put into effect relations, and this is what comprises the *implementational* layer. For a sign relation to hold, it needs to be mapped to the elements of a sign relation, such as a physical object, in correlation with a certain perceptual structure. This structural need is grounded on the physical, but it is differentiated because of its specificity. Yet, having a perceptual apparatus structured in some way is not enough to be able to talk about meaningful relations. This insufficiency comes from the fact that having the possibility of meaning does not actually equate to having any form of meaning for an organism. What we need, finally, is a way to combine the previous layers in a dynamic system that can be accounted for. Behavior is an indicator of this and we can assume it being causal enough to provide us with a sense for the third and final layer, the *enactive* layer of the model. While the concept of *enactivism* is a rather loaded one, the point here is that we can observe some fundamental patterns of cognition in simple biological organisms that allow us to see in behavior a form of semiotic result. Given a combination of all three layers, we have a basal assumption for the entailment of semiosis in a minimal aspect.

The consequences of such a model may be rather modest, but in following it we can coin a specific unit of analysis given in not just the individuation of a sign or the black-box like processing of the sign, but rather in the systematization of organism and environment. This allows us to reformulate complementarity as a form of semanticity based on simple constraints and without a specific formulation of content. This we call *P-Semanticity*, a realization of biological meaning within semiosis characterized as the non-deterministic implemented mapping of relevance for an organism within a given environment.

This research has to do with, finally, the metaphysical constraints we can set when discussing the simplest expressions of semiosis and how biosemiotics can model them. Our perspective has taken us from the background assumptions of the theories of biosemiotics towards proposing our own model for conceptualizing a frame with which to refer to semiosis in a reduced manner. In this way we hope we have fruitfully discussed both philosophical implications and conceptual applications of biosemiotic terminology while being aware of our assumptions and what they do in the theories of biosemiotics.

## SUMMARY IN ESTONIAN

### Semantika koht biosemiootikas: semioosivõimete minimaalse mudeli kontseptualiseerimine

Käesolev töö analüüsib võimalusi modelleerida minimaalset semioosi, järgides naturaliseeritud biosemiootilist perspektiivi. Tuues esile hüpoteetilised eeldused, mis tulenevad metafüüsilistest probleemidest nii nagu need esinevad semioosi käsitlemisel biosemiootikas, üritatakse väitekirjas põhjendada piiratud ontoloogia relevantsust semioosi-teooriate väljatöötamisel. See viib aruteluni sellest, milline on modelleerimise roll biosemiootikas kui teadusdistsipliinis, samuti kitsama käsitluse kasutuselevõtuni semioosist nii nagu seda võiks potentsiaalselt modelleerida.

Esmalt küsime, milline täpselt on metafüüsika osa biosemiootikas. Biosemiootika kui üldise uurimisvalla teaduslik iseloom näikse keelavat igasugused metafüüsilised arutlused, kuivõrd neid peetakse väheinformatiivseteks bioloogiliste protsessidega tegelevate teooriate jaoks, või külge poogituiks definitsioonidele, ilma põhjuslike seosteta biosemiootiliste protsessidega. Igal juhul tuleb meil arvesse võtta mitut asjaolu. Ehkki semiootilised seletused peaks teoreetiliselt omama tugevat alust naturaliseeritud, teaduslikes eeldustes, sõltuvad biosemiootika teooriad ometi ka oma metafüüsilisest taustast. Mõne teooria metafüüsiline taust hõlmab neid teooria poolt tehtud eeldusi, mis ei ole selgelt välja toodud muul viisil kui algsete definitsioonide ja eeldatavate elementide kaudu, küll aga teevad taustal suuremahulist tööd. Teisisõnu, metafüüsilised eeldused biosemiootika teooriates tegelevad märkide ja suhete loomusega ning nende kasutatavusega semiootikateooriates.

Peirce'i mõisted tõepoolest määravadki palju biosemiootilistes teooriates, kus *semioosi* mõiste rakendamine ise toimib (kontseptuaalse) põhjusena semiootilise lähenemise kasutamiseks. Semioosi esilekerkimine, universaalsed evolutsioonilised astmikud, semioos kui baastasandi seadus – kõik need on tahud, kus biosemiootika filosoofilisemad kalduvused selgelt esile tulevad, hoolimata semioosi teaduslikumast käsitlusest biosemiootikas teiste semiootika harudega võrreldes. Et need kaks aspekti moodustaksid koherentsema vaatenurga, tuleb aktsepteerida, et metafüüsilised seletused on üks viis märgimõistest põhistada. Peirce'iliku semiootika puhul on meil mitmeid võimalusi, mis võivad tulemuseks anda erinevad raamistused semioosilistele nähtustele, nagu näiteks omistades semioosilistele triaadidele põhjusliku rolli universaalse seaduse näol. Takistamaks metafüüsilisel taustal seletusi laiendada ja monopoliseerida, tuleb paika panna teatavad kindlad piirangud, mis põhinevad arusaamal semioosi rollist, definitsioonidest ning semiootika suhtest muude teaduslike seletustega. Semiootika naturaliseerimine ehk semiootikateooriate kokkuviimine teaduslike seletustega väljaspool tema enda valdkonda annab meile ühe võimaluse mõtestada, kuidas saaksime seada ontoloogilised piirangud oma seletustele semiootikas.

Kitsam arusaam semioosi põhjuslikust rollist aitab meil vältida semiootika-teooriat, mis oleks liialt üldine. Semioosi ülesehitus peab leidma tasakaalu, kus

ta on põhjuslikult efektiivne, ent samas ei hõlma kõiki võimalikke mudeleid. Võib küll olla võimalik seletada (eeldatavalt) mittesemiootilisi nähtusi triaadiliste seletuste abil, kuid see võib endaga kaasa tuua semiootiliste seletuste kasutamise seal, kus need pole efektiivsed. Eelistades deflatsioonilist arusaama ontoloogiast, ehk siis eemaldades nii palju elemente kui võimalik meie ontoloogiast, väidame samas siiski, et metafüüsikal on biosemiootikas väärteline koht, kuna ta seob kokku erinevad teooriad. Sel viisil saame me anda seletuse teatavatele minimaalsetele elementidele meie arusaamas semioosist ning modelleerida neid vastavalt.

Üheks näiteks sellest, mida me peame ontoloogiliselt ekspansiivseks perspektiiviks ja mis põhjustab naturaliseeritud biosemiootika jaoks vaieldavaid probleeme, on arusaam, et füüsikalised süsteemid võivad kaasa tuua märgisuhted, ilma et sellesse sekkuks mingitki tunnetust, isegi kui meie tunnetusmõiste on siin piisavalt lai, et sisaldada käitumuslikke reaktsioone sümbolikasutuse asemel. Niisugune on idee füsiosemioosist, mille järgi objekt, representamen ja interpretant leiaksid füüsikalise väljenduse mingis oletatavalt põhjuslikus triaadis.

Põhjus pidada seda arusaama semioosist problemaatiliseks on kahetine. Esiteks, kui semioos saab teostuda puhtalt füüsikalises süsteemis – olgu süsteem siin üsna laialt defineeritud –, osutuvad meie teooriad selle kohta, mida on minimaalselt tarvis kasutamaks semioosi kasuliku mõistena, sõltuvaks arusaamast märgist kui eelbiootilisest. Teiseks, kui me väidame, et semioos toimib põhjusliku jõuna enne tunnetuse tekkimist, siis me võime semiootikateooriad ümber tõlgendada üheks juhuks universaalsest baasseadusest. Esimene nimetatud tahkudest on problemaatiline, kuna see võimaldab esitada triaade justkui oleksid need päris märgid, ilma et selle aluseks oleks mingi konkreetne eristus, välja avatud oletuslik rolliomistamine märgisuhte igale elemendile füüsikalises süsteemis, mida me oleme otsustanud kirjeldada semiootilise terminoloogia abil. Teine tahk on problemaatiline, kuna see muudab semiootika eesmärgi üldiselt, muutes semioosi tingimused universumi füüsiliste piirangute poolt ettemääratuks, tehes samas sellest samast nähtusest füüsikaseaduste sarnase universaalse seaduse. Viimase kaitseks on aga väga raske argumenteerida ja see vajaks ulatuslikku ontoloogilist aparatuuri, mis pole aga semioosi-teooriatele kohane.

Eeltoodu meeles, asume analüüsima naturaliseerimise rolli semiootilistes kirjeldustes. Ehkki semiootiline terminoloogia on üsna idiosünkraatiline selles osas, kuidas mõisteid kasutatakse, on biosemiootika kesksed eeldused – et elusorganismid kasutavad märke ja et tähendus on bioloogilistes protsessides oluline tegur – üldistatud tema reduktsionismi-vastases hoiakus ja vajaduses mingit tüüpi komplementaarsuse järele bioloogilise tähenduse seletamisel. Siin me aga väidame, et biosemiootika ulatus peab piirnema üldistustega tähenduse, mitte täiemahuliste universaalsete seaduste kohta, nagu nägime vastupidise näite puhul, mis tuleneb eelbiootilise füsiosemioosi teooriatest. Samas on biosemiootiliste käsitluste aktsepteerimisel positiivne mõju üldistele semiootika-

teooriatele, kuna ükskõik millise üldisema semiootilise funktsiooni naturaliseerimine annab uut teavet semiootika teistele harudele teooria aluste kohta.

See viib küsimuse juurde neist põhilistest printsiipidest, mille alusel me saame rääkida semioosist. Kui eeldame, et märgitoime põhivorm tuleneb bioloogilistest alustest, on oluline küsida, millisel määral see füüsikalistest või bioloogilistest süsteemidest emergeerub. Emergentsuse mõiste on filosoofilises mõttes üsna viljakas selles mõttes, et pakub meile terminoloogiat analüüsimaks, millises ulatuses saame emergentsust seletada. Siinkohal me teeme tava-pärase eristuse tugeva ja nõrga emergentsuse vahel. Tugev emergentsus osutab emergentse mittetuletavusele ja selle võimele tekitada uusi põhjuslikke jõude. Teisalt nõrk emergentsus osutab emergentse ennustamatusele või ootamatusele, alludes samas endiselt printsiipidele, mis valitsevad sellel tasandil, millest ta emergeerub. Mõlemad emergentsi iseloomustused võivad öelda midagi semioosi kohta, aga asi sõltub sellest, kuidas me seda iseloomustame emergentsusena mõne konkreetse tasandi suhtes. Mõlemat võimalust saab edasi arendada, ent esmalt tuleb täpsustada, mida tähendab, et semioos on emergentne. Semiootilist emergentsi võib niisiis mõtestada kas semioosiprotsessi või siis mõne märgisuhte konkreetse elemendi emergeerumisena.

Täpsemalt, kui mõtestame semioosi tugevalt emergentse nähtusena, iseloomustame me seda mittetuletatavana eeldatavatest algtingimustest. Kuna oleme üritanud liikuda eemale fusiosemiootilisest seletusest, tuleb meil näha, kuidas keerukal bioloogilisel süsteemil – järgides Sebeoki teesi – võivad olla märgisuhted. Sel juhul me aga iseloomustame semioosi vähemalt osaliselt kaasnevana suhtes olevate elementidega, nagu näiteks objekt ja selle tajuja. Kui üritame eeldada, et märgisuhte elemendid emergeeruvad individuaalselt, ei ole mitte midagi erilist näiteks selles, et objektil on omadus olla objekt niisugusel viisil, et teda ei saa tuletada teistest saadaval olevatest elementidest. Me võime seda tähelepanekut korrata teiste märgisuhte elementide juures, jõudmata mingisugusele kindlusele nende elementide staatuse osas tugevalt emergentsetena.

Liikudes edasi nõrga emergentsuse juurde, saab võimalikku semiootilist emergentsi iseloomustada teisiti. Nõrga emergentsuse käsitus on lähemal kompleksuse-uuringutele – teadusharule, mis on biosemiootikat oluliselt mõjutanud. Bioloogilist tähendust, mis võimaldab semioosi, võib pidada nõrgalt emergentseks selles mõttes, et bioloogiliste süsteemide keerukus ja nende interaktsioonid keskkonnaga ei pea põhjustama piiratud arvu interpretandi-taolisi reaktsioone. Vastupidi, me eeldame, et tähendus ei piirdu lihtsate vastavustega. Olulise asjana tuleb veel märkida, et nõrk emergentsus ei laienda meie metafüüsilisi eeldusi samal moel nagu seda teeb tugev emergentsus.

Nõrk emergents pakub selgema viisi sätestada biosemiootikale metafüüsiline taust, ilma et vajataks tuge keerukamate ontoloogiatest, andes samas konkreetsema pildi elementidest, mida on tarvis, et semioosi mõiste oleks produktiivne. Kui nii, siis võime üritada modelleerida semioosilisi nähtusi kitsamas sfääris ja vähemate taustaeeldustega, millel võib olla konkreetne tagajärg meie modelleerimise metodoloogias. Seda konkreetset tagajärge võib täpsemalt

kirjeldada piiratumat ontoloogiana, mis, nagu eelpool märkisime, on soovimisväärt tulemus, nagu ka raamistikuna meie võimalikele kirjeldustele semioosist.

Lähtudes eelnevast liigume edasi analüüsima minimaalsuse mõistet ja parsimoonilist lähenemist, mille poole me oleme algusest peale rihtinud – nii oma uurimisobjektide kui semiootilise metodoloogia ehk modelleerimise kontseptualiseerimisel. Meie seisukohalt on see oluline, kuna käia välja viis mõista bioloogiliselt põhistatud semioosi peamisi komponente sõltub sellest, kuidas me raamistame oma modelleerimispraktikad ja mõistame eeltingimusi, mis aitavad vältida nende objektide rohkendamist, mida meie teooria põhiline struktuur peab hõlmama. Modelleerimispraktikate mõistmisel on erinevusi selles, kuidas koheldakse teaduslikke ja semiootilisi mudeleid, kuid võime leida kompromissi, eesmärgiga esitada semiootiliste mudelite abil asjakohaseid väiteid maailma kohta, kui raamistame mõned teaduslike mudelite võimalikud tähendused semiootilise mõistestikuga.

Kui me väldime mõistete rohkendamist, võib semiootikateooriate objekte käsitada parsimooniast lähtudes. Peame seda tarvilikuks, apelleerides semiootiliste mõistete naturaliseerimisele kui biosemiootika jaoks olulise tähtsusega ülesandele. Seda vaadet arendatakse edasi püüdega seletada semioosi olemasolu lihtsates organismides. Me arendame edasi ka mudelorganismide ideed, eesmärgiga näitlikustada varasemat arutelu mudelistest, ning üritame selgitada spetsiifilist semantilisuse mõistet ja selle rakendamist. Kuna küsimused semioosist ja semantikast on omavahel seotud, ei saa me üht teisest otseselt lahutada. Kuid saame siiski teha eristuse, mille kohaselt semantilisus on *semioosiprotsess*, ja mitte vastupidi, kuna semioos on seotud organismide interaktsioonidega ja nende keskkondadega.

Siiski tuleb eeldust, et semioos ja semantilisus on olemas lihtsates organismides, konkretiseerida selles osas, kuidas me oma hüpoteesi minimaalsetest semioosilistest võimetest üles ehitame. Sel eesmärgil formuleerime lihtsustatud tasandilise mudeli. Meie sooviks on anda seletus semantilisusest kui viimasest osisest tähendust loovas operatsioonis semioosi sees. Sel eesmärgil püstitame kihilise mudeli üles nõnda, et see annaks tulemuseks semantilisuse, võttes arvesse kõige põhilisemaid elemente, mida on tarvis märgisuhte põhistamiseks.

Kuna teadupärast on tähenduse tekkeks tarvis mingit komplementaarsust *aine ja sümboli* vahel, nagu seda on kirjeldatud, tuleb meil leida elemendid, mis selle komplementaarsuse õigupoolest moodustavad. Komplementaarsuse idee on siinkohal määrava tähtsusega, kuna võtab kokku asjaolu, et meie naturaliseeritud vaade sõltub realistlikust arusaamast füüsikalisusest kui alusest, mille pinnale muud elemendid rajame, ja seda ka siis, kui võtame arvesse seisukoha, et kõrgema järgu elemente ei saa redutseerida nende füüsilistele aspektidele. See, kuidas eelnev on komplementaarsuse idees väljendatud, aitab mõista, kuidas luua toimivat mudelit, kui me tahame kõne alla võtta minimaalsed komponendid, mida on märgitoime jaoks tarvis.

Mudeli moodustame kihiti, jõudmaks täpsema arusaamani komplementaarsusest. Me alustame füüsikalisest kihist, mida komplementaarsuse osas on tähenduse tekkeks tarvis – maailmast “seal väljas”, ent mis on ebapiisav, kuna

pelk füüsikalise topoloogia olemasolu meie mudelis ei suuda üksinda tähendust luua. Komplementaarsus peab sõltuma mingist kombineerivast tegurist, ja antud olukorras on füüsikalisisus kindlasti ebapiisav. Et semioos saaks olla efektiivne, on tarvis võtta kasutusele suhted, ja need moodustavadki *täidesaatva [implementational]* kihi. Märgisuhte kehtimiseks tuleb see kaardistada märgisuhte elementidele, korreleerides füüsikalise objekti teatava tajumusliku struktuuriga. See struktuurne vajadus põhineb füüsikalisel, kuid eristub sellest tänu oma spetsiifilisusele. Siiski ei ole teatud viisil struktureeritud tajuaparatuuri olemasolu piisav, et võiks rääkida tähenduslikest suhetest. See ebapiisavus tuleneb asjaolust, et tähenduse võimalikkus ei ole sama kui see, et on olemas tähendus mingil kujul organismi jaoks. Mida meil viimaks tarvis, on mingi viis eelnevad kihid dünaamilisse süsteemi kokku kombineerida, mida oleks siis võimalik seletada. Käitumine on selle indikaatoriks, ja me võime eeldada, et see on piisavalt põhjuslik, andmaks meile mõista kolmandast ja viimasest kihist, mudeli *jõustavast [enactive]* kihist. Ehkki mõiste *enactivism* on üsna laetud, on mõte siin, et meil on võimalik vaadelda teatavaid fundamentaalseid tunnetusmustreid lihtsates bioloogilistes organismides, mis võimaldavad pidada käitumist teatavaks semiootilisuse tagajärjeks. Kui on antud kombinatsioon kõigist kolmest kihist, on meil käes peamised eeldused, mida on minimaalselt tarvis, et kaasneks semioos.

Niisuguse mudeli tagajärjed võivad olla üsna tagasihoidlikud, kuid seda järgides saame sõnastada konkreetse analüüsiühiku, mis on antud mitte ainult märgi individuatsioonis või märgi musta kasti taolises töötlemises, vaid pigem organismi ja keskkonna süstematiseerimises. See võimaldab meil komplementaarsuse ümber sõnastada teatud semantilisuse vormiks, mis põhineb lihtsatel piirangutel ja ilma et määratletaks konkreetne sisu. Selle me nimetame *P-semantilisuseks*, bioloogilise tähenduse realiseerimiseks semioosis, mida iseloomustatakse organismi jaoks antud keskkonnas olulise mitte-deterministlikuna täidesaadetu [*implemented*] kaardistamisena.

Antud uurimus tegeleb lõpuks ka metafüüsiliste piirangutega, mida me saame paika panna arutelude tarbeks semioosi kõige lihtsamate avalduste üle ja selleks, et biosemiootika saaks neid modelleerida. Meie vaatenurk on viinud meid biosemiootika teooriate taustaeeldustelt meie oma mudeli esitamiseni, mis kontseptualiseerib raamistikku, mille abil osutada semioosile redutseeritud viisil. Me loodame, et oleme viljakalt arutlenud nii filosoofiliste implikatsioonide kui biosemiootika terminoloogia rakenduste üle, olles samas teadlikud tehtud eeldustest ja sellest, mida need biosemiootika teoorias teevad.

## CURRICULUM VITAE

**Name:** Claudio Julio Rodríguez Higuera  
**Date of birth:** December 20, 1983  
**E-mail:** higuera@ut.ee

### Research interests:

Biosemiotics, cognitive semiotics, theory and philosophy of general semiotics

### Education:

2012–2016 Doctoral studies in Semiotics, University of Tartu  
2010–2012 MA studies in Semiotics, University of Tartu. Dissertation: *A Typology of Arguments for the Existence of Physiosemosis*. Supervisor: Kalevi Kull.  
2003–2008 BA studies in Linguistics and Literature, Pontifical Catholic University of Chile.

### Grants:

2015, Nordic Association for Semiotic Studies Graduate Student Grant

### Publications:

Rodríguez Higuera, Claudio Julio 2013. Tartu variations: Objects, subjects and the third way. *Chinese Semiotic Studies* 9: 271–283.  
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### Conference presentations:

Rodríguez Higuera, Claudio Julio 2014. The implementation of biosemiosis in a naturalized framework: Between causality and multiple realizability. *Poster presentation at The First Conference of the International Association for Cognitive Semiotics, Lund, Sweden*.  
Rodríguez Higuera, Claudio Julio 2015. The disunity of semiotics: Bridging gaps through biosemiotics. *Presentation at the Second International Congress of Humanities ICoN 2015, Kaunas, Lithuania*.



- Rodríguez Higuera, Claudio Julio 2015. Just how emergent is the emergence of semiosis? *Presentation at the 15th Gathering in Biosemiotics, Copenhagen, Denmark.*
- Rodríguez Higuera, Claudio Julio 2015. In place of a placeholder: The role and future of predictions in biosemiotics. *Presentation at the Tartu Summer School of Semiotics 2015, Tartu, Estonia.*
- Rodríguez Higuera, Claudio Julio 2016. Conceptualizing a minimal framework for the implementation of biosemiosis. *Presentation at the 16<sup>th</sup> Gathering in Biosemiotics, Prague, Czech Republic.*

## ELULOOKIRJELDUS

**Nimi:** Claudio Julio Rodríguez Higuera

**Sünniaeg:** 20. detsember, 1983

**E-post:** higuera@ut.ee

### **Uurimisvaldkonnad:**

Biosemiotika, kognitiivsemiotika, üldsemiotika teooria ja filosoofia

### **Haridus:**

2012–2016 Tartu Ülikool, doktoriõpe, semiotika ja kultuuroloogia

2010–2012 Tartu Ülikool, magistriõpe, semiotika. Lõputöö: *A Typology of Arguments for the Existence of Physiosemiosis*. Juhendaja: Kalevi Kull.

2003–2008 Pontificia Universidad Católica, Tšiili, bakalaureuseõpe, keele- ja kirjandusteadus

### **Stipendiumid:**

2015, Nordic Association for Semiotic Studies Graduate Student Grant

### **Peamised publikatsioonid:**

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### **Ettekanded konverentsidel:**

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- Rodríguez Higuera, Claudio Julio 2016. Conceptualizing a minimal framework for the implementation of biosemiosis. *Ettekanne, 16th Gathering in Biosemiotics, Praha, Tšehhi*.

## DISSERTATIONES SEMIOTICAE UNIVERSITATIS TARTUENSIS

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