The Status of Biosemiotics

Wolfgang Hofkirchner
Institute of Design and Technology Assessment
Vienna University of Technology
Vienna, Austria
hofi@igw.tuwien.ac.at

ABSTRACT

This paper deals with the scientific status of biosemiotics. It tries to characterize the purpose, the domain and the approach of biosemiotics in the perspective of the overall trend in science towards unification within complexity.

1 INTRODUCTION

Every scientific undertaking aims to solve particular problems of society by providing the best knowledge available about the particular area of investigation; this requires specific methods. In short, each scientific undertaking is characterized by its own purpose, its own domain, and its own approach. What is the purpose of biosemiotics? What is its domain? What is its approach? These questions must be addressed in order to give biosemiotics a clear identity. The answers to these questions lies within the nature of semiotics. Therefore, it is worthwhile to first examine semiotics.

2 THE CHALLENGE

Questioning the identity of a scientific discipline, however, turns out to involve another and far deeper question – the question of how unity and diversity in science are related. Given the divide between the so-called *two cultures*; that is, the humanities on the one hand, and science – albeit in a narrow sense – on the other, this fundamental question suggests four basic answers.

1. This divide is accepted as an unbridgeable gap in terms of a dichotomy of "cultures". The result is a fragmented reality yielding diversity without unity. Since the differences between the perspective of the humanities and the perspective of natural science prevail then as a result this way of thinking represents a trend toward fragmentation.

2. The division is considered unjustified. There are two realities and the existence of either depends on which perspective is eliminated for the sake of the other.

    2.1. Either the features of humanities are projected onto science — this way of thinking in terms of the humanities can be considered an attempt to humanize science;

    2.2. Or, the unique features of the humanities are reduced to those of (natural) science. This may not only be ascribed to attempts to naturalize the humanities, but also to attempts to formalize humanistic properties within mathematical formulae, and within technological or mechanical relations. It's a way of thinking only in terms of natural, formal, technical science.

    In both cases unity is established, although without diversity, because one of the two perspectives subsumes the other.

3. The division is held to be only partially true. Differences between the perspectives are considered within a foundation of their having something in common. A dialectic involving the universal and the particular, the one and the many, is established. You get unity and diversity at the same time, unity in diversity, unity through diversity. This way of thinking in terms of integrating one "culture" with the other — of a dialectic of "cultures" — makes up the fourth trend.

All of these four basic answers are actually found in practice, be it as state of the art, or as some ideal-to-be-realized. Within the first answer, that of fragmentation, the result is that experts of closely related disciplines have difficulty understanding each other. Philosophical reflections within the so-called post-modern perspective legitimise the fragmentation, heterogeneity and disintegration of scientific knowledge. Within the trends to unification, a minority of social scientists are trapped within anthropomorphic extrapolations. They do not offer an alternative to the challenge of colleagues who criticise their portrayal of all science as a social construct. On the other hand, some physicists continue to search for a reductionist TOE (Theory of Everything) or at least the GUT (Grand Unified Theory) and extend a materialistic perspective to the explanation of mind.

Modern critics now call for a paradigmatic change towards a synthetic view. This integrative view of what can be perceived by human intelligence does not need to, indeed must not, be a return to the speculative natural philosophy of antiquity. Rather, it can and must assimilate the knowledge gained from research in all disciplines. Although the split into a number of estranged disciplines remains an obstacle to this development, the need to transcend the barriers between the disciplines and move towards transdisciplinarity,

with its basis of understanding between the domains of science, is vital. What is known by various names as complexity, as second-order cybernetics, as self-organization, referring to dynamic processes within open, non-linear systems, is an element, if not the core, of this overall shift. Complexity cuts across the natural and social sciences.

3   A SEMIOTIC ANSWER

According to this fourth trend, all science serves to support efforts to comprehend the cosmos and its challenging realities. According to it, diverse methodological approaches are less and less viewed as impediments that endanger the unity of science; rather, they are increasingly regarded as useful means towards the same end and as an enrichment of science as long as the common basis of the different methods is not violated. All scientific developments are subject to this overall change. Semiotics is no exception. That means, semiotics has to re-position itself. Semiotics must abandon its confinement of its analyses to society and cultural artifacts, a perspective developed by the long-held opinion that sign processes appear exclusively in a social context and nowhere else. And at the same time semiotics must refrain from extrapolations that start from society and end with anthropomorphic views of what is non-societal or pre-societal. Semiotics must also withstand naturalising trends that reduce the societal to the non-societal or pre-societal. Semiotics has to abandon the thinking that unity and diversity yield the one only at the expense of the other.

According to the new approach of science in general, it is clear that semiotics, too, will gain from finding a way to contribute to the re-definition of science by enhancing both the problem solving capacity of the growing information society and its governance at a point in history when the traditional means of regulating society have become obsolete. Semiotics has to recognise that it can join with other disciplines that undergo similar restructuring in order to establish a newly defined information science (Hofkirchner 1995). Here information is not understood as an intermediary unit between data and knowledge as in computer science but is a much broader term that includes not only data, knowledge and wisdom, as well as other human cognitive processes but also human communicative and co-operative processes, and their non-human antecedents. From this perspective the notion of the information process converges with the notion of semiosis and the notion of information with the notion of sign. There is an intimate relationship between the process of self-organization, on the one hand, and information or sign processes, on the other (Hofkirchner 2001).

3.1   SELF ORGANIZATION

In a system subject to input and output, information or sign relations can be supposed to occur when the nexus between input and output is no longer strictly determined, but rather subject to the system's own activity. The starting point (input) is just the trigger of self-defined processes in the system. The final result (output) is a change in the system's behaviour, state or structure. The system makes a decision, an option is realized and the system has changed. Insofar as the system selects one of a number of possible responses to a causal event in its environment, insofar as it shows preference for the particular option it chooses to realize over a number of other options, insofar as it decides to discriminate – insofar does self-organization stand at beginning of all information. For the decision to discriminate, to distinguish, is nothing less than the generation of information. The system creates the effect in the process of self-organization by assuming a form, by forming, reforming, *in-forming* itself.

Insofar as in each self-organizing process the activity that is performed by the system in its own way is nevertheless triggered by an input originating outside the system (a physical change, a change of the control parameter to a critical value or beyond), each self-organizing process establishes relations that can be categorized as semiosic, i.e., relations between the external triggers, the system itself, and its activities (including the products of these activities). In semiotic terms, there is something that is (to be) signified (the "object"), i.e. the trigger, there is something to which this signified is of significance (the "interpreter" that produces an *"interpretant"*), i.e., the system, and there is something that stands for the signified (the *"representamen"*), i.e. the way the system acts. This triad, according to the semiotics of Charles S. Peirce (1983, 2000) suffices to constitute a sign (see figure 1). The essential point to grasp here is that a *difference* in the *umwelt* or contextual situation does make a difference to the self-organizing system itself [as Gregory Bateson (1981) defined information] and it is this system that interprets the *difference* in the *umwelt* by virtue of its own activity.
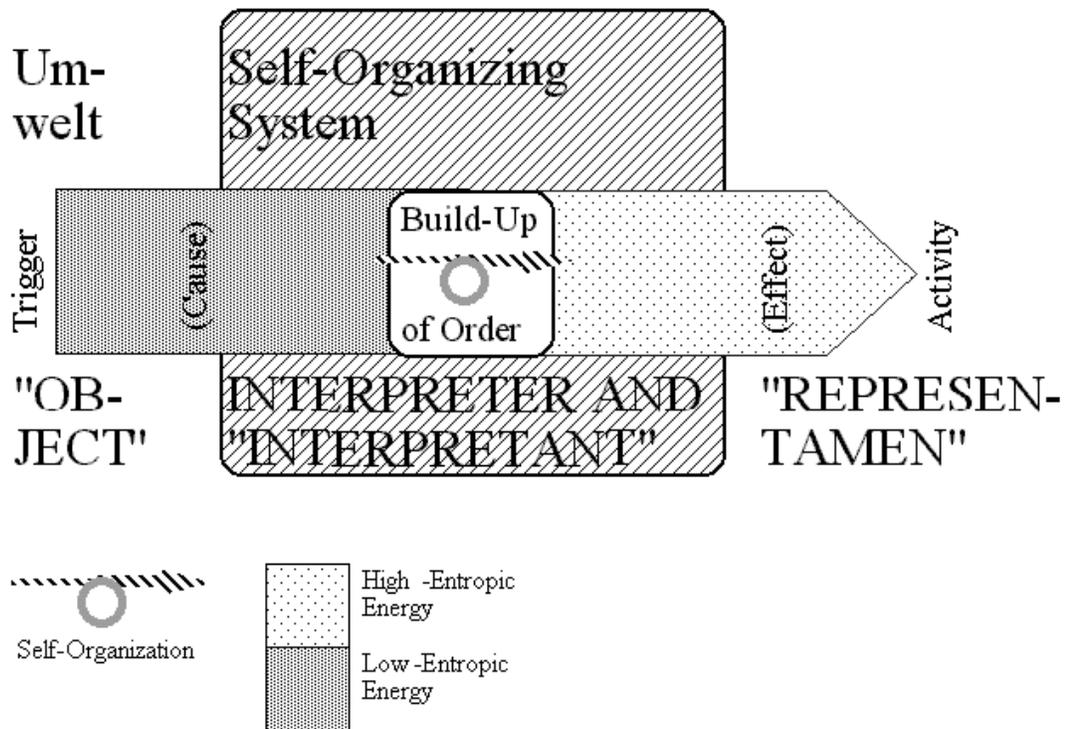
Figure 1: Sign Process in an Evolutionary System

That is, since each self-organized action is a process where within a system any effects over and above the external causation is due to the system itself and where the system then changes its behaviour, its state, or its structure (Fenzl et al 1996), then this cohesive result is at the same time a process by which information is generated and a sign is produced. And *vice versa*: information generation and semiosis are tied to a capacity to self-organization.

The overall rationale of semiotics *qua* information science acknowledges the informational perspective of the complex interplay of self-organizing systems that constitute the world we live in.

4   THE SHAPE OF BIOSEMIOTICS AND PANSEMIOTICS

Having said this about semiotics becoming (part of) information science, it seems clear that – in order to stay consistent – the answer to the question about the scientific status of biosemiotics in particular precludes the establishment of biosemiotics as an isolated field or within a naturalisation trend.. Biosemiotics must resume the continuity-discontinuity dialectic and focus on the *differentia specifica* of the study of semiosic processes in a biological context while being aware that the *genus proximum* of semiotics possesses

common features irrespective of the context. These common features link biosemiotics to other semiotic subdisciplines.

What then is the biological context and perspective? The answer to this question is linked to ontological considerations concerning a special type of self-organization processes. Suffice it here to underline that it has to be acknowledged that there is a biological perspective amongst other perspectives without going into details about what life is. Provided that – in accordance with the thesis that semiosis and self-organization are co-extensional – there are as many different basic types of semiosic processes as there are basic types of systemic self-organizing processes, we can conclude that the semiotic threshold is not identical with the starting point of biosemiotics. Semiotics thus transcends biosemiotics in both directions (see an overview of the current debate in Nöth 2000 and 2001). The simplest semiosic unit is the most rudimentary self-organizing system. Systems like these are already present in the anorganic, prebiotic, abiotic environments.

Different types of semiosis will have to be related to, if not derived from, different types of self-organization that are characteristic of different evolutionary systems. Self-organization characteristic of one type of evolutionary system differs from self-organization characteristic of another type. So does semiosis.

On the one hand, semiosis does have an analytic outline of evolving sign processes. Every single one of the different sign processes builds on a previous stage and may, in turn, provide the preparatory stage for a subsequent sign process. It is via leaps of self-organization that particular semiosis processes unfold one after another to build consecutive cones of information generation types. Each cone limits the possibilities allowed by the previous cone. It narrows the bandwidth of the previous cone, but it also enriches reality, i.e., the equivalent of a variety of realized cones, by adding new realizations of options to those already provided by the previous cone (see figure 2).
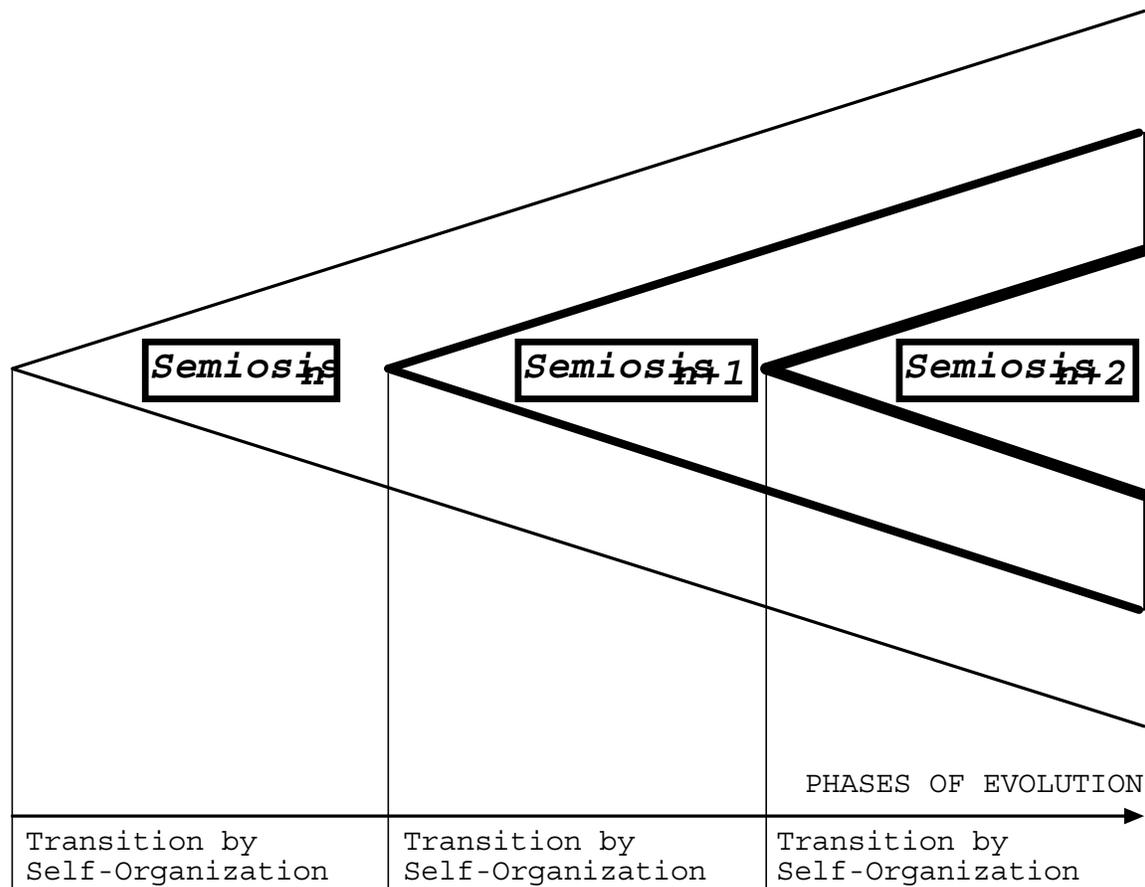
Figure 2: Cones of Evolutionary Spaces of Semiosis

On the other hand, every semiosis characteristic of a particular type of evolutionary system differs in the sophistication of its levels of self-organization. That is, the more levels a system includes in its operations, the more sophisticated is its information generation. The levels are connected by bottom-up processes or top-down processes, which manifest the emergent or dominant features of the self-organization interactions. Higher levels depend on lower ones, but are not completely determined by them, and higher levels dominate the lower ones, but do not completely determine them. Both higher and lower levels have additional individual features. Levels give rise to the next-higher level, and mediated by this level, to the level above. A particular level harnesses the level below and through this level the level below that (see figure 3).
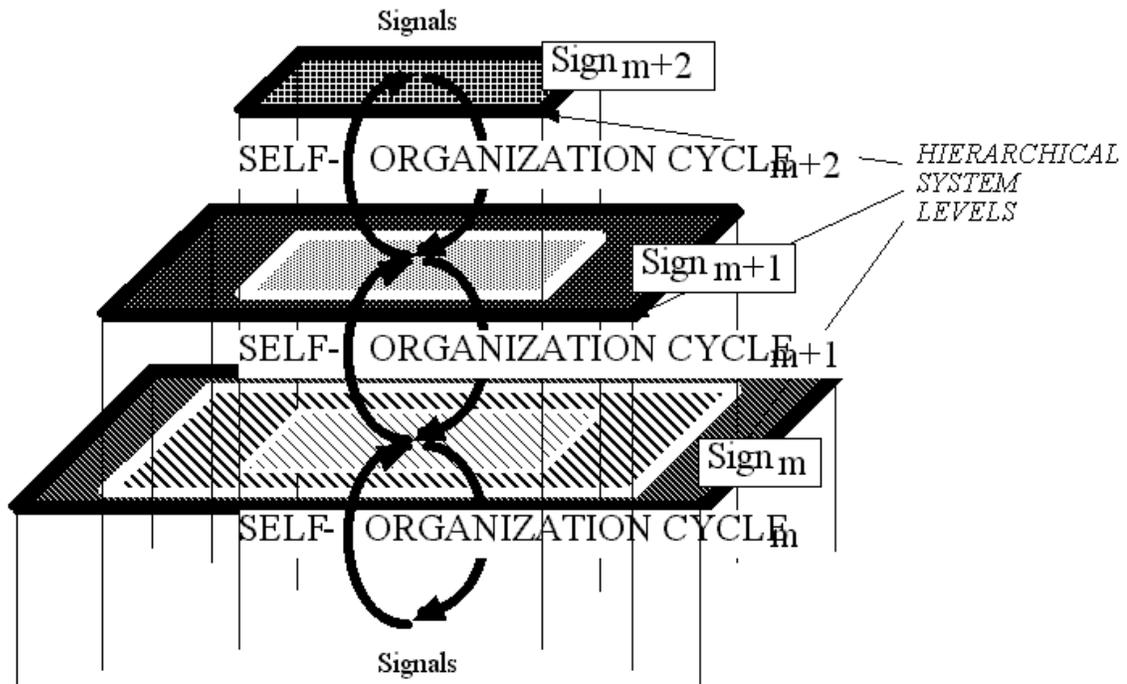
Figure 3: Multi-Levelled Architecture of Sign Production in Self-organizing Systems

4.1   THE STAGE OR SCALAR MODEL OF SELF-ORGANIZATION

Given the widely shared scientific distinction between the physical, the biological, and the socio-scientific fields, a stage or scalar model of self-organization can be conceived of that combines a phase model of evolving self-organization from the physical to the biological to the socio-scientific field and a model of layers in which the physical, the biological and the socio-scientific fields form successive levels of systemic self-organization. Phases and layers are linked in such a way that each new phase adds a new layer. The more recent a stage in this model is, the more levels belong to its architectural framework.

This model may serve as a blueprint for the classification of semiotic disciplines and for discussing the place and significance of biosemiotics. There are three stages to which semiotics applies, that is, three phases and three layers, which yield six boxes (see figure 4).

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Sign Processes in an
Evolutionary Systems
World

                              Social
                              Stage

                  Biotic      4 Socio-      SOCIAL LAYER
                  Stage       semiosis
                          ┌──────────── ─ ─ ─ ─ ─ ─ ─ ─ ─ ─
   Physical   │2 Bio-     │5 Socio-Bio- BIOTIC LAYER
   Stage      │semiosis   │semiosis
          ┌───┘           ├──── ─ ─ ─ ─ ─ ─ ─ ─ ─ ─
   1 Physico│3 Bio-       │6 Socio-      PHYSICAL
   semiosis  │Physico-    │Bio-Physico- LAYER
  ─ ─ ─ ─ ─ ─│_semiosis   │_semiosis ─ ─ ─ ─ ─ ─ ─ ─
   │         │            │
   │PHYSICAL │BIOTIC      │SOCIAL
   │PHASE    │PHASE       │PHASE
   │         │            │
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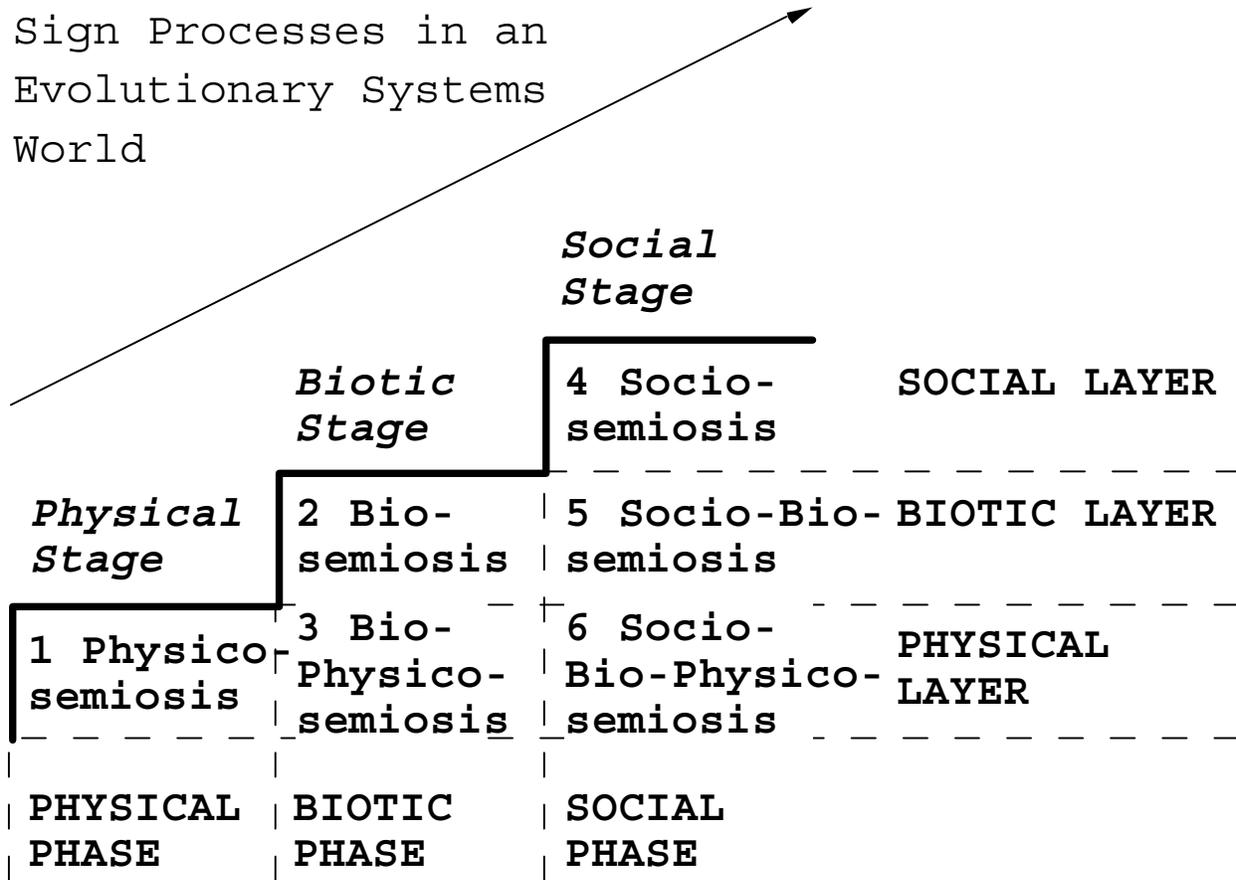
Figure 4: Sign Processes in an Evolutionary Systems World

The first box describes pure physical semiosis, that is, semiosis in physical self-organizing systems, called physicosemiosis.

Box two denotes the qualitative leap from the pure physical realm to a biotic semiosis; that is, semiosis in living systems, called biosemiosis. It appears at the beginning of the biotic phase in the evolution of self-organizing systems and manifests itself in the higher layer of the build-up of biotic system sign processes.

The lower level in the build-up of informational biosystem processes is shown in box three. Biosystems depend on a physical substratum that is a component part of their reality. This physical substratum differs from the physical processes that are not part of biosystems because this level within the biosystem is dominated by the higher biotic level. Biosemiosis in the same way depends on a special sort of physicosemiosis, called bio-physicosemiosis.

Boxes four to six designate semiosis at the social stage, that is, in social systems. Box four – in an analogy to what box two does in relation to box one – covers the leap from biotic to social signs in semiosis, called sociosemiosis. Sociosemiosis forms the highest level of semiosis in social systems. In an analogy to the relationship between the information processes in boxes two and three, sociosemiosis depends on biosemiosic processes, which it controls and turns into the socio-biosemiosic ones sketched in box five. And the last box – box number six – indicates those physicosemiosic processes which the socio-biosemiosic ones control and on which these socio-biosemiosic ones, in turn, depend. So the ultimate basis of informational processes in social systems is made up of socio-bio-physicosemiosis.

5   CONCLUSION

Therefore, defining the scope of biosemiotics as the scientific investigation of bio-semiosic processes is just a terminological dispute, if we consider the interrelationships in the object domain. It may be a composite including all of boxes two to six, while only physicosemiosis in box one is definitely not a component of biosemiotics. The core object of biosemiotics is biosemiosis (as outlined in cell number two). This domain can, however, be extended vertically or horizontally.

It can be argued that all semiosic processes to be found in the biotic phase of evolution of self-organizing systems belong to the domain of biosemiotics. Then bio-physicosemiosis (box three) may form part of the object domain of biosemiotics (and bio-physicosemiotics part of biosemiotics). The main interest here would be in how physicosemiosis is shaped by biosemiosis.

It can also be argued that all semiosic processes to be found in the biotic layer of the evolutionary systems world are to be dealt with by biosemiotics. Then socio-biosemiosis (box five) may be addressed (and socio-biosemiotics considered as a subdiscipline of semiotics). But the main focus – this has to be pointed out here very clearly – of the bio-perspective of socio-biosemiotics would be on how sociosemiosis depends on bio-semiosic processes (and not on how sociosemiosis shapes biosemiosis which would be left to the socio-perspective of socio-biosemiotics). Last and not least, a biosemiotic touch may be attributed to socio-bio-physicosemiotics (research in the object of box six) in a similar way.

Although it can be argued that stages are emergent specifications of previous stages and that sociosemiosis (box four) is a specified emergent of biosemiosis, it might be misleading to classify sociosemiotics as part of biosemiotics because of the danger of subsuming the new social quality under the old biotic quality. The point is that each particular realm has its own nature albeit still in the context of the universal.

Summing up, to define biosemiotics as a part of the transdisciplinary scientific undertaking of an as-yet-to-be-developed information-science has the following implications for its approach, domain and purpose. It uses a variety of methods appropriate to the study of informational processes within and between living self-organizing systems, and between them and other self-organizing systems that populate the sphere on our planet earth that humanity is part of. The goal is to provide knowledge for the basis of evaluations, recommendations, etc., that can guide actions towards accomplishing a leap to an integrated organizational level of world society that allows for sustainable development.

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