

Three Levels of Semiosis: Three Kinds of Kinds

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In philosophy, there is an as yet unresolved discussion on whether there are different kinds of kinds and what those kinds are. In particular, there is a distinction between indifferent kinds, which are unaffected by observation and representation, and interactive kinds, which respond to being studied in ways that alter the very kinds under study. This is in essence a discussion on ontologies and, I argue, more precisely about ontological levels. The discussion of kinds of kinds can be resolved by using a semiotic approach to ontological levels, building on the key semiotic concept of representation. There are three, and only three, levels of semiosis: non- or proto-semiotic processes without representation, such as physical or causal processes; semiotic processes with representation, such as the processes of life and cognition; and second-order semiotic processes with representation of representation, such as self-awareness and self-reflexive communication. This leads to the distinction between not two, but three kinds of kinds: indifferent, adaptive and reflexive kinds, of which the last two hitherto have not been clearly distinguished.

Keywords: natural kinds, ontological levels, semiotic levels, semiotic thresholds, biosemiotics, second-order cybernetics, constructivist, representation, Peirce.

Introduction: Natural Kinds and Other Kinds of Kinds

There is a long tradition for talking about *natural kinds* in philosophy, though there is little agreement on what those kinds exactly are (e.g., Hacking, 1991; Cooper, 2004; Bird & Tobin, 2015). However, there is general agreement that fundamental particles, chemical elements, biological species and such are paradigmatic examples of natural kinds. The discussion of natural kinds is interesting not only in itself, but also because it is linked up with discussions of, for example, realism, ontologies, natural laws, explanations, inductive inference, differences between natural and human sciences, and classification. In short, the discussion of natural kinds is a discussion of whether and to what degree our ontological classifications are determined by nature. For example, do the differences between different elementary particles reflect real features of the world that determine these particles as natural kinds?

However, as noted by Ian Hacking, so many radically incompatible theories of natural kinds are now in circulation that the concept itself has self-destructed: “Some classifications are more natural than others, but there is no such thing as a natural kind” (Hacking, 2007, p. 203). Some philosophers have diverted their attention from the question of to what extent the world falls into discrete and well-defined kinds, to the question of scientific practices of *kinding* or making classifications (Kendig, 2016). This turn to practice is certainly appropriate and much needed. But in effect this changes the discussion of kinds from a question of ontology to a question of

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epistemology. In this paper, we shall maintain the focus on ontology (acknowledging that ontologies are never absolute, see below), because the shift to epistemology and practice misses out on an important question, the question of ontological levels.

Before denouncing the concept of natural kinds, Hacking (e.g., 1995) made the very interesting point that *human kinds* (Hacking's term) are distinctly different from natural kinds, because they exhibit looping effects: making classifications that describe human kinds results in feedback which alters the very kinds under study. Human kinds respond to being studied in ways that natural kinds do not. Apart from the specific distinction, the distinction also suggests that there are different kinds of kinds (here, natural and human) and opens up for a discussion of whether Hacking's distinction is the right one and what the proper kinds of kinds are.

To avoid the philosophical baggage built into the notion of natural kind, Hacking changed his terminology to talk of the distinction between indifferent kinds and interactive kinds, while maintaining the gist of the distinction (Hacking, 1999, pp. 103ff), and I will refer to these two sets of terms interchangeably in the following.

For our purpose here, Hacking's discussion of indifferent and interactive kinds is relevant in two ways: Firstly, it presents the idea of different kinds of kinds in a striking manner, and this is our lead into an analysis of ontological levels. Secondly, it points out the looping effects of interactive kinds; that they may be aware of how they are classified and react to it—and this is an idea that calls for a semiotic approach, semiotics being the formal science of the capacity for observation and learning and the nature of meaningful worlds.

Indifferent and interactive kinds are kinds of kinds, not kinds of things or phenomena. In other words, the interactive is a way of characterizing classifications, such as hyperactive children, sorts of suicide, and sorts of sexuality: “because kinds can interact with what is classified, the classification itself may be modified or replaced” (Hacking, 1999, p. 103). Hacking is particularly interested in how new classifications of human beings come into existence and how such classifications affect those who are classified by them. And he considers his work a contribution to the study of “making up people” (Hacking, 1995, p. 351).

Hacking and some of his commentators see the distinction between natural and human kinds as the primary and only distinction between kinds of kinds. They draw the border precisely there, between nature and human, based on an existentialist approach. And they argue that human kinds differ from other natural kinds in an ontologically significant sense because the epistemology, semantics and ethics of human kinds feed back onto and change their ontology in a way unlike other natural kinds (Lambert, 2006). Other commentators criticise the ontology suggested by Hacking by way of denouncing exactly this point, that human kinds are essentially different from natural kinds, or by arguing that the border between indifferent kinds and interactive kinds is not found between human and nature.

Rachel Cooper (2004) argues that human kinds are still natural kinds, because classifying and describing natural kinds can also result in feedback that alters the very kinds under study. She refers to the example that the work that led to the classification

of bacteria according to their sensitivity to certain kinds of antibiotics may very well change exactly that sensitivity by inducing resistance toward the antibiotics in the bacteria. Cooper sees no reason that we should think differently about the kind of interactivity that is due to ideas and the kind of interactivity due to antibiotics, and she concludes that Hacking has failed to show that human kinds are not natural kinds.

Muhammad Ali Khalidi (2010), in the same vein, challenges Hacking's distinctions and argues that interactive kinds are not only human or social kinds. The philosophically distinct and significant ability to loop back and influence its own classification is not confined to the human or social realm. Awareness and intentional action are not required for interactivity and the looping effect. Khalidi argues that newly invented kinds of chemical compounds, dogs as domesticated wolves, and genetically engineered biological species are examples of interactive kinds, though he does find that biological species and human kinds are more strongly interactive than chemical compounds. –

The philosophical discussion of kinds of kinds thus points out very important issues, but there is no clarification in sight as to what the main kinds of kinds are and why these are the main kinds. For instance, it seems there is a distinction to be made between interactive kinds as human kinds, as they are characterized by Hacking, and interactive kinds in a broader sense, as suggested by Khalidi. But Hacking and Khalidi use the same term, interactive kinds, and this conflates the distinction, and thus the issue is not resolved.

Three Theses and the Aim of the Paper

This paper poses three theses. The first thesis is that the “kinds of kinds” discussion is best investigated as a discussion of ontological levels. The discussion, as briefly referenced above, is concerned with how different kinds of kinds differ in ontologically significant senses with regard to for example interactivity, awareness and self-awareness—and thereby in their abilities to react to their own classification—and where the border between these different kinds lie. In essence, these are questions of ontological levels, and the paper will show how analyzing ontological levels can help clarify the kinds-of-kinds discussion.

The second thesis is that the question of ontological levels is best investigated as a question of levels of semiosis. Or, in other words, that the basic ontological levels are semiotic, that they are determined by the nature of semiosis. This thesis connects the kinds-of-kinds discussion to the current discussion of semiotic levels and thresholds (described below). The rationale for this thesis is that the ontologically significant differences in the kinds-of-kinds discussion concern the abilities to observe and react to the environment (and here particularly the irritation from the environment of being studied and described), which are at the core of semiotics and, in particular, biosemiotics.

The third thesis is that there are three and only three ontological levels of semiosis. As the paper will show, this follows from the second thesis based on the

grounding of semiosis in representation, combined with the idea of second-order observation from systems theory and second-order cybernetics.

The aim of the paper is to develop and investigate these three theses, with emphasis on the third. The paper elaborates a second-order semiotic framework for ontological levels of semiosis and discusses how it compares to other approaches to ontological levels and how it accounts for overall explosions in evolutionary history. Finally, it describes the implications of this framework for the discussion of kinds of kinds.

Ontology and Levels

The discussions of kinds of kinds in relation to Hacking's work clearly have implications for the issues of realism versus constructivism and the role of ontology. It is not possible here to go into these issues in any detail, but it is necessary to sketch the position taken here. Semiotics and in particular biosemiotics are essentially (radical) constructivist (Nöth, 2001, 2011a; Alrøe & Noe, 2012). This does not mean that semiotics has no use for a metaphysical or ontological foundation, but that this metaphysics is of a pragmatic nature. It must always have the form of a working ontology, a hypothesis that we build on and live by and which is fallible and open to revision like all scientific knowledge. Such foundational working ontologies are indispensable in science and must be discussed just as intensely as realists discuss *reality*. It is in this sense that the terms ontological kinds and ontological levels are used in the paper.

Following the second thesis of the paper, the question of ontological levels is best investigated as a question of levels of semiosis. Within semiotics, there have been several attempts to address questions regarding semiotic levels or types of semiosis, which are analogues to the kinds of kinds outlined above, and these questions are considered just as important in semiotics as they are in philosophy. Kalevi Kull, Claus Emmeche and Donald Favareau (2008) thus pose questions about the boundary levels of biosemiosis, and what the main types and levels of semiosis are, in their series of questions that any worthwhile semiotic study of life should ask.

A great number of semiotic levels have been suggested and discussed (e.g., Nöth, 2001; Stjernfelt, 2003; Kull, 2009), and much of the discussion has focused on the thresholds between the levels. As a basis for investigating the three theses of this paper, some details of this discussion are described in the next section. Generally, the discussion has two focal points, empirical adequacy and philosophical consistency. The basic semiotic thresholds and levels should correspond to the empirical findings about the world (taking into account that these findings are not independent of the classificatory schemes used in making them, as indicated in the discussion of kinds of kinds above), and they should provide a theoretically and philosophically satisfactory account of semiotic levels and thresholds.

Semiotic Thresholds

Umberto Eco (1976) introduced the term semiotic threshold for the natural boundary between the semiotic and non-semiotic world, which he considered to coincide with the distinction between human culture and nature. Later, *semiotic threshold* has been generally used as a concept for the border between levels or types of semiosis such as Terrence Deacon's (1997) use of symbolic threshold to differentiate between the human-specific (symbolic) and other (iconic and indexical) sign systems. Kalevi Kull (2009) further elaborated these ideas into a theory of semiotic threshold zones, with a primary threshold zone between semiosic and non-semiosic systems (in line with Eco, but placing this basic threshold between living and non-living systems in line with the tradition of biosemiotics), and secondary threshold zones that separate vegetative and animal semiosis (at the indexical threshold zone), and animal and cultural semiosis (at the symbolic threshold zone).

There is still much discussion of whether there are any secondary thresholds and what they are, but there seems to be a general consensus today, at least in the field of biosemiotics, that there are two major semiotic thresholds, which correspond roughly to the evolutionary emergence of life and human culture.

The Threshold of Life

Frederik Stjernfelt (2003, 2007, pp. 271ff) points out a whole range of suggested and implied semiotic thresholds that specify where the border between the semiotic and non-semiotic world can be found, as the lowest semiotic threshold. Two major ideas of the lower threshold of semiosis are Thomas Sebeok's idea that semiosis and life are coextensive, which has demarcated the field of biosemiotics (see Kull, 2009), and Charles S. Peirce's original idea that the whole universe consists of signs.

Winfried Nöth (2001) considers the lower semiotic threshold to be between the organic and the inorganic world, which seems to be congruent with Sebeok's threshold of life, but he further discusses whether the inorganic world harbours genuine semiosis or merely quasi-semiosis, in line with Peirce. Peirce's universal theory of signs is sometimes characterized as pansemiotic, but to be more precise Peircean semiosis presupposes Thirdness. While the world also consists of Firstness and Secondness, these are not genuinely semiotic, but may be considered quasi-semiotic as a degenerate or rudimentary form of semiosis (Nöth, 2001). This conception is consistent with the framework of semiotic levels suggested below.

The Threshold of Human Culture

In a longer discussion of the *semiotic missing link*, Stjernfelt (2007, pp. 243ff) argues against Deacon's symbolic threshold as the distinction between man and animal, because the Peircean notion of symbol can be found widespread in higher animals. Symbols refer to their object by means of habit, and the ontogenetic ability to make habits in form of learning is found in higher animals. For instance, simple Pavlovian conditioning is a symbol in Peirce's terminology. Instead, Stjernfelt proposes that

Peirce's notion of hypostatic abstraction (i.e., making a predicate, such as *hard*, into an object, such as *hardness*, that can be subjected to further investigation) is a more specific form of symbol that distinguishes (most) men from (most) animals. In other words, it takes thought as a thing in a recursive operation that may produce an unlimited hierarchy of ever more abstract notions. Hypostatic abstraction is a crucial element in the reasoning process that seems only to be found in man; man is the abstract animal: "abstraction adds the possibility for the construction of the enormous subdomains of discourse involving counterfactual universes: myth, religion, literature, science whose vast capacity for general truths mirrors an equally large capacity for general fallacies" (Stjernfelt, 2007, p. 255).

It seems clear that there is a main threshold to be found here and that the important question is not the distinction of man from animal, but the characterisation of the specific semiotic ability that gives rise to the explosion of distinct features found in human culture. The crucial point is that this ability is not found in all humans (including babies, the demented, etc.), but in persons (a distinction that is well known in ethics, see below). Furthermore, the argument in the present paper is that this semiotic ability is not restricted to individual persons, but can also be found in social systems, and that it may eventually be found in computer-based systems. This is in agreement with Stjernfelt's argument that symbolic signs as such are not the proper distinguishing feature of human culture, but the alternative, hypostatic abstraction, is not sufficiently general to characterize this basic semiotic threshold. Interestingly, Stjernfelt (2001) in a footnote speculates that the representation of consciousness could play a special role in hypostatic abstraction as a form of representation that especially enables the fast and effective treatment of hypostatic abstractions. This speculation points towards the idea of second-order semiosis that is presented below.

The Three Levels of Semiosis

As stated in the exposition of semiotic thresholds above, there seems to be a general consensus that there are two major semiotic thresholds that correspond to the evolutionary emergence of life and human culture. But there is still much discussion on the where and why, especially on where exactly the threshold of human culture is and why, and how this relates to possible secondary thresholds.

The semiotic levels proposed in this paper, as a general working ontology, are based on the structure of semiosis like the suggestions discussed above, focusing on different types of relations and processes, and not objects or entities (in line with Kull, 2009, p. 15), but in a different and more fundamental way. The significance of the second-order semiotic framework presented here lies not in that it suggests new and different major thresholds (though many other thresholds have been suggested and the specifics are important), but in the way these thresholds are determined.

The framework originates from discussions in the late 1990s on the philosophy of Robert M. Pirsig's relational metaphysics and the nature of ontological levels (Glover, 2003, pp. 59, 196, 411). It is based on the semiotic concept of representation and the

concept of second-order observation from cybernetics and social systems theory. The framework allows for three and only three fundamental ontological levels of semiosis: a non-semiotic level, a first-order semiotic level, and a second-order semiotic level (see Table 1).

Table 1: Three Levels of Semiosis

Type of Semiotic Processes	Type of Evolutionary Processes	Type of Relations	Form of Semiosis	Level
non-semiotic or proto-semiotic processes	physical or causal evolution	without representation	zeroth-order semiosis	0
semiotic processes	emergence of life and cognition, biological evolution	with representation	first-order semiosis	1
second-order semiotic processes	emergence of self-awareness and self-reflexive communication, evolution of human culture	with representation of representation	second-order semiosis	2

Second-Order Semiosis: Representation of Representation

The key notion in the framework is that of second-order semiosis, the process of representation of representation. The central conceptions here are those of representation and second-order.

Representation was the most fundamental concept for Peirce in his development of semiotics, and it is distinctly triadic in contrast to the dualist sense of representation found in cognitive science, such as the simplistic idea of representation as a direct mapping between internal symbols and external objects in relation to artificial intelligence (Nöth, 1997, 2011b).² According to Peirce, a sign (a representamen) is something that stands to somebody (in the form of an interpretant) for something (an object) in some respect or capacity (Peirce, 1931–1966, vol. 2, para. 228). This standing to/for is representation. Representation mediates not only ideas, concepts and cognitions, but also the feelings, wishes, desires and actions resulting from the interpretation of the sign (Nöth, 2011b, p. 33). Accordingly, Peircean representation is

2. So-called anti-representationalist views of cognition (e.g., Varela, Thompson & Rosch, 1991) are thus directed against a restricted and simplistic view of representation and not the Peircean triadic model of representation (Emmeche, 2001).

here to be understood in connection with the interaction that is a necessary part of observation (see Alrøe, 2000; Alrøe & Noe, 2012, 2014).³

This is in line with the theory of signs and meaning developed for the study of animal behavior by Jakob von Uexküll, who is considered one of the main roots of biosemiotics along with Peirce (e.g., Emmeche, 2001; Sebeok, 2001). According to Alrøe and Noe (2012), in Uexküll's work the organism is characterized in terms of meaning, and observation is basically an act of representation: "Behaviors are not mere movements or tropisms, but they consist of perception (*Merken*) and operation (*Wirken*), they are not mechanically regulated, but meaningfully organized" (Uexküll, 1982, p. 26).

Peirce moreover distinguishes between the immediate object, "the object as the sign represents it," and the dynamical object, "the really efficient but not immediately present object" (Peirce, 1998, p. 482). There is no position from where we can observe the dynamical object as it is in itself, but every perspective adds to the number of immediate objects that refer to, point at, or hint at the dynamical object (Peirce, 1998, p. 480; Nöth, 2011b, p. 30; Alrøe & Noe, 2014, p. 69). Uexküll makes a similar distinction between perceptual sign (*Merkzeichen*) and perceptual cue or characteristic feature (*Merkmal*), where each perceptual cue is a perceptual sign that is "transposed to the outside" (Uexküll, 1992, pp. 292–293; translation of Uexküll, 1973, p. 102). Here, Uexküll's expression "transposed to the outside" seems to perform the same function as Peirce's notion that the immediate objects within the sign refer to dynamical or really efficient objects outside the sign. Peirce's conception is much stronger and clearer, but Uexküll's theory of signs has the built-in connection between semiosis and the interaction between the observer and the observed, which is needed in a general semiotic theory of observing systems.

The second-order character of second-order semiosis is based on second-order cybernetics in the tradition of Heinz von Foerster (1981, 2003) and Niklas Luhmann (e.g., 1989, 1995). Especially the comprehensive work of Luhmann on social systems has shown the importance and strength of working with second-order concepts in characterizing the communicative systems that structure human society.

In a striking formulation that lays out the premises of observation of observation, or second-order observation, Luhmann (1989, p. 23) says that: "a system can only see what it can see. It cannot see what it cannot. Moreover, it cannot see that it cannot see this." But when the system's observation is observed by another system, this second-

3. The triadic action of the sign is semiosis, and Peirce's conception of representation is not only a process of interpretation, where somebody interprets a sign as a sign of some object in some respect, but also, concurrently, a process of determination where the determination of a sign by its object is mediated to determine a new sign, the interpretant of the first sign (Peirce, 1955, p. 99; Peirce, 1998, p. 482). Semiosis as a process of determination is connected to the interaction that is a necessary part of observation. The "somebody" used in Peirce's popular 1897 definition of the sign, "A sign, or representamen, is something which stands to somebody for something in some respect or capacity" (Peirce 1931–1966, vol. 2, para. 228), is to be understood in a very general sense as indicated in the following more formal definition from 1902, which also explicates how this leads to ongoing semiosis: "A Sign is anything which is related to a Second thing, its Object, in respect to a Quality, in such a way as to bring a Third thing, its Interpretant, into relation to the same Object, and that in such a way as to bring a Fourth into relation to that Object in the same form, ad infinitum" (Peirce 1931–1966, Vol. 2, p. 92).

order observing system can also observe the constraints that the observed observing system enforces on itself through its own mode of operation. It can, to some extent, observe the horizons of the observed system so what they exclude become evident (see further in Alrøe & Noe, 2012, 2014). Luhmann (1989, p. 23) continues: “At present, second-order cybernetics seems to be the place where the problems of the foundations of logic and epistemology can, at least, be handled if not ‘solved.’”

Second-order semiosis, the representation of an object as in itself a triadic representation, applies this notion of second-order observation to the core of semiotics. And this determines the exact nature of the threshold that is often referred to as “the threshold of human culture.”

Further Explication of the Three Levels

The three levels are named after the order of semiosis that determine them. The middle level is called Level 1, because this is the common level of first-order semiosis as it is usually studied in organisms, cognition, and so forth, characterized by autonomous systems that represent their phenomenal world, or *Umwelt* (see Uexküll, 2010). This is the territory of biosemiotics, and relatively uncontroversial within this field (e.g., Kull, 2009).

Level 2 is the level from where the framework takes its name as a second-order semiotic framework. This level consists of relations that can be characterized as representations of representations or second-order semiosis. Here, we find the basis for concepts such as self-awareness and self-consciousness (as distinct from plain consciousness as a term for the ongoing process of semiosis in an organism such as a pig or a new-born infant).⁴ The concept of self depends on the ability to grasp oneself as a semiotic, observing and reasoning being, that is, the ability to represent this representational character.

A consequence of the second-order semiotic framework is that much of what has in the tradition of Eco and other human-centered semioticians plainly been called semiotics, is here considered second-order semiotics: a semiotics that exhibits a self-reflexive awareness that what is represented is itself representations. This is the semiotics of language, discourses, literature, and so forth.

Level 0 is characterized as zeroth-order semiosis. The term zeroth-order semiosis may seem awkward. However, it is appropriate because there is obviously no way of observing this level except by means of semiosis (with what follows in form of perspectival contextuality, possible complementarity, etc., see Alrøe & Noe, 2014, 2016), yet what is represented at Level 0 is not semiosis, or at least not genuine semiosis (which includes an interpretant) as discussed above. Zeroth-order semiosis is the level of semiosis necessarily alluded to in first-order semiosis, in form of the dynamical object referred to, even though it is not a genuinely semiotic level. If there is no reference, however feeble, to a “dynamical object, or really efficient but not

4. Unfortunately, this distinction is often lacking in discussions of consciousness, thus conflating first-order and second-order consciousness.

immediately present object” (Peirce, 1998, p. 482), then there is no genuinely semiotic relation (not ruling out, in line with Peirce, that the object may be fictive, hypothetical or ideal).

Discussion in Relation to Other Semiotic Thresholds and Ontological Levels

The first threshold, the emergence of first-order semiosis in life and cognition, is similar to the threshold promoted by Thomas Sebeok (see Kull, 2003), which states that life is semiosis. But here the defining characteristic is the semiotic ability of forming representational relations, and this means that Level 1 includes not only living organisms, but also computers, robots, and so forth (e.g., Nöth, 2001; Ziemke & Sharkey, 2001⁵).

The second threshold, the emergence of second-order semiosis in self-awareness and self-reflexive communication, is different from the semiotic approaches to levels discussed above. There has been no shortage through history of approaches that separate humans from the rest of nature as a special kind of being, but these distinctions are problematic. For example, in ethics the decisive distinction for moral responsibility is not between man and animal, though this is often presumed in anthropocentric ethics, but between persons and non-persons, because the faculty of self-awareness is the key to moral responsibility (e.g., Alrøe & Kristensen, 2003). The second-order semiotic threshold is different from thresholds that specify an essential difference between man and animal and point at symbols or culture as distinctively human phenomena. The second-order threshold does not include all that is human, nor does it preclude that some first instances of second-order semiosis may appear in animals, or in computer based systems.

As an exception, Søren Brier (2008, pp. 395–400, 2011, pp. 99ff.) operates with semiotically inspired levels that have self-consciousness as a characteristic of the top level (level five), but in a rather more complicated model of cybersemiotics. Stjernfelt (2003) also mentions self-consciousness as a semiotic threshold, as part of a discussion of the precise character of the threshold that sets human semiotics apart from the semiotics of other higher animals, but he does not state an author of the idea.⁶

Ontological Levels and Systems

This second-order semiotic account of the basic ontological levels is partly in agreement with a suggestion of ontological levels coming from discussions of

5. This is actually in line with Sebeok (see Ziemke & Sharkey, 2001, note 2).

6. “Many different ideas prevail as to the precise character of this semiotic ‘missing link’ threshold. Sebeok would claim the privilege of human language as against animal semiotics is the existence of syntax; some have pointed to the importance of reflexive self-consciousness and the emergence of a self-concept as the decisive step; Chomsky holds a related idea of universal grammar module in the brain as responsible for this threshold; Terrence Deacon has proposed (1997) that man’s special abilities owe all their might to the introduction of the symbol. These competing ideas may even turn out to possess each their grain of truth, dissolving the maybe deceptively simple Eco threshold into a subladder of more refined thresholds: we have no reason not to assume that more than one decisive limit has been passed through the extraordinary coevolution of human brain and language during the past million years.” Stjernfelt (2003, p. 490)

reduction and emergence in philosophy of science. Claus Emmeche, Simo Køppe and Frederik Stjernfelt (1997) identify, as a working hypothesis, four primary ontological levels, the physical, the biological, the psychological and the sociological. Their first threshold is the emergence of life, which, following Sebeok, is the threshold to genuine semiosis. At the second threshold, two interwoven levels emerge in parallel, the psychological and the sociological. The psychological is defined by the emergence of self-consciousness, the primary entity at the psychological level. The primary entity defining the sociological level is the institution. The second-order semiotic framework is in agreement with the location of the two thresholds that mark the emergence of life and self-consciousness, and it gives a deeper semiotic explanation of these two thresholds. But it disagrees with the characterization of the top level as psychological, and with the suggestion of two parallel top levels; the sociological level is not considered a primary ontological level.

It is not possible here to elaborate in detail the place of the social in the second-order semiotic framework. But in outline, the social is considered not as a separate level, but as a systems phenomenon. Biosemiotics shows many steps toward a general semiotic theory of ecological systems, and Luhmann (e.g., 1989, 1995) has elaborated a comprehensive theory of social systems as systems of communication, which is not based on semiotics, but on meaning and second-order cybernetics. Efforts have also been made to work out a unified theory based on a combination of biosemiotics and second-order cybernetics, such as Brier's (2008) cybersemiotics. Maybe the framework of semiotic levels suggested here can help in this direction by pointing out the need to distinguish between Level 1 systems, which consist of mutual representational relations, and Level 2 systems, which consist of mutual second-order representational relations.

Each semiotic level is thus characterized by a certain type of relations, causal relations, semiotic relations and second-order semiotic relations, and each type of relations gives rise to certain kinds of systems, such as physical systems, ecosystems and social systems. But the framework does not necessarily support the well-known classifications that originate from other sciences. For example, what is usually considered an ecosystem incorporates physical as well as semiotic processes, but in the perspective presented here, ecosystems are to be distinguished by their reliance on semiosis. In other words, what is distinctly different in ecosystems compared to purely physical systems is due to semiosis, and this should play a significant role in the studies of ecosystems. For instance, this speaks for the use of agent-based models rather than mechanistic population models in ecological modelling (Topping, Alrøe, Farrell & Grimm, 2015). Similarly, social systems harbour a mixture of causal, semiotic and second-order semiotic processes, and it would be helpful to recognize these different levels in social studies. For instance, calls for ethical behavior are only appropriate, and always appropriate, in relation to social systems with the necessary capacity for second-order semiosis, such as organizations and businesses with a well-developed sense of self-identity.

Second-order representational relations build on representing the other as capable of representing representations and, thereby, capable of lying and representing the other as lying. It is thus second-order semiosis and not semiosis per se, contrary to Eco (1976), which is characterized by the possibility of lying. Some might argue that there are examples of deception in plants and animals as well, such as mimicry and the “broken-wing” behavior in birds. But these examples are the result of co-evolution of mutual representational relations, and not of second-order semiosis. A bird would not be able to change its broken-wing act if it was found out by the observer, but a person, or a company, would.

Discussion in Relation to Evolutionary Explosions

Some of the theoretical clarification that this framework offers has been outlined above in the comparisons with other approaches, and further down it is shown how the framework provides a new way to clarify the discussions of kinds of kinds described in the introduction. Here, this is supplemented with a brief discussion of how the framework accounts for the major shifts in evolutionary history.

A major testbed for ontological thresholds and levels is how they account for the evolutionary histories as we know them from natural and cultural history. Unfortunately those evolutionary histories are not independent of the categorical frameworks we use to investigate them, but such are the conditions of science due to the complex relations between classification practices and possibilities for human action (see Hacking, 2002).

If we look at the overall picture, I will argue that the evolutionary history we know exhibits two main explosions, the explosion of life and the explosion of human culture, and that each explosion corresponds to the emergence of a new ontological level of complexity. *Explosion* here indicates both a qualitative shift in complexity, to representational relations and to second-order representational relations, respectively, and a shift in the pace or timescale of evolution enabled by the shift in complexity. Generally, biological evolution takes place on a different timescale than cosmological or physical evolution (though it is difficult to apply the concept of timescale to the origin of the universe), and the evolution of human culture takes place on a different timescale than biological evolution.

Within biological evolution, there are also secondary explosions, such as the Cambrian explosion of different types of animals (*Metazoa*). In the second-order semiotic framework, such secondary explosions are the consequence of a social or systems evolution based on the available type of relations (see the previous section). Causal processes on Level 0 form the basis for differentiation of elements and systems evolution in form of atoms, molecules and galaxies, stars and planetary systems. Semiotic processes, mutual representational relations, on Level 1 form the basis for functional differentiation and systems evolution (coevolution) of living entities to form ecosystems and complex organisms. Second-order semiotic processes at Level 2 form the basis for functional differentiation and systems evolution (structural

coupling) of communicative social systems, and for the differentiation and coupling of ideas in works of fiction and science.

Moreover, the emergence of secondary explosions due to functional differentiation and new structural couplings in society results in an ongoing social acceleration (Rosa, 2003). Life is no longer the only medium of semiosis. Human technology provides a medium for semiosis that develops at a much more rapid pace than natural and early human cultural evolution, and there are growing aspirations to create artificial life and, especially, artificial intelligence. The second-order semiotic framework would suggest that a qualitative shift in computer-based semiosis, a shift that will enable genuine artificial intelligence, will happen at the threshold where the representation of representations is enabled in this medium.

Implications for the Kinds-of-Kinds Discussion

In relation to the discussion of different kinds of kinds in philosophy described in the introduction, the second-order semiotic framework has at least two major implications. Firstly, the framework suggests that there are three fundamental kinds of kinds, which can be characterized as *indifferent*, *adaptive* and *reflexive* kinds, dividing the contested notion of interactive kinds into two, adaptive and reflexive kinds, based on the characteristics of the semiotic levels. That the world consists of indifferent kinds seems to be the default assumption in most natural sciences, but also, surprisingly, in many social and human sciences. It was this situation that Hacking reacted to.

At Level 1, the level of semiosis, scientific and other observers must be prepared for adaptive kinds. A single example is that of resistant pathogens. For a long while after the discovery of antibiotics, medical science has acted like bacteria and other pathogens were indifferent kinds. In fact, this seems still to permeate the use of medicine in some veterinary and medical practices. But pathogens are adaptive kinds, and in step with the recognition that new antibiotics are hard to come by, it becomes more and more clear that the growing problem of resistant pathogens is not only a problem of inappropriate medical practice, but also a problem of inappropriate science that treats adaptive kinds as indifferent kinds.

At level 2, the level of self-reflexive semiosis, Hacking (1995, 1999) provides a number of examples of how the research objects of science—such as the persons involved with hyperactive children, potentially suicidal persons, and persons of different sexual orientations—observe the scientific results and methods, and how these reflexive kinds change their practices as a consequence of those observations. Sciences that operate at Level 1 and 2 must always prepare for the autonomy connected with semiosis (expressed in form of the interpretant in Peircean semiotics). Observations and experiments at these ontological levels must take the possible consequences of the autonomy of adaptive and reflexive kinds into account.

Secondly, in relation to the issues at stake in the philosophical discussion of kinds of kinds, we must distinguish between the metaphysical question concerning the character and number of ontological levels, and the kinds of ontological kinds that this

gives rise to, and an epistemological, philosophy of science question concerning the relation between the observer and the observed. The relation between the scientific perspective and the research object is different in different kinds of science. Many kinds of science can be characterized as *systemic sciences* (Alrøe & Kristensen, 2002). A systemic science is a science that influences its own subject area. Agricultural science is a systemic science because agriculture is an area in rapid development and agricultural research plays an influential role in this development. Other systemic sciences are health science, environmental science, engineering and technological sciences such as biotechnology and information technology, economics and political and social sciences, (notably) philosophy of science and social studies of science, and even some of the physical sciences such as condensed matter physics. In a systemic science, the notion of objectivity obviously needs to be used in a modest way, as indicated in the notion of reflexive objectivity, which takes into account the influence of the cognitive context on observations, including the very conditions that enable observations, such as the experimental and observational apparatuses (Alrøe & Kristensen, 2002; Alrøe & Noe, 2014, 2016).

Some of the issues discussed by Khalidi (2010) in terms of interactive kinds, such as the production of new chemical compounds, are in fact issues that should be discussed in form of the interaction of scientific perspectives with their research object, using notions such as systemic science and reflexive objectivity. This interaction of the (scientific) observer and the observed is a potential issue across all three semiotic levels, and thus not something that can be used to settle questions of what kinds of ontological kinds there are.

Conclusions

This paper has provided a theoretical substantiation of three theses: that the philosophical kinds-of-kinds discussion is best investigated as a discussion of ontological levels, that these levels are levels of semiosis, and that there are three ontological levels of semiosis. The second-order semiotic framework presented here entails that there are exactly three fundamental ontological levels, no more, no less, and that they are semiotic levels distinguished by the type of relations found on each level. Level 0 consists of zeroth-order semiosis in form of physical or causal processes with no element of representation. Level 1 consists of first-order semiosis in form of, for example, the processes of life and cognition, which are based on representation. Level 2 consists of second-order semiosis in form of, for example, the processes of self-awareness and self-reflexive communication, based on representation of representation. Basic ontological levels, such as the three levels in this second-order semiotic framework, have implications for a range of other concepts and issues, such as agency, communication, meaning, consciousness, intentionality, habit, language and culture, because the meaning of these concepts will change across the levels. Often, the distinction between first-order and second-order semiosis is not taken adequately into account. As an example of these implications, this paper has elaborated on the implications for the philosophical kinds-of-kinds discussion. The

three semiotic levels give rise to not two, but three kinds of kinds: indifferent kinds (Level 0), adaptive kinds (Level 1), and reflexive kinds (Level 2), of which the last two hitherto have not been clearly distinguished. Sciences that operate at levels where first- and second-order semiosis is found must always prepare for the possible reactions of adaptive and reflexive kinds to the research that investigates them.

References

- Alrøe, H. F. (2000). Science as systems learning: Some reflections on the cognitive and communicational aspects of science. *Cybernetics and Human Knowing*, 7(4), 57–78.
- Alrøe, H. F., & Kristensen, E. S. (2002). Towards a systemic research methodology in agriculture: Rethinking the role of values in science. *Agriculture and Human Values*, 19(1), 3–23.
- Alrøe, H. F., & Kristensen, E. S. (2003). Toward a systemic ethic: In search of an ethical basis for sustainability and precaution. *Environmental Ethics*, 25(1), 59–78.
- Alrøe, H. F., & Noe, E. (2012). Observing environments. *Constructivist Foundations*, 8(1), 39–62.
- Alrøe, H. F., & Noe, E. (2014). Second-order science of interdisciplinary research: A polyocular framework for wicked problems. *Constructivist Foundations*, 10(1), 65–95.
- Alrøe, H. F. & E. Noe (2016). Sustainability assessment and complementarity. *Ecology and Society*, 21(1), article 30. <http://dx.doi.org/10.5751/ES-08220-210130>
- Bird, A., & Tobin, E. (2015). Natural kinds. *Stanford Encyclopedia of Philosophy*, Spring 2015 Edition [online at <http://plato.stanford.edu/archives/spr2015/entries/natural-kinds/>]
- Brier, S. (2008). *Cybersemiotics: Why information is not enough*. Toronto: University of Toronto Press.
- Brier, S. (2011). Cybersemiotics: A new foundation for transdisciplinary theory of information, cognition, meaning, communication and consciousness. *Signs*, 5, 75–120.
- Cooper, R. (2004). Why Hacking is wrong about human kinds. *British Journal of Philosophy of Science*, 55, 73–85.
- Deacon, T. (1997). *The symbolic species*. London: Penguin.
- Eco, U. (1976). *A theory of semiotics*. Bloomington, IN: Indiana University Press.
- Emmeche, C. (2001). Does a robot have an Umwelt? Reflections on the qualitative biosemiotics of Jakob von Uexküll. *Semiotica*, 134(1/4), 653–693.
- Emmeche, C., Køppe, S., & Stjernfelt, F. (1997). Explaining emergence—Towards an ontology of levels, *Journal of General Philosophy of Science*, 28(1), 83–119.
- Foerster H. von (1981). *Observing systems*. Seaside, CA: Intersystems.
- Foerster H. von (2003). *Understanding understanding. Essays on cybernetics and cognition*. New York: Springer.
- Glover, D. (Ed.) (2003). *Lila's child: An inquiry into quality*. Bloomington, IN: 1st Books Library.
- Hacking, I. (1991). A tradition of natural kinds. *Philosophical Studies*, 61(1–2), 109–126. (online version <http://link.springer.com/journal/11098/61/1/page/1>)
- Hacking, I. (1995). The looping effects of human kinds. In D. Sperber, D. Premack & A. J. Premack (Eds.), *Causal cognition* (pp. 351–383). Oxford, UK: Clarendon Press.
- Hacking, I. (1999). *The social construction of what?* Cambridge, MA: Harvard University Press.
- Hacking, I. (2002). *Historical ontology*. Cambridge, MA: Harvard University Press.
- Hacking, I. (2007). Natural kinds: Rosy dawn, scholastic twilight. In A. O'Hear (Vol. Ed.), *Philosophy of Science: Volume 61 Royal Institute of Philosophy Supplements* (pp. 203–239). Cambridge, UK: Cambridge University Press.
- Kendig, C. (Ed.) (2016). *Natural kinds and classification in scientific practice*. Oxon, UK: Routledge.
- Khalidi, M. A. (2010). Interactive kinds. *British Journal of Philosophy of Science*, 61, 335–360.
- Kull, K. (2003). Thomas A. Sebeok and biology: Building biosemiotics. *Cybernetics and Human Knowing*, 10(1), 47–60.
- Kull, K. (2009). Vegetative, animal, and cultural semiosis: The semiotic threshold zones. *Cognitive Semiotics*, 4(4, issue supplement), 8–27.
- Kull, K., Emmeche, C., & Favareau, D. (2008). Biosemiotic questions. *Biosemiotics*, 1(1), 41–55.
- Lambert, E. (2006). Hacking and human kinds. *Aporia*, 16(1), 49–71.
- Luhmann, N. (1989). *Ecological communication*. Cambridge, MA: Polity Press. (Original work published 1986.)
- Luhmann, N. (1995). *Social systems*. Stanford, CA: Stanford University Press. (Original work published 1984.)
- Nöth, W. (1997). Representation in semiotics and in computer science. *Semiotica*, 115(3/4), 203–213.
- Nöth, W. (2001). Protosemiotics and physicosemiosis. *Sign Systems Studies*, 29(1), 13–25.
- Nöth, W. (2011a). Some neglected semiotic premises of some radically constructivist conclusions. *Constructivist Foundations*, 7(1), 12–14.
- Nöth, W. (2011b). Representation and reference according to Peirce. *International Journal of Signs and Semiotic Systems*, 1(2), 28–39.
- Peirce, C. S. (1931–1966). *Collected papers of Charles Sanders Peirce* (C. Hartshorne, P. Weiss, & A. W. Burks, Eds.). Cambridge, MA: Belknap.
- Peirce, C. S. (1955). *Philosophical writings of Peirce* (J. Buchier, Ed.). New York: Dover Publications.

- Peirce, C. S. (1998). Excerpts from letters to Lady Welby. In Peirce Edition Project (Ed.), *The essential Peirce Volume 2* (pp. 477–491). Bloomington, IN: Indiana University Press.
- Rosa, H. (2003). Social acceleration: Ethical and political consequences of a desynchronized high-speed society. *Constellations*, 10(1), 3–33.
- Sebeok, T. (2001). Biosemiotics: Its roots, proliferation and prospects. *Semiotica*, 134(1/4), 61–78.
- Stjernfelt, F. (2001). Skemaer, abstraktion og biologi—mennesket som det abstrakte dyr, snarere end den symbolske art. In T. L. Thellefsen (Ed.), *Tegn og betydning* (pp. 80–103). Copenhagen: Akademisk Forlag.
- Stjernfelt, F. (2003). Sebeotics at the threshold: Reflections around a brief Sebeok introduction. *Semiotica*, 147(1/4), 485–494.
- Stjernfelt, F. (2007). *Diagrammatology. An investigation on the borderlines of phenomenology, ontology, and semiotics*. Dordrecht: Springer.
- Topping, C. J., Alrøe, H. F. K., Farrell, N., & Grimm, V. (2015). Per aspera ad astra: Through complex population modelling to predictive theory. *The American Naturalist*, 186(5), 669–674.
- Uexküll, J. von (1973). *Theoretische Biologie*. Frankfurt: Suhrkamp. (Reprint of second edition from 1928. First edition from 1920 translated as: Uexküll, J. von [1926]. *Theoretical biology*. New York: Harcourt, Brace & Co.)
- Uexküll, J. von (1982). The theory of meaning. *Semiotica*, 42(1), 25–79. (Original work published 1940)
- Uexküll, J. von (2010). *A foray into the worlds of animals and humans: with A theory of meaning*. Minneapolis, MN: The University of Minnesota Press. (Original works published 1934 and 1940)
- Uexküll, T. von (1992). Introduction—the sign theory of Jakob von Uexküll. *Semiotica*, 89(4), 279–316.
- Varela F. J., Thompson, E., & Rosch, E. (1991). *The embodied mind: Cognitive science and human experience*. Cambridge, MA: The MIT Press.
- Ziemke, T. & Sharkey, N. E. (2001). A stroll through the worlds of robots and animals: Applying Jakob von Uexküll's theory of meaning to adaptive robots and artificial life. *Semiotica*, 134(1/4), 701–746.