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# GATHERINGS IN BIOSEMIOTICS

Edited by
Silver Rattasepp
Tyler Bennett

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# Preface

The Gatherings in Biosemiotics is the first and only regular series of worldwide conferences in semiotic biology. Originally these annual meetings alternated between Copenhagen and Tartu, but broadened their scope early on to include other destinations. This year's Gatherings in Biosemiotics again takes place in Tartu, and we have prepared a special edition of the Tartu Semiotics Library book series, Gatherings in Biosemiotics, to commemorate this, the twelfth and largest of the Gatherings so far. This commemorative edition includes new material on the basics of biosemiotics, as well as a complete history of the Gatherings as told by their organizers.

The book is divided into three parts.

The first part, Approaches to Biosemiotics, includes five short papers on the importance of semiotics for biology. In these papers Kalevi Kull, Terrence Deacon, Howard Pattee, Stuart Kauffman, and Myrdene Anderson describe their personal perspectives on the history and functionality of biosemiotics.

The second part, History of the Gatherings, begins with two retrospectives, by the president of the International Society for Biosemiotic Studies, Jesper Hoffmeyer of the University of Copenhagen, and by the long-time vice president of ISBS, Donald Favareau of the National University of Singapore. We also publish here an original communiqué between Thomas Sebeok and Jesper Hoffmeyer on the topic of the very first Gatherings. We hope that these as well as a series of shorter historical documents will lend perspective on the Gatherings in Biosemiotics in their entirety.

The third part features nearly the entire set of submitted abstracts for this year's conference. We included them to give the reader an indication of the whole breadth of ideas and topics that biosemiotics currently covers.

In the simplest sense, "gathering" here means merely to get people together. For our purposes though, the additional connotation of "gathering one's strength" for some great task also seems appropriate. Only the knowledge

gained from the entire history of the Gatherings would be equal to such a task. What this task will ultimately turn out to be remains to be seen. It is part of our business here to find out.

*Tyler Bennett*
*Silver Rattasepp*

# Contents

# I. APPROACHES TO BIOSEMIOTICS

# Advancements in biosemiotics: Where we are now in discovering the basic mechanisms of meaning-making

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## Exordium

It is now 20 years since the publication of the first book titled *Biosemiotics*[1] and from the Glottertal meetings that initiated much for the further decades. It is already 50 years since the coinage of the term 'biosemiotics'.[2] It is now 40 years since the Waddington symposia, at which the theory for general biology has been actively searched for, with some clear, although not fully self-aware hints towards a semiotic biology.[3] And there have been 11 annual Gatherings in Biosemiotics held with hundreds of scholars altogether discussing and advancing the approach. What has been achieved with these two decades?

We have two solid anthologies of biosemiotics (Favareau 2010; Maran *et al.* 2011) as well as descriptions of its history (Favareau 2007; Kull 2005). We have a monograph that can be used as a textbook of biosemiotics (in two versions – Hoffmeyer 1996, 2008). We have at least three special selections of chapters on biosemiotics that can also be used for teaching purposes (Barbieri 2007a; 2007b; Emmeche, Kull 2011). And we have study programs on the masters and doctoral level, with many students having completed and defended their theses on biosemiotics – in Tartu, Copenhagen, and elsewhere. However, what has been achieved within these two decades in the science of biosemiotics – that is, in understanding the phenomena of life?

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1 Sebeok, Umiker-Sebeok 1992.

2 Rothschild 1962.

3 Waddington 1968–1972. In these symposia, Howard Pattee and Brian Goodwin expressed straightforwardly biosemiotic ideas. It is notable that Stuart Kauffman was one of the participants.

Understanding is deepened in a dialogue, in conversations. In a couple of occasions, we have tried to formulate the main questions[4] and the main statements of biosemiotics together – including the collective manifesto of biosemiotics that provides a version of its major principles (Kull *et al.* 2009).

Let me try to formulate here some conclusions and problems that have been collectively reached and formulated in our biosemiotics inquiry.

## 1. The lower semiotic threshold zone

Sebeok's thesis that semiosis is coextensive with life[5] is one of the major keystones of biosemiotics. However, it is still waiting for a more persuasive demonstration. Therefore it should still be treated as a hypothesis – and apparently a very productive hypothesis. After Krampen's (1981) paper on phytosemiosis, and Sebeok's inclusion of all life (thus, biology) under the field of semiotics, biosemiotics began to truly grow, as indicated by the collective statement on the scope of semiotics (Anderson *et al.* 1984). After that, and in some extent in parallel, Hoffmeyer and Emmeche developed their concept of code duality,[6] which has been seen simultaneously as the necessary requirement for both life and semiosis, and the inclusion of Umberto Eco's concept of semiotic threshold[7] into this analysis (for example, W. Nöth organised a meeting in Kassel on this topic). Remarkable work has been done by H. Pattee in describing the epistemic cut,[8] and M. Barbieri in explicating the concept of code[9] – both, in this way, adding arguments for Sebeok's thesis. Very important work has been done by Terrence Deacon, who has provided modelling of processes close to the origin of life, thus enabling us to describe the stepwise origin of semiosis.[10] This led to the formulation of the concept of semiotic threshold zone.[11] Also, instead of just extending the usage of the concept of intentionality (Hoffmeyer 2008), Deacon (2011) has introduced the concept of ententionality that covers the phenomenon upwards from the first processes of life.

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4 Kull *et al.* 2008.

5 See the formulations collected in Kull *et al.* 2008, also Kull 2011.

6 Hoffmeyer, Emmeche 1991.

7 Eco 1976.

8 Pattee 2001.

9 Barbieri 2003.

10 Deacon 1997.

11 Worked out in Saka meeting, August 2008 (Kull, Deacon, Emmeche, Hoffmeyer, Stjernfelt 2009).

Nevertheless, what needs still to be done is the further modelling of minimal semiosis in operational terms, i.e. in the way that would make it possible to apply semiotic models on the cellular level and to test these empirically. A persuasive enough model of semiosis for this purpose still seems to be absent.

## 2. (Re)interpretation of Peircean semiotics

Peirce sees semiosis as a process and this processual instead of structural view has made his approach appropriate and productive for biosemiotics. However, the concrete application of Peirce's concepts has also raised a series of problems and controversies.

Briefly, the statement is this. *If* one accepts Sebeok's thesis (which states that the phenomenon that distinguishes life forms from inanimate objects is semiosis) *then* it is reasonable to interpret Peirce's model of semiosis as limited to living systems. *This is supported by Peirce's claim* that "since the phenomena of habit may [...] result from a purely mechanical arrangement [of the molecular arrangement of protoplasm], it is unnecessary to suppose that habit-taking is a primordial principle of the universe" (CP 6.262). In this case, the concept of habit corresponds closely to the concept of code.

We should, of course, distinguish between and separate the history of science (which reconstructs what Peirce exactly said in context, and in different periods of his life) from science itself (which uses some models formulated by Peirce and decontextualises them in order to apply them where relevant). In biosemiotics, we need to do the latter, and thus we need not agree with everything that he has said. Analogically, whenever anybody is effectively using the Darwinian model of natural selection, it is used (ever since the neo-Darwinians) by completely abandoning Darwin's concept of inheritance (called pangenesis, on gemmules that would diffuse in the body and aggregate in the reproductive organs).

Peirce, indeed, developed a strong version of synechism and applied fallibilism to physical laws, meaning that physical laws themselves need not be exact, but have exceptions. He needed this in order to explain diversification. Acceptance of the primordiality of habit in its extreme actually means that there are no physical laws in the sense that physics deals with them; instead they are all habit-like, i.e., as if mental *sensu lato*.

Due to knowledge that came much after Peirce, it is now possible to completely abandon the hypothesis of the primordiality of habit. We may call this neo-Peirceanism, if we like.

Contemporary understanding of the role of physical laws in explaining the phenomena of life (e.g., by H. Pattee, or S. Kauffman) is different from Peirce's understanding of laws. Howard Pattee argues that physical laws (however strict) do not cover everything; they leave something open (such as initial conditions, or the construction of instruments – which obey strict physical laws but are not determined by these). Stuart Kauffman, somewhat similarly, states that there is no entailment by physical laws in the living.[12] The model of diversification, as described by Ilya Prigogine, is one that does not require the primordiality of habit either. Its freedom for diversification stems from fluctuations that can be thermal. The mathematics necessary for explaining self-organization was not yet available for Ch. Peirce.

Thus there are now models that solve the problem of diversification without the assumption that physical laws themselves have to be habit-like. And we are still within Peirce's realism.

It seems that most cases that support the existence of prebiotic physiosemiosis (see review in Rodríguez Higuera 2012) are ones in which the author has not analysed the cellular processes and the current biological understanding about the differences between living and non-living systems. Similarly, insufficient analysis and knowledge of vegetative life processes may be the reason for an opposite deviation, where interpretation processes and thus semiosis are confined to higher animals only (e.g., Short 2007).

In science (meant as *Wissenschaft*, i.e. more broadly than the word is commonly used in English), including semiotics, a large part of the work involves the comparison of models. This is an analysis of whether and to what extent the models fit. Our understanding of phenomena is almost entirely based on our ability to find a match between unidentical models. (And this usually requires that we should not pay attention to the differences in names – words, or terms – that are used by the different models. Ch. Morris and L. Bertalanffy already taught us this.) If we find the right and effective match, then the particular differences between the models become useful, since these are then the points at which one model can instruct the other.

The same is true of Peirce's model of semiosis – its usefulness depends on how we put it in correspondence with other models. And here I am: *if* one accepts Sebeok's thesis, *then* it is reasonable to limit the Peirce's model with living systems. And Peirce himself might like this.

In this respect, I would suggest one to read Peirce's "Man's glassy essence" (CP 6.238ff) (although it requires some knowledge of physics), because this is where Peirce speaks about biophysics, and explicitly attempts to find the

[12] Longo *et al.* 2012.

molecular mechanism of protoplasm that is responsible for habit. From this text, one can see that (a) Peirce tends to believe that a specific molecular constitution of protoplasm is responsible for semiosis, and (b) at the time there was so little known about the physical structure of matter, the energetics of the cell and nonlinear thermodynamics that his further hesitations about the lower semiotic threshold are forgivable. For illustration, let me present here some not so often quoted passages of Peirce (I intentionally abbreviated these so that in some cases his thought is slightly altered):

> "I have to elucidate [...] the relation between the psychical and physical aspects of a substance. The first step towards this ought, I think, to be the framing of a molecular theory of protoplasm" (CP 6.238-9).
>
> "[...] physical property of protoplasm is that of taking habits" (CP 6.254).
>
> "The problem is to find a hypothesis of the molecular constitution of this compound which will account for these properties, one and all" (CP 6.256).
>
> "The truth is that, though the molecular explanation of habit is pretty vague on the mathematical side, there can be no doubt that systems of atoms having polar forces would act substantially in that manner, and the explanation is even too satisfactory to suit the convenience of an advocate of tychism. For it may fairly be urged that since the phenomena of habit may thus result from a purely mechanical arrangement, it is unnecessary to suppose that habit-taking is a primordial principle of the universe" (CP 6.262).
>
> "[...] unless we are to accept a weak dualism, the property must be shown to arise from some peculiarity of the mechanical system" (CP 6.264).

Peirce is indeed trying to find the mechanical model for the necessary conditions of habit, and he more-or-less succeeds. He then, however, turns to the hypothesis of primordial origin of habit because he cannot explain certain other things... which, as I see it, can be explained with the physics of the second half of the 20th century.

I mean, first, the dissipative systems as a necessary (but not sufficient) condition for life, and, second, what Howard Pattee, Terry Deacon, Peter Wills and some others have understood and described as the emergence of semiosis. Stuart Kauffman calls this *radical emergence*. Would Peirce have known this, he would have come to the Gatherings in Biosemiotics. (And would tell us that he now sees that what Kalevi and Marcello call codes would be habits in his terminology.)

It is reasonable to use Peirce's model of semiosis as one good model, but certainly not as the ultimate one. For instance, triadicity, which is a basic

feature of Peirce's model, can be generalised into multiplicity – i.e., a sign may have many aspects instead of just three, and how many are relevant can be concluded as a result of empirical analysis of concrete cases. Occam's razor, which works well in the physical sciences, may not have a similar stand in semiotics.

Thus, in biosemiotics, it is productive to work with Peircean models, and to develop these – but to do this as scientists, not as historians of science.

### 3. Modelling of semiosis, of umwelt and knowing, and temporalization of basic sign types

When modelling semiosis, classifying signs or describing the semiotic phenomena, it is highly insufficient to limit ourselves to theoretical work. It is necessary to look at and to carefully describe and classify the sign processes as they occur throughout the living realm, by conducting fieldwork and studies of biocommunication proper.

Until now, there exist only a few works that could interrelate a large number of different models of semiosis (such as Krampen's article), and there are even less of those that have developed semiotic models on the basis of empirical studies. Typology of semiosis cannot be done just deductively. It is important to see that both binarism and triadicity are the logical assumptions that stem from theoretical models, and not from empirical findings, when describing the signs. (In this context it is remarkable to notice how, for instance, in the work of Juri Lotman from the 1960s to the late 1980s, his view on the structure of sign developed from binary, to ternary, to plural.)

An important reformulation of the Peircean model has been developed by Terrence Deacon (1997), who demonstrates how the mechanism of indexical semiosis always includes the iconic, and the symbolic one the other two, relating these to concrete neurobiological processes. This also means that the movement from iconic to indexical to symbolic may have an ontogenetic (and consequently also a phylogenetic) basis. Such temporalization of sign types (also described by Hoffmeyer, *et al.*) is an effective heuristic in (bio)semiotic inquiry.

A remarkable analysis of primary semiotic phenomena has also been provided by Umberto Eco in his *Kant and the Platypus*. He has introduced the concepts of primary iconicity and primary indexicality, demonstrating, that the icon is primarily the sign that is itself responsible for creating a similarity relation, i.e., the primary icon does not reflect similarity, but instead makes things similar, introduces similarity as such.

This is in a good accordance with the way that Jakob von Uexküll has attempted to describe umwelten of different species of organisms. The semiotic mechanisms themselves are those responsible for the diversity and diversification of umwelten. Uexküll also saw the big differences in the general approches to the study of living beings, to doing biology. We can thus say that the way in which semiotics (including biosemiotics) differs fundamentally from physics (including biophysics) is that whereas physics studies the world as reducible to universal laws, semiotics instead studies all kinds of knowing. Biophysics studies the physico-chemical structure of organisms, biosemiotics studies what the organisms may know, what are the types and ways of knowing, and what it does with the world.

The typology of biosemiotic processes may distinguish between vegetative and animal (icon-like and index-like) semiosis; however, the further studies should not just limit themselves to a Peircean or any other sign typology, but instead develop comparative studies of the mechanisms of meaning-making and introduce typologies that are empirically based. This means that there may be a different number than three (vegetative, animal, and cultural) levels of sign processes in life itself.

Another evidently efficient heuristic is the linking of types of semiosis with the types of mechanisms of learning (as was done already by G. Bateson). Among other things, this would allow us to include the study of the forms and mechanisms of conditioning into biosemiotic science. An example of an interesting problem in this respect would be the analysis of the mechanisms of associative learning and their relationships to the indexical threshold zone.

## 4. The symbolic threshold zone

The origin of humans and of the human capacity for language is certainly a semiotic problem. Since Lev Vygotsky, it has been related to the emergence of the capacity to use and create symbols. T. Sebeok has forcefully and repeatedly argued for a sharp difference in sign use between humans and non-humans, stating strongly that the term 'language' should be reserved exclusively for the sign systems that human babies start to acquire close to their first birthday, and which is almost completely absent in other known species of organisms. Thus we can call language only those sign systems that include (among others) some symbols.

T. Deacon has further argued for this view in his *The Symbolic Species*, bringing in the description of symbolic semiosis on the basis of neural mechanisms that are required for it.

The importance of a careful description of this leap from non-linguistic sign systems to the linguistic ones on the basis of differences in semiotic mechanisms is evident: (1) it provides a basis for understanding the relationship between language and the objects it describes, via the inextricable role of lower levels of sign-processes in language; (2) it makes it possible to overcome the false use of biological models in the humanities (called darwinitis, and neuromania by Tallis 2011).

## 5. The relationship between semiosis and codes

This question has been rather difficult to resolve in the discussions during the last decade of biosemiotics. The conclusion, briefly, is this: semiosis has primacy before codes; codes are products of semiosis. However, the question requires a more detailed analysis.

We can define *code* as a regular correspondence or link between entities that would not form such a regular correspondence on the basis of self-assembly (because, in cases where we have a code, there is an immense number of possibilities to form alternative links). As different from self-assembly, the creating or inheriting of codes requires work; i.e., a code is a correspondence or link that is created or inherited by semiosis (by life).

A code, always built by semiosis, may nevetheless persist for some time without further activity of semiosis – such as in many machines and automatons. Thus, code may exist (temporarily) without semiosis.

One can say that a code (and likewise, a grammar) is a frozen pragmatic, a frozen habit. This is a general feature of artefacts – their pieces are put together, thereby building a code-relation into their body.

*Semiosis* is what is capable of creating new code-relations. Simultaneously, semiosis also carryies on existing codes, rebuilding and inheriting these. Semiosis always includes certain codes. Thus semiosis cannot exist without codes. Code is a necessary but not a sufficient condition for semiosis.

Semiosis always requires a previous semiosis (*omne semiosis ex semiosis*; *omne vivum ex vivo* – except at their initial emergence at the origin of life). The capacity of creating a new code implies that semiosis is also a unit of learning from experience. This means that semiosis assumes certain ambiguity, certain indeterminacy, unpredictability.

A living cell is a semiosic system. The translation process carried by ribosomes is a code-process, but it is only a part of semiosis. The adaptors (called code-makers by M. Barbieri, like tRNAs in the case of the genetic code) are

necessary for building the code-relation, but nevertheless are insufficient for semiosis.

It seems reasonable to say that meaning-making is a feature of semiosis and not of code.

Meaning-making (and semiosis) appears when more than one code is involved, and the codes are mutually incompatible (i.e., code-plurality, or at least code-duality, is necessary). Semiosis is the search that appears due to the unpredictability (or, a piece of freedom) that results from an incompatibility situation. This implies the primary intentionality. Therefore, life as ongoing semiosis as challenging incompatibility, can be described as permanent problem-solving.

In computers, or at least in simple calculators, there are built-in codes, but no new codes are created, there is no semiosis by itself. (However, a calculator in a process of being used by a human is a part of semiosis.) In the case of more advanced computers, I can imagine that a process equivalent to simple code-making (in Barbieri's sense) can be simulated. Yet this is not semiosis. However, in even a more advanced case, e.g., of independently moving and sensing robot-computers that would try to communicate with each other on the basis of non-identical codes, semiosis may temporarily appear.

There certainly exists a gray zone between semiosis and non-semiosis, at the lower semiotic threshold zone. For example, auto-cells (Terry Deacon's concept) would belong to that zone.

Improving these central concepts is most certainly our work.

## 6. The evolution of semiosis

The semiotic approach has radically changed our understanding of biological evolution. The statement of F. Saussure that in the case of signs, the primary processes that are responsible for their formation are synchronic and not diachronic, also holds more generally for biosemiotics. For biology, this means that the explanations of phenomena, in first place, have to pay attention to the synchronic (or somewhat more generally, to ontogenetic) mechanisms, and the diachronic (evolutionary, phylogenetic) processes can be seen as their resultants. Here, for the biological theory of evolution, the most interesting discussions will start.

The alternative theories of evolution can be put very briefly as, either (1) genetic change precedes the epigenetic one, or (2) the epigenetic change is prior to the genetic, in an evolutionary adaptive change.

The neo-Darwinian model of evolution clearly speaks in favour of the first option – the first thing to happen is a new random mutation, which creates a new phenotype, which can or cannot be preserved due to natural selection, defined as the differential reproduction of genotypes. The semiotic model of evolution states the opposite – the first thing to happen is the change in phenotype (which includes changes in the usage of the genome, in its expression pattern), which can or cannot be affixed by random changes in the genome.

For a long time, the neo-Darwinian model has been seen as having no real alternatives for explaining adaptive evolution. However, just in the recent decade, a remarkable shift in this has taken place due to advances in developmental biology (Müller, Newman 2003; West-Eberhard 2003; Kull 2000).

A somewhat misleading concept is that of meme, because it tends to hide an important difference that exists between semiotic and physical approaches. According to the initial content of this concept, a meme reproduces and evolves on the basis of a natural selection mechanism – it may have a random mutation, and the differences in reproduction of memes determine their evolution. The reproduction of memes occurs via imitation, and here is the crux of the matter. According to R. Dawkins and his followers, imitation can be modelled as copying. In this case, indeed, the neo-Darwinian model applies. However, if one considers that imitation is by itself a sign process, one that requires agency and thus is dependent on the choices made by the organism that imitates, then it is clear that here the mechanism of evolution is semiotic and not neo-Darwinian. Accordingly, it is organic selection and not natural selection that drives the process. The concept of meme as a vulgarized concept of sign is thus not only unnecessary, but also misleading. Instead, we should use a typology of signs in which certain types of iconic signs may look *as if Dawkins' meme*.

It is thus important that the evolvement of semiosis includes both the diminishing of semiotic freedom, when new codes are introduced in habituation, and an increase of semiotic freedom, when new options appear due to the replacement or abandoning of codes.

## 7. Tools for modelling

Since meaning-making is by its very nature unpredictable in the first place, deductive formal models cannot work for modelling the results of this process.

Semiosis occurs at the interaction of two or more codes (or languages) that are mutually and partially incompatible.

Semiosis assumes polysemy. Formal languages, including mathematics, as different from natural languages, aim to be monosemic. Polysemy (homonymy) is the very source of meaning-making (as well as freedom). From a mathematical point of view, semiosis includes incompatibility. Among the models of semiosis, Lotman's model explicitly describes the fundamental role of incompatibility, or non-translatability. The inclusion of incompatibility makes semiotic modelling different from physical modelling as well (for the latter, mathematics fits perfectly), because the modelling of semiosis assumes that the object under description is logically incompatible. Natural language can therefore be a better tool than a formal language for modelling semiosis, or life itself.

## Peroration

The major limitation in today's biosemiotics (and also in semiotics in general) is the insufficient development of models of semiosis. Most of the existing models are so simple and primitive that they do not allow to us operationally distinguish between sign types, they do not include enough of the necessary distinctions in order to analyse the concrete semiosic phenomena of life. In order to develop biosemiotics as a theoretical and an empirical field of study, further work in elaborating semiotic models is crucial.

This means that the models used in anthroposemiotics have to be updated, so that the necessary coexistence of lower levels of semiosis will be explicated. Only then can it be properly demonstrated to what extent it is true that the major watershed does not lay between culture and nature, but between living (together with all that life produces) and non-life.

Biology can then become a science that not only knows the chemicals of life, but also the world in which the organisms live, the issues they distinguish in their umwelten, the meanings that they make.

This is also important in order to replace the false biologization of the humanities by the appropriate description of the semiotic, tying together again the fragile diversity of the fascinating living world. Until there is life to enjoy.

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# On the importance of semiotics for biology

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Biology stands in a central position astride a great intellectual chasm that has defined the Western science since the Enlightenment. On one side there is the shiny clean edifice of the physical sciences, that has as its foundation the three pillars of mathematics, physics, and chemistry. On the other side there is a tangled jungle of ideas constituting the social sciences and humanities, whose every trunk and shoot is rooted in a muddy humus of feelings, representations, purposes, and values.

Contemporary biology, however, is in the curious position of claiming to be firmly resting on the physical side of this divide and yet is permeated with concepts and assumptions with deep affinities to the other. Life defiantly resists full analysis without the use of such concepts as selves, functions, adaptations, and information. And no matter how hard we protest that these are merely temporary stand-ins for fully reduced chemical and mechanistic relationships, each time a living function is analysed to expose its component materials and dynamics we find that we must yet again embed our descriptions of these new findings in a language replete with intentional and normative terms. It is because of this that biologists have more and more often found themselves having to fend off the insistence of vitalists and religious fundamentalists who argue that only some immaterial essence or intentional "force" could explain life.

A crucial crossroads was encountered with the discovery of the structure and function of DNA, and its identification with information. Coincidentally, with the nearly simultaneous coining of a new technical concept of information, which reduced it to mere statistical and physical difference, and the parallel development of the computer sciences it was possible for decades to avoid confronting the paradoxical stance of treating this most basic function of life as both merely chemical and at the same time semiotic.

That time has passed. Simple mechanistic conceptions of life and computational theories of mind have had half a century to prove themselves

adequate, and while it is true that both paradigms have yielded enormous technical advances, neither has moved science any closer to resolving these dilemmas. This is because this critical "epistemic cut" is located at the root of life and so merely importing terminology from human phenomenal and communicational experience and applying it by analogy to basic living functions is ultimately a circular enterprise. Minds were not in some way grafted onto biological systems; mentality emerged from and grew out of organisms during their evolution.

So not only do we currently have an un-grounded theory of semiotic processes at the molecular, cellular, and organism level, but lacking this foundation we are very likely making unsupported assumptions about the nature of mental and interpersonal semiosis as well. For this reason developing a well-grounded biosemiotic theory based on first principles is actually critical for theories of semiosis at all levels. It's time that we turn to the work of making this heuristic theory scientific. And to do this we must start from the ground up – with biosemiotics.

# Biosemiotics needs to engage other scientists

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I had just finished re-reading J. B. S. Haldane's *Daedalus or Science and the Future* when Kalevi asked me to write a few informal comments on the "importance of semiotics for biology" for the Tartu meeting. Haldane warns that the paper may be irritating – but irritation has a purpose. He says: *"It will be criticized for its undue and unpleasant emphasis on certain topics. This is necessary if people are to be induced to think about them, and it is the whole business of a university teacher to induce people to think."* Most biosemioticians would be happy if they could induce biologists to think of more meaningful ways to "make sense" of their data. We all know from our own efforts, that inducing people to think in novel ways is often a useless exercise, especially if they are embedded in highly specialized and well-established disciplines, such as genetics, molecular, and evolutionary biology.

Haldane originally presented the paper in 1923. It was reissued with commentaries in 1995. The paper was both controversial and influential because it predicted, among other technologies, "birth control" and "ectogenetic procreation" – topics that shocked many Victorians. This is also the paper where Haldane quipped that, "Einstein was the greatest Jew since Jesus" – an opinion irritating for many Christians who felt it was blasphemous. The paper even upset Haldane's liberal father, the physiologist John Scott Haldane.

Haldane was skilled at being irritatingly clever enough to induce thought, without crossing the line and just being irritating. In my opinion, biosemiotic criticism of biologists and physicists has not always been that clever. For example, calling physicists "reductionists" and "mechanists" will not produce any change in how physicists think. It will, however, produce irritation. Also, I have not known any biologists who feel the need for biosemiotics to "liberate" them from "the big-brother role" of physics, as Hoffmeyer suggests. Haldane certainly did not feel that way. He pictured physics as "a degenerate form of biology" – a concept that did induce some new thoughts among physicists.

To some extent biologists have been changing their thinking out of necessity, because of the plethora of data. Joshua Lederberg in the Foreword to the 1995 *Daedalus* reissue commented that *"Biology is already so fact laden that it is in danger of being bogged down awaiting advances in logic and linguistics to ease the integration of particulars"*. Today, seventeen years later, data continue to fill petabytes of memory faster than ever. Necessity has given rise to many highly specialized datasets, the so-called "-omes," and technical disciplines, the "-omics," and to the re-emergence of "systems biology" as a necessary complement to what is often mislabelled as "reductionist" data processing.

In my opinion, biosemiotics has not yet effectively engaged biologists, or induced them to think differently. It is still too isolated to be influential. I would suggest that biosemiotics needs to actively engage more physicists and biologists in direct conversations if it expects to influence how they think. For example, I learned about biosemiotics only because Kalevi convinced me to write a paper (Pattee 2001), and subsequently we learned more about both our subjects from personal discussions (Pattee, Kull 2009). It would also help to invite active scientists to speak at department seminars and at biosemiotics meetings, especially those scientists from disciplines that biosemiotics has criticized and hopes to influence.

Of course, there is risk in such direct two-way engagement. One risk is that it would allow physicists and biologists to answer the criticisms of their thinking that are often used to justify the field of biosemiotics, like the charges of reductionism and mechanism. There is also a general attitude that semiotic terms as used by biologists are unprincipled (Emmeche's *"spontaneous semiotics"*). I have not found this to be the case with the biologists I have known. For example, speaking in defence of Lederberg, I would say his discovery of communication in bacteria was certainly not unprincipled or spontaneous; nor was his proposal that it is the *information* in the coded *one-dimensional* base sequences, not the material *three-dimensional* DNA structure, that determines enzyme folding, and therefore its function. Lederberg discussed this in his Nobel Lecture in 1959, before the genetic code was discovered. It was empirically demonstrated by Christian Anfinsen in the following year, for which he also received the Nobel Prize 12 years later. As far as I know, this was the first principled and *empirically verified* support for the argument that all life depends on *symbolic* information controlling material function. This is the level where a *scientific* biosemiotics first arises.

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# From physics to semiotics

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## Introduction

My greatest aim in this chapter is to take us from our deeply received scientific world view and, derived from it, our view of the "real world" in which we live, from the world spawned by Newton and modern physics, to an entirely different, newly vibrant, surprising, unknowable world of becoming, in which the living, evolving world – biological, economic, cultural – co-creates, in an unprestatable mystery, its own possibilities of becoming. We will pass from physics to the edges of semiotics along the way. One issue to ask is this: Why is the subject of semiotics regarded as almost a pseudoscience by so many scientists? I shall argue that this view is deeply wrong, among the other points I seek to make.

I have many points to make and ideas to explore, and hope they shall prove relevant and find resonance. If I am right, we are in the world in a way that we do not now clearly recognize. In it we will find a natural magic, in William Gaddis' sense in *The Recognitions*: "There is no truth beyond magic".

I begin with an amazing statement by the early sociologist Max Weber, who said, roughly, that "With Newton we became disenchanted and entered modernity". Weber was right. In the 15$^{th}$ and 16$^{th}$ centuries, the white and black magi sought magical knowledge of the world. Kepler was perhaps the last of the white magi, with his transition to modern physics, starting with the five Platonic solids for the orbits of the planets and finding his way to, of all things, ellipses.

The black magi were convinced that by incantations they could stand Nature on her head and wrest their due. Following Newton's triumph in founding classical physics there came our Enlightenment, the Industrial Revolution, and modernity. Newton's amazing successes left no room for magic.

*Newton*

The Western and now modern world 350 years later changed with the inventions of, largely, one mind, Newton: he invented not only the mathematics of differential and integral calculus that gives us moderns our way of thinking, but from physics upward, he gave us his famous three laws of motion, and universal gravitation.

Ask Newton: "I have 9 billiard balls rolling on a billiard table. What will happen to them?" Newton might have rightly responded: "Measure the positions and momenta and diameters of all the balls, the boundary conditions of the table, write down my three laws of motion representing the forces between the balls and between the balls and the edges of the table, then integrate my equations to yield the deterministic future trajectories of the balls".

What had Newton done? He had mathematized Aristotle's "efficient cause" in his differential equations, giving forces between the entities, the laws of motion. He had invented a conceptual framework to derive the deterministic trajectory consequences by integration. But integration is deduction is "entailment", so the laws of motion in differential form entail the deterministic trajectories. In this entailment, Newton mathematized in a very general framework Aristotle's argument that scientific explanations must be deductive: All men are mortal, Socrates is a man, hence Socrates is mortal.

In the early 1800s, Pierre-Simon Laplace generalized Newton: given a massive computing system, the Laplacian demon, informed of the instantaneous positions and momenta of all the particles in the universe, the entire future and (because Newton's laws are time reversible) past of the universe is fully predictable and determined.

This statement by Laplace is the birth of "reductionism", the long-held view that there is some "final theory" down there, Steven Weinberg's "Dream of a final theory", that will entail all that becomes in the universe.

We need two additional points.

(a) By the time of Poincaré, studying the orbits of three gravitating objects (a topic Newton knew was trouble), Poincaré was the first to show what is now known as deterministic chaos. Here tiny changes in initial conditions lead to trajectories which diverge from one another exponentially. Since we cannot measure positions and momenta to infinite accuracy, Poincaré showed that we cannot *predict* the behavior of a chaotic deterministic dynamical system. Determinism, contra Laplace, does not imply predictability.

(b) Quantum mechanics overthrew the ontological determinism of Newton, on most interpretations of quantum mechanics. Nevertheless, quantum systems obeying the Schrödinger equation *deterministically* evolve

a *probability distribution* of the ontologically indeterminate probabilities of quantum measurements.

With General Relativity and Quantum Mechanics, the twin pillars of 20th century physics were and remain firmly in place. No attempt to unite General Relativity and Quantum Mechanics has been successful after 85 years of trying. Success may or may not come.

*Darwin*

After Newton, and perhaps as profoundly, Darwin changed our thinking. We all know the central tenets of his theory: heritable variation among a population, competition for resources insufficient for all to survive, hence Natural Selection culling out those variants "fitter" in the current environment. Thus we achieve adaptation, and critically, the *appearance of design* without a designer.

The story of the difficulties of Darwin's theory with "blending inheritance" and its unexpected rescue by Mendelian genetics, even the fact that a copy of Mendel's work lay unopened on Darwin's desk, is well known. Mendelian genetics prevents blending inheritance and paved the way for the mid-20th century "neo-Darwinian synthesis".

The entire panoply of life's evolution at last lay open, or at least the start of its understanding provided by Darwin.

*Monod and "teleonomic"*

The concepts of "function", "doing", and "purpose" in biology, and with it, a potential "meaning" for signs or symbols, that are entirely absent from physics, where only "happenings" occur, were muted in standard biology by Jaques Monod. Consider a bacterium swimming up a glucose gradient. It "seems" to be "acting to get food". But, said Monod, this view of the organism is entirely wrongheaded. The cell in its environment is just an evolved molecular machine. Thanks to natural selection, the swimming up the gradient gives the appearance of purpose, of teleology, but this is false. Instead, this behavior is a mere "as if" teleology that Monod called "teleonomy".

In short, for Monod, and for legions of later biologists and philosophers, "doing" is unreal in the universe; there is only the mechanical, selected appearance of "doing".

Indeed, in so arguing, Monod is entirely consistent with physics. As noted, there are no "functions", "doings", or "meanings" in physics. Balls rolling down a hill are merely Newtonian "happenings". So too are the happenings in the evolved molecular machine that is the bacterium swimming up the glucose gradient.

Yet we humans think that functions and doings are real in our world. If so, from whence come functions, doings and meanings?

## Functions, meanings, and doings are real in the universe

I now give, as far as I know, an entirely new set of arguments that, I believe, fully legitimize functions, doings and even meanings as real in the universe, but beyond physics. The discussion has a number of steps.

*The non-ergodic universe above the complexity of the atom*

Has the universe in its 13.7 billion years of existence created all the possible fundamental particles and stable atoms? Yes.

Now consider proteins. These are linear sequences of twenty kinds of amino acids that typically fold into some shape and catalyze a reaction or perform some structural or other function. A biological protein can range in length from perhaps 50 amino acids to several thousands. A typical length is 300 amino acids long.

Then let's consider all the possible proteins that are 200 amino acids long. How many are possible? Each position in the 200 has 20 possible choices of amino acids, so there are 20 x 20 x 20 200 times or 20 to the 200th power, which is roughly 10 to the 260th power possible proteins with the length of 200.

Now let's ask if the universe can have created all these proteins since its inception 13.7 billion years ago. There are roughly 10 to the 80th particles in the known universe. If these were doing nothing, ignoring space-like separation, but making proteins on the shortest time scale in the universe, the Planck time scale of 10 raised to -43 seconds, it would take 10 raised to the 39th power times the lifetime of our universe to make all possible proteins length 200 just *once*.

In short, in the lifetime of our universe, only a tiny fraction of all possible proteins can have been created. This means profound things. First, the universe is vastly non-ergodic. It is not like a gas at equilibrium in statistical mechanics. With this vast non-ergodicity, when the possibilities are vastly larger than what can actually happen, history enters.

Not only will we not make all the possible proteins with lengths of 200 or 2000, we will not make all possible organs, organisms, social systems... There is an *indefinite* hierarchy of non-ergodicity as the complexity of the objects we consider increases.

*Kantian wholes and the reality of "functions" and "doings"*

The great philosopher, Immanuel Kant, wrote that "In an organized being, the parts exist for and by means of the whole, and the whole exists for and by means of the parts". Kant was at least considering organisms which I will call Kantian wholes.

Functions are clearly definable in a Kantian whole. The function of a part is its causal role in sustaining the existence of the Kantian whole. Other causal consequences are side effects. Note that this definition of function rests powerfully on the fact that Kantian wholes, such as a bacterial cell dividing, are complex entities that *only get to exist in the non-ergodic universe above the level of atoms because they are Kantian self-recreating wholes.* It is this combination of the self-recreation of a Kantian whole and therefore its very existence in the non-ergodic universe above the level of atoms that, I claim, fully legitimizes the word "function" as a part of a whole in an organism. Functions are real in the universe.

Now consider the bacterium swimming up the glucose gradient to "get food", Monod's merely teleonomic *as if* "doing". We can rightly define a behavior that sustains a Kantian whole, say the bacterium existing in the non-ergodic universe, as a "doing". Thus, I claim, "doings" are real in the universe, not merely Monod's teleonomy.

Interestingly, Kant opined that there would never be a Newton of biology. Despite Darwin, a major point of this paper, which will take us beyond physics, is that here Kant was right. There never, indeed, will be a Newton of biology, for, as we will see below, unlike physics and its law entailed trajectories, the evolution of the biosphere cannot be entailed by laws of motion and their integration. No *laws* entail the evolution of the biosphere, a first and major step beyond physics at the "watershed of life".

*Collectively autocatalytic DNA sets, RNA sets or peptide sets*

Gonen Ashkenasy at the Ben Gurion University in Israel has created in the laboratory a set of nine small proteins, called peptides. Each peptide speeds up, or catalyzes, the formation of the *next* peptide by ligating two fragments of that next peptide into a second copy of itself. This catalysis proceeds around a *cycle* of the nine peptides (Wagner, Ashkenasy 2009).

It is essential that in Ashkenasy's real system, no peptide catalyzes its *own* formation. Rather, the set as a whole *collectively catalyzes its own formation.* I shall call this a collectively autocatalytic set, CAS.

These astonishing results prove a number of critical things. First, since the discovery of the famous double helix of DNA, and its Watson-Crick template

replication, many workers have been convinced that molecular reproduction *must* rest on something like template replication of DNA, RNA or related molecules. It happens to be true that all attempts to achieve such replication without an enzyme have failed for 50 years. Ashkenasy's results demonstrate that small proteins can collectively reproduce. Peptides and proteins have no axis of symmetry like the DNA double helix. These results say that molecular reproduction may be far easier than we have thought.

I shall only mention briefly that between 1971 and 1993, I invented a theory for the statistically expected emergence of collectively autocatalytic sets in sufficiently diverse "chemical soups" (Kauffman 1971; 1986; 1993). This hypothesis, tested numerically, is now a theorem (Mossel, Steel 2005). If it is correct, routes to molecular reproduction in the universe may be abundant.

Collectively autocatalytic DNA sets and RNA sets have also been made (Lam, Joyce 2009; Kiedrowski 1986).

*Collectively autocatalytic sets are the simplest cases of Kantian wholes and the peptide parts have functions*

A collectively autocatalytic set is precisely a Kantian whole, which "gets to exist" in the non-ergodic universe above the level of atoms, precisely because it is a self-reproducing Kantian whole. Moreover, given that whole, the "function" of a given peptide part of the nine peptide set is exactly its role in catalyzing the ligation of two fragments of the next peptide into a second copy of that peptide. The fact that the first peptide may jiggle water in catalyzing this reaction is a causal side effect that is *not* the function of the peptide. Thus, functions are typically a subset of the causal consequences of a part of a Kantian whole.

*Task closure*

Collectively autocatalytic sets exhibit a terribly important property. If we consider catalyzing a reaction a "catalytic task", then the set as a *whole* achieves "task closure". All the reactions that must be catalyzed by at least one of Ashkenasy's nine peptides *are* catalyzed by at least one of those peptides. No peptide catalyzes its own formation. The set as a whole catalyzes its own reproduction via a clear *task closure*.

*Task closure in a dividing bacterium*

Consider a dividing bacterium. It too achieves some only partially known form of *task closure* in part in and via its environmental niche. But the tasks are far wider than mere catalysis. Among these tasks are DNA replication, membrane

formation, the formation of chemiosmotic pumps and complex cell signaling mechanisms in which a chemically *arbitrary* molecule can bind to part of a trans-membrane protein, and thereby alter the behaviour of the intracellular part of that molecule, which in turn unleashes intracellular signalling. Thus this task closure is over a wide set of tasks.

*Biosemiosis enters at this point*

I thank Professor Kalevi Kull of the Department of Semiotics at the University of Tartu for convincing me that at just this point, biosemiotics enters.[1] As Kull points out, the set of molecules that can bind the outside parts of transmembrane proteins are chemically arbitrary – a point Monod emphasized as well in considering allosteric enzymes. Thus, as Kull (2009; 2010) points out, the set of states of the different molecules outside the cell that can bind to the outside parts of these transmembrane proteins and unleash intracellular signaling and a coordinated cellular response, constitute a *semiotic code* by which the cell navigates its "known" world, "known" – without positing consciousness – via the code and, in general, probably evolved by selection encoding of the world as "seen" by the organism. Change the molecule species binding the outside of the transmembrane proteins, and the world the cell "knows" changes.

Biosemiosis is real in the universe.

## Toward: No entailing laws, but enablement in the evolution of the biosphere

I now shift attention to a new and I believe transformative topic. With my colleagues Giuseppe Longo and Maël Montévil, mathematicians at the Ecole Polytechnique, Paris, I wish to argue that *no law* entails the evolution of the biosphere.[2] If we are right, entailing law, the centerpiece of physics since Newton, ends at the watershed of evolving life. If this claim is right, it is obviously deeply important. More, it raises the issue of how the biosphere, the most complex system we know in the universe, can have arisen beyond entailing law. I will discuss these issues as well. Again, the discussion proceeds in several steps.

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1 Kull, Kalevi 2012, *pers. comm.*

2 The full article, the title of this section, by Longo, Montévil and Kauffman, is online (2012a), and in press (2012b).

*The uses of a screwdriver cannot be listed algorithmically*

Here is the first "strange" step. Can you name all the uses of a screwdriver, alone or with other objects or processes? Well, screw in a screw. Open a paint can, wedge open a door, wedge closed a door, scrape putty off a window, stab an assailant, *objet d'art*, when tied to a stick, a fish spear, the spear rented to "natives" for a 5% fish catch return it becomes a new business...

I think we all are convinced that the following two statements are true: (i) the *number* of uses of a screwdriver is indefinite; (ii) unlike the integers which can be ordered, there is no natural ordering of the uses of a screwdriver. The uses are *unordered*. But these two claims entail that there is no "Turing effective procedure" to *list* all the uses of a screwdriver alone or with other objects or processes. In short, there is no algorithm to list the uses of a screwdriver.

Now consider *one* use of the screwdriver, say to open a can of paint. Can you list all the other objects, alone or with other objects or processes that may carry out the "function" of opening a can of paint? Again, the number of ways to achieve this function are indefinite in number, and unorderable, so again, no algorithm can list them all.

*Adaptations in an evolving cell cannot be prestated*

Now consider an evolving bacterium or a eukaryotic single celled organism. In order to adapt in some new environment, all that has to occur is that some one or many cellular or molecular "screwdrivers" happen to "*find a use*" that enhances the fitness of the evolving cell in that new environment. Then there must be heritable variation for those properties of the cellular screwdrivers, and natural selection will select, or cull out, the fitter variants with the new uses of the molecular screwdrivers which constitute adaptation. This *is* the arrival of the "fitter".

But no algorithmic *list* of the possible uses of these cellular screwdrivers can be had, thus we cannot know, ahead of time, what natural selection *acting at the level of the Kantian whole organism*, will reveal as the new uses of the cellular screwdrivers acting in part via the niche of the organism, which *succeed better*, hence were selected. We cannot, in general, prestate the adaptive changes that will occur. This is the deep reason evolutionary theory is so weakly predictive.

*We cannot prestate the actual niche of an evolving organism*

The task closure of the evolving cell is achieved, in part, via causal or quantum consequences passing through the environment that constitutes the "actual niche" of the evolving organism. But the features of the environmental "niche"

that participate with the molecular screwdrivers in the evolving cell, which will allow a successful task closure, are circularly defined with respect to the organism itself. We only know after the fact of natural selection what aspects of the evolving cell and its screwdrivers, and causal consequences of specific aspects of the actual niche, are successful when selection has acted at the level of the Kantian whole evolving cell population.

Thus, we cannot prestate the actual niche of an evolving cell by which it achieves task closure in part via that niche.

But these facts have a deep meaning. In physics, the phase space of the system is *fixed*, for Newton, Einstein and Schrödinger. This allows for entailing laws. In evolution, each time an adaptation occurs and a molecular or other screwdriver finds a new use in a new actual niche, the very phase space of evolution has *changed*, and done so in an unprestatable way. But this means that we can *write no equations of motion for the evolving biosphere.* Moreover, the actual niche can be considered as the boundary condition on selection. But we cannot prestate the actual niche. In the case of billiard balls, Newton gave us the laws of motion, told us to establish initial and boundary conditions, and then integrate laws of motion stated in differential equation form to get the entailed trajectories. But in biology, we cannot write down the laws of motion, and so cannot write them down in differential equation form. Nor, even if we could, can we know the niche boundary conditions, so could not integrate those laws of motion which we do not have anyway. It would be like trying to solve the billiard ball problem on a billiard table whose shape changes forever in unknown ways. We would then have no mathematical model. Here, too, the profound implication is that *no laws entail the evolution of the biosphere.*

If this is correct, we are, as stated above, at the end of reductionism at the watershed of evolving life. Now the machine metaphor since Descartes, perfected by Newton, leads us to think of organisms, as Monod stated, as molecular *machines.* Let me distinguish diachronic from synchronic science. Diachronic science studies the evolution of life and its "becoming" over time. Synchronic science studies the presumably fully reducible aspects of, for example, how a heart, once it has come to exist in the non-ergodic universe, "works". In these synchronic studies, reductionism presumably works. But in the diachronic becoming of the biosphere, *life is an ongoing, unprestatable, non-algorithmic, non-machine, problem solving for survival, becoming.*

*Darwinian preadaptations and radical emergence: The evolving biosphere, without the "action" of selection, creates its own future possibilities of becoming*

If we asked Darwin what the function of my heart is, he would respond, "Pump your blood". But my heart makes heart sounds and jiggles water in my pericardial sac. If I asked Darwin why these are not the functions of my heart, he would answer that I have a heart because its pumping blood was of selective advantage in my ancestors. In short, he would give a selection account of the causal consequence for virtue of which I have a heart. Note that he is also giving an account of why hearts exist at all as complex entities in the non-ergodic universe above the level of atoms. By pumping blood, hearts are functioning parts of humans as reproducing Kantian wholes. Note again that the function of my heart is a subset of its causal consequences, pumping blood, not heart sounds or jiggling water in my pericardial sac.

Darwin had an additional deep idea: A causal consequence of a part of an organism of no selective significance in a given environment might come to be of selective significance in a different environment, so be selected, and typically, a new function would arise. These are called "Darwinian preadaptations", without this meaning foresight on the part of evolution. Stephen Jay Gould renamed them "exaptations".

I will give but one example of the thousands of Darwinian preadaptations. Some fish have a swim bladder, a sac partly filled with air and partly with water, whose ratio determines the neutral buoyancy in the water column. Paleontologists believe the swim bladder evolved from the lungs of lung fish. Water got into some lungs, now sacs partly filled with air, partly with water, poised to evolve into swim bladders. Let's assume the paleontologists are right.

I now ask three questions: (1) Did a new function come to exist in the biosphere? Yes, neutral buoyancy in the water column. (2) Did the evolution of the swim bladder alter the future evolution of the biosphere? Yes, new species of fish evolved with swim bladders. They evolved new mutant proteins. And critically, the swim bladder, *once it came to exist*, constituted what I will call a *new adjacent possible empty niche*, for a worm, bacterium or both could evolve to live only in swim bladders. I return to this point in a moment, for magic hides here. (3) Now that you are an expert on Darwinian preadaptations, can you name all possible Darwinian preadaptations just for humans in the next three million years? Try it and feel your mind go blank. We all say no. A start to why we cannot is this: how would you name all possible selective environments? How would you know you listed them all? How would you list all the features of one or many organisms that might serve as "preadaptations"? We cannot.

The underlying reasons for why we cannot do this are given above in the discussion about screwdrivers, their non-algorithmically listable uses alone or with other objects/processes, and the non-algorithmically listable other objects/processes that can accomplish any specific task (opening a can of paint), that we can use a screwdriver to accomplish.

*The adjacent possible*

Consider a flask of 1000 kinds of small organic molecules. Call these the "actual". Now let these react by a single reaction step. Perhaps new molecular species may be formed. Call these new species the molecular "Adjacent Possible". It is perfectly defined if we specify a minimal stable lifetime of a molecular species. Now let me point at the Adjacent Possible of the evolving biosphere. Once lung fish existed, swim bladders were in the Adjacent Possible of the evolution of the biosphere. But two billion years ago, before there were multi-celled organisms, swim bladders were not in the Adjacent Possible of the evolution of the biosphere.

I think we all agree to this. But now consider what we seem to have agreed to: with respect to the evolution of the biosphere by Darwinian preadaptations, *we do not know all the possibilities.*

Now let me contrast our case for evolution with that of flipping a fair coin 10,000 times. Can we calculate the probability of 5640 heads? Sure, use the binomial theorem. But note that here we know *ahead of time* all the possible outcomes, all heads, all tails, alternative heads and tails, all the 2 to the 10,000th power possible patterns of heads and tails. Given that we know all the possible outcomes, we thereby know the "sample space" of this process, so can construct a probability measure. We do not know what *will* happen, but we know what *can* happen.

But in the case of the evolving biosphere, not only do we not know what *will* happen, we don't even know what *can* happen. There are at least two huge implications of this: (1) We can construct no probability measure for this evolution by any known mathematical means. We do not know the sample space. (2) Reason, the prime human virtue of our Enlightenment, cannot help us in the case of the evolving biosphere, for we do not even know what *can* happen, so we cannot reason about it. The same is true of the evolving econosphere, culture, and history: we often do not know ahead of time the new variables which will become relevant, so we cannot reason about them. Thus, real life is not an optimization problem, top down, over a known space of possibilities. It is far more mysterious. How do we navigate, not knowing what can happen? Yet we do.

*Without natural selection, the biosphere enables and creates its own future possibilities*

Now I introduce radical emergence, a kind of natural magic that I find enchanting. Consider the swim bladder once it has evolved. We agreed above, I believe, that a bacterium or worm or both could evolve to live only in that swim bladder, so the swim bladder as a *new adjacent possible empty niche*, once it had evolved, alters the future possible evolution of the biosphere.

Next, did natural selection act on an evolving population of fish to select a well-functioning swim bladder? Of course. (I know I am here anthropomorphizing selection, but we all understand what is meant.) But did natural selection "*act*" to create the swim bladder *as a new adjacent possible empty niche? No!* Selection did not "struggle" to create the swim bladder as a new empty adjacent possible niche.

But that means something I find stunning. Without selection acting to do so, evolution is creating its own future possibilities of becoming! It is a kind of natural magic.

And the worm that evolves to live in the swim bladder is a radical emergence unlike anything in physics.

*Evolution often does not* cause, *but* enables *its future evolution*

The bacterium or worm that evolves to live in the actual niche of the swim bladder, whereby it achieves a task closure selected at the level of the Kantian whole worm or bacterium, evolves by quantum indeterminate, and ontologically acausal quantum events. Thus, the swim bladder does not *cause*, but *enables* the evolution of the bacterium or worm or both to live in the swim bladder.

This means that evolving life is not only a web of cause and effect, but of empty niche opportunities, that enable new evolutionary radical emergence. The same is true in the evolving econosphere, cultural life and history. We live in both a web of cause and effect and a web of enabling opportunities that enable new directions of becoming.

*Toward a positive science for the evolving biosphere beyond entailing law*

The arguments above support the radical claim that no laws entail the evolution of the biosphere. If right, Kant was right. There will be no Newton of biology. Not even Darwin was that Newton yielding entailing laws.

But the biosphere is the most complex system we know in the universe, and has grown and flourished, even with small and large avalanches of extinction events, for 3.8 billion years. Indeed, there has been a spectacular increase in species diversity over the Phanerozoic.

How are we to think of the biosphere building itself, probably beyond entailing laws?

Organisms are Kantian wholes, and the building of the biosphere of these past 3.8 billion years seems almost certainly to be related to how Kantian wholes co-create their worlds with one another, including the natural magic of creating, without selection, new empty adjacent possible niches that alter the future evolution of the biosphere.

There may be a way to start studying this topic, a new quest. Collectively autocatalytic sets are the simplest models of Kantian wholes. In very recent work with Wim Hordijk and Michael Steel, a computer scientist and a mathematician, respectively, we are studying what Hordijk and Steel call RAFs, which are collectively autocatalytic sets in which the chemical reactions, without catalysis, occur spontaneously at some finite rate, and that rate is much sped up by catalysis. Fine results by Hordijk and Steel show that RAFs emerge and require only that each catalyst catalyses between 1 and 2 reactions. This is fully reasonable chemically and biologically (Hordijk, Steel 2004).

Most recently the three of us have examined the substructure of RAFs (Hordijk, Steel, Kauffman 2012). There are irreducible RAFs, which, given a Food Set of sustained small molecules, have the property of autocatalysis, but if any molecule is removed from the RAF, the total system collapses. It is irreducible. Then, given a maximum length of polymers allowed in the model as the chemicals, from monomers to longer polymers, there is a maximal RAF, which increases as the length of the longest allowed polymer, and hence the total diversity of possible polymers allowed, increases.

The most critical issue is this: There are *intermediate* RAFs called "sub-maximal RAFs", each composed either of two or more irreducible RAFs, or of one or more irreducible RAF and one or more larger "submaximal" RAF, or composed of two or more smaller submaximal RAFs.

Thus we can think mathematically of the complete set of irreducible RAFs, all the diverse submaximal RAFs, and the maximal RAF. For each we can draw arrows from those smaller RAFs that jointly comprise it. This set of arrows is a partial ordering among all the diverse RAFs possible in the system.

The next important issue is this: If new food molecule species, or larger species, enter the environment, even *transiently*, the total system can grow to create *new* submaximal RAFs that did not exist in the system before. This is critical. It shows that existing Kantian wholes can create new empty Adjacent Possible niches, and with a chemical fluctuation in which molecular species are transiently present in the environment, the total "ecosystem" can grow in diversity. A model biosphere is building itself!

In this system, the diverse RAFs can "help" one another: for example, a waste molecule of one can be a food molecule of another, or via inhibition of catalysis, or toxic products of one with respect to another can hinder one another in complex ways. They form a complex ecology. Further, these RAFs, if housed in compartments that can divide, such as bilipid membane vesicles called liposomes (Luisi *et al.* 2004), have been shown recently to be capable of open-ended evolution via natural selection, where each of the diverse RAFs act as a "replicator" to be selected and, in that selection, chemical reaction "arcs" that flower from the RAF core act as the phenotype with the core.

Thus, to my delight, we have the start of a theory for the evolution of Kantian wholes.

But there is a profound limitation to these models: They are in a deep sense algorithmic and their possible phase spaces can be prestated. The reason is simple: the only functions that happen in these RAF systems are molecules undergoing reactions, which are catalyzed by molecules. But the set of possible molecules up to any maximum length polymer can be prestated. And the set of possible catalytic interactions can be prestated, even in models where the actual assignment of which molecule catalyzes which reaction is made at random or via some "match rule" of catalyst and substrate(s).

By contrast, in the discussion above, we talked about the vast task closure achieved by an evolving bacterium or eukaryotic cell or organism. These tasks were not limited to catalysis, and as we saw with the discussion of the possible uses of a molecular screwdriver in a cell, those uses are both indefinite in number and not orderable, so no algorithm can list all those uses. Nor can we prestate how the evolving Kantian whole cell, where selection acts at the level of the Kantian whole and culls out altered screwdriver parts with heritable variations, can achieve some often new functional task closure via the actual niche. Thus the real evolutionary process is non-algorithmic, non-machinic, non-entailed.

With respect to our initial evolving RAF ecosystems, we do not yet know how to make this evolution non-algorithmic and non-entailed. While we have a start, and a useful one, it is not enough.

*Re-enchantment and creating a new world*

I return to Max Weber's astonishing statement: "With Newton we became disenchanted and entered modernity". Was Weber right? I think so. As noted above, the 15$^{th}$ and 16$^{th}$ centuries saw the black and white magi, the former seeking occult knowledge to stand nature on her head and wrest their due. With Newton, magic lost its magic, and we entered a world-view of the

deterministic dynamics of celestial mechanics, the Theistic God retreated in the Enlightenment to a Deistic God who set up the universe with Newton's laws and let them unfold. The war between theistic religion and science, let alone science and the arts, was underway. Next came our beloved Enlightenment: "Down with the Clerics, up with science for the perpetual betterment of Man". The Enlightenment was the "Age of Reason". Next came the Industrial Revolution, based on science derived from physics and chemistry. Thence we entered modernity.

We know the goods and ills of our fully lived Enlightenment dreams. We have democracy, a higher standard of living, are better educated, have better health and longer lives. Yet our democracies are often corrupted by power elites, we are, as Gordon Brown said as Prime Minister of the United Kingdom, "Reduced to price tags" in our increasingly global economy, where we often make, sell and buy purple plastic penguins for the poolside. If we ask why we do this, part of the answer is that we do not know what else to do.

Moreover, we *are* disenchanted. We are, a billion of us, secular realists in a meaningless universe, to quote Steven Weinberg's famous dictum. We have lost our spirituality.

But our physics-based world-view, if right for the abiotic universe, seems badly wrong for the living, evolving world, past the watershed of life. We do live in a world of cause and effect, but also of unprestatable opportunities that emerge in an unprestatable, ever growing and changing adjacent possible that we partially co-create, with and without intent.

It really is true that, with no selection acting to do so, the newly evolved swim bladder is a new adjacent possible empty niche that alters the future possibilities of biological evolution. The worm or bacterium that is enabled to evolve really is radically emergent. It really is true that the Turing machine enabled the mainframe computer, whose widespread sale created the market opportunity for the personal computer, whose widespread sale created the market opportunity for word processing and file sharing, whose wide use created a niche for the World Wide Web, whose creation generated an opportunity to sell things on the Web, which created content on the Web, which created a market opportunity for companies such as Google and Yahoo. Facebook came and the Arab Spring. None could have foreseen this. None intended this radically emergent becoming, so similar to the radical emergence in the evolving biosphere. In both cases, with neither selection nor intent, the evolving system creates, typically unprestatably, its own future possibilities.

*How much magic do we want to be re-enchanted*

Moreover, the Age of Reason assumed that we could come to *know*, that the world was solvable by reason. But if we often do not know what *can* happen, we cannot reason about it. Reason, the highest virtue of our Enlightenment, is an inadequate guide for living our lives. And top-down decision making, as if we could know ahead of time the variables that would become relevant and then "optimize", is often an illusion. We need to rethink how we make and live in our worlds.

Then what if we ask whether the current First World civilization best serves our humanity, or do we largely serve it, price tags and all? I think we are lost in modernity, without a clear vision of what our real life is.

Ralph Waldo Emerson is famous for his "Emersonian perfectionism". We are born with a set of virtues or strengths, and should devote our lives to perfecting them. But this perfectionism seems static, like a European hotel breakfast room, with all the food choices laid out. We have only to choose among our preset virtues and perfect them.

But this is not how real life is: we live a life of ever unfolding, often unprestatable opportunities that we partially create and co-create, with and without intent. I'm thus falling in love with "Living the Well Discovered Life".

From this, my own dream for "beyond modernity" starts to resemble the thirty civilizations around the globe, woven gently together to protect the roots of each, yet firmly enough to generate new cultural forms by which we can be human in increasingly diverse, creative ways, each helping himself or herself and others to live a well discovered life, and ameliorating our deep shadow side.

We need an enlarged vision of ourselves and what we can become.[3]

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# Birthing prepositional logics

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*Spirals*

In the centripetal swirl of biosemiotics, attracting undisciplined disciplinarians coming from art, botany, zoology, and beyond, we share a relatively slender but surely deep genealogy. Some might argue for older or newer neglected figures from this or that intellectual tradition, but sooner or later most will cite, in some fashion, in alphabetical order: Peirce, Sebeok, and Uexküll. The next rung will be much broader and delightfully diverse, perhaps to include Darwin; yet, as often happens, the obvious may remain uncited. The most familiar intellectual threads may be western and scientific, but there is no aversion to other traditions provided there is some payoff in their going against the grain.

This is to assume that anyone finding a calling in biosemiotics assents to getting his or her mind wet in contact and/or conjunction with other disciplines, regardless of how provincial or catholic one might once have been.

Those drawn to biosemiotics may themselves have been centrifuged, as it were, from a normative discipline, and anyone thereafter associated with biosemiotics may likewise find themselves catapulted from biosemiotics into fresh endeavours, with or without leaving the fold. Given the traffic in and about biosemiotics, there should be no danger of being isolated in a single inbred paradigmatic silo.

*Conjunctions*

Human language, mediated by the strange bedfellows of culture and biology, has provided the very generativities that enable and limit human projects in every realm. "Linguïculture" better captures these human faculties, more fundamental than ordinary notions of either or both of "language" and "culture". Linguïculture's fusion with or constitution of the human condition – involving sensing/perceiving/experiencing/cognizing – extends far beyond and beneath our everyday notion of spoken grammars.

Seldom do scholar-scientists pause to consider this human faculty of linguïculture, or a myriad of other influences on humans, that together conspire to guarantee plural perspectives and to contest facile translations between them.

Over the past several decades, one has frequently heard and read about inter-/multi-/meta-/trans-disciplinarity – with reference to biosemiotics as well as to many other literally and figuratively hyphenated endeavours. But biosemiotics is not really a discipline, nor is semiotics. Rather, semiotics as a foundation is a twisting technicolored ouroborean chameleon, having itself endured many labels. I am most comfortable with a general descriptor for semiotics: an approach for the understanding of meaning-making. If "biology" then links with or modifies "semiotics", the former may narrow the latter, or the former may deepen the latter, or/and any number of other relations more compelling than coordination and conjunction may obtain.

The coordinating link obscured in "biosemiotics" – from the knitting of "biology *and* semiotics" – raises more questions than can be fielded by foregrounding that single conjunction. And should there arise some mandate for mutual exclusion of biology and semiotics, as in "biology *or* semiotics", that would take us back to square one, when few scholar-scientists anticipated biosemiotics.

Still, biology and semiotics are far from being coordinate, especially since biology, unlike semiotics, has always laid claim to the mantle of being a discipline. More provocative conjugations might be "biology *yet* semiotics!" or "semiotics *but* biology!" or "biology *even* semiotics" or "semiotics *so* biology!", just to explore "conjunctivitis".

*Prepositions*

Grammatically, conjunctions contrast with nouns, adjectives, verbs, and adverbs, as the latter set is endowed with content or substance, called meaning. The nouns, "biology" and "semiotics", do mean whatever users assume they mean, even when congruence and context are lacking. Furthermore, the number of words in these meaningful parts of speech is potentially infinite. Mere humans come up with content words all the time, "biosemiotics" being a case in point.

Conjunctions cannot be said to be endowed with meaning at all. Together with adpositions (prepositions and postpositions) and pronouns, conjunctions are classed as function or syntax words that, by relating content words to each other, serve as mortar holding the bricks of meaning in coherent place. The inventory of syntax words (or their grammatical equivalents) in any language

is limited, and their operational habits bind them into functional sets that are seldom perturbed through time, either by endogenous processes or exogenous language contacts. And no one goes about inventing any more of them either.

Imagine how many ways biology and semiotics, in either sequence, might productively be related through some handy English prepositions. Just considering of/in/by/for/from/with, we could explore "biology *of* semiotics", "semiotics *in* biology", "biology *by* semiotics", "semiotics *for* biology", "biology *from* semiotics", "semiotics *with* biology". These prepositions probe possible relations through multiple angles of space and time, while the conjunction hiding behind the missing hyphen in "biosemiotics" can not.

The irreverent logic justifying these preposition-linked strings can set other processes into gear – abductions fuelling questions and confrontations and more abductions.

In other words, to zero in on biosemiotics, one can't just add "bio" to "semiotics" and stir. Indeed, "biosemiotics" may be a convenient empty signifier -- better yet, a zone allowing a forum for those teasing the paradigms inherited within their home disciplines. As such, any gathering of explorers in biosemiotics takes on the flavour of fuzzy set or tribal group or foraging band. Biosemioticians find themselves related through time and space, through similarity and contagion, through genealogical kin and lateral friend, captured and captivated in an emerging fabric that stretches and folds, elastic and plastic, while overall remaining amorphous, egalitarian, and thriving despite, or because of, fission and fusion. These very processes mimic those in our focal subject matters, such as evolution and development, genes with somatic as well as extrasomatic environments, and organisms refocused as swarms.

*Logics*

To review: the conjunction tames relationships; the preposition troubles them. The conjunction proposes; the preposition preposes, suggests, tickles. The flat, linear conjunction comports with deductions and inductions; these arguments are dedicated to proposing, not preposing. Conjunction operates in logical propositional space and, occasionally, in time, promising through suspense some resolution, closure, "endarkenment". The irregular, alinear preposition wiggles, assaults, assails, nimble as a trickster or a knight in chess, promising nothing but for waves of surprise and contingent serial enlightenments, not any comfort of closure.

Propositional logic could be plural, but only with effort; basically it is beautifully crystalline. Propositional logic represents, and especially re-presents rationality as we've come to call tame overdetermined logic. As

"proposed" here, wild prepositional logics obligate open abductive musements that problematize jagged nonlinear linkages, valencies, alignments, scales, synchronicities, all suspended from underdeterminacy. Yet these kinks may still spring back to feed any argument, including a monolithic linear logic.

Propositional arguments flatter themselves when water-tight; prepositional inducements leak. Sometimes we get wet.

Prepositional logics entail risk. Individually and collectively, our human disposition for curiosity guarantees that we succumb to episodic bouts of rhizomic discovery. Even so, there can be no instruction manual for these preposterous prepositional logics. So, we persevere, also in biosemiotics, tinkering with objects along with ideas, toying with digital units of analysis and analogue ranges of flow, trusting that we may avoid throwing out the paradigmatic trash cans along with the garbage.

Prepositional logics do not expect answers, but rather invite responses. I will nevertheless close, provisionally, with conventional "how" questions that touch, however peripherally, with the expansive and expanding biosemiotic project.

- How can we descendants of fish expect to detect the water;
- How can we organisms relying on our finite senses investigate livingness and life, let alone comprehend ourselves inquiring about our organic selves;
- How can we humans diversely saturated linguïculturally contemplate any phenomenon except through that variable and varying lens, language-cum-culture, and our other senses, that distinguish our individual selves, our collective experiences, and our species?

In contrast with the demands of any strident, distal "why", the more modest "how" invites plural and proximate responses from ongoing biosemiotic inquiries.

## Background note

I composed the above paean to biosemiotics from the hip and heart, without leaning on any particular literature that has informed biosemiotics or that has emerged from biosemiotics.

When I started the essay, I expected to be drawing on such literatures, perhaps my own slender contributions to it, and definitely my experience in participating in conferences from a wide range of disciplines over the past 35

years. Some such conferences were inaugural ones of nascent thought groups that might persist or fizzle out. After reflection about all these numerous congregations of scholar-scientists, I notice a pattern. Each inaugural conference seemed to offer the most irresistible mix of people, ideas, and venue: I would become hooked, but following conferences typically never matched the first, and I would drop out.

The exception: these international and interdisciplinary Gatherings in Biosemiotics. One reason for their synergy must be the tensions between the vague and the general that are tolerated if not accommodated in biosemiotics.

Though this essay is subliminally saturated with a literature that is richer for its incommensurabilities, I will only list these few uncited bibliographical items.

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# II. HISTORY OF THE GATHERINGS

# A short history of Gatherings in Biosemiotics

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One gloomy day in 2000 Claus Emmeche called me to tell that Kalevi Kull would stop over in Copenhagen later that day on his way back to Tartu. We immediately arranged to meet with him in my office at the Molecular Biology Institute. Neither I, nor Claus I suppose, had any idea of what was on Kalevi's mind, but knowing Kalevi as I do now I should of course have anticipated that this visit would lead to lots of unpredicted work. After the usual talk of this and that Kalevi – *en passant* – suggested that perhaps the time had come to organize some meetings that would focus on biosemiotics from the biology angle rather than from the semiotics angle. And this suggestion then became the birth of Gatherings in Biosemiotics[1].

Throughout the 1990s all three of us had travelled around the world and presented the idea of biosemiotics in a range of different fora. Thus, as far back as in 1989 Claus had presented the two joint papers on the "semiotics of nature" that we wrote together (Emmeche, Hoffmeyer 1991; Hoffmeyer, Emmeche 1991) at a conference in Oslo. One of the participants in this conference took these papers back to New York and showed them to Stanley Salthe who already had an open mind to biosemiotics. Stan further contacted Myrdene Anderson and thus we soon found important support from professional semioticians, not the least of whom, of course, were Tom Sebeok and John Deely. In the next 10 years biosemiotics was put on the agenda at a number of semiotic conferences (Berkeley 1994, Trondheim 1994, Imatra 1996, Guadalajara 1996, Toronto 1997, Sao Paulo 1998, Imatra 1998, Dresden 1999) – most of these meetings were organized by the IASS (the international association for semiotic studies).

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[1] I remember that Myrdene Anderson at the first Gatherings in Biosemiotics pointed out that in anthropology the term gatherings was used to denote remnants from the past. I have nothing against this connotation since I indeed hope that something will be left to the future from our gatherings.

Also other fora were open to the idea however. In 1995 I was invited to speak on biosemiotics at a conference in Vienna on evolutionary systems, assembling a number of scientists from different areas (ecology, biochemistry, evolutionary biology, mathematics, bioinformatics, complex systems research, philosophy of science, etc.) and opposing the prevailing genocentric paradigm inside evolutionary biology (Vijver *et al.* 1998). Many of the contributors to this meeting and a later meeting in Ghent (1999, see Chandler, Vijver 2000), have contributed to the development of biosemiotics, are active members of ISBS, and some of them have taken part in our 'Gatherings'. Biosemiotics was also presented at meetings in the ISHPSSB[2] (Leuven 1995 and Seattle 1997), and at the conference on the Baldwin effect organized by Bruce Weber and David Depew at Bennington College, Vermont 1998 (Weber, Depew 2003). A third important track in the 1990s was biosemiotics in the context of medical science. Thus biosemiotics was on the agenda at medical conferences in Jerusalem 1995, Karlskrona 1995, Heidelberg 1996, Lisbon 1996, and Glotterbad 1998. In addition to such major events, biosemiotics was of course also presented at a lot of minor seminars around the world.

Therefore, when Kalevi and Claus arrived in my office that day in 2000, biosemiotics was already well established in many areas. Yet, we always had to speak about biosemiotics in the context of some other major theme such as general semiotics, evolutionary biology, ecology, information biology, psycho-neuro-immunology, or psychosomatic medicine. Seen against this background Kalevi's idea was to establish a forum dedicated to biosemiotics as such, i.e. fully dedicated to the study of the semiotics of living systems. We of course warmly embraced this idea but also saw some serious problems. First and foremost among them, how should we get funding for such an event? As biologists/biochemists we were well aware that normal scientific channels would not easily commit themselves to fund a conference on biosemiotics, a concept members of normal scientific boards would hardly understand even if they should happen to know what was implied by the term semiotics. From the beginning therefore it was clear to us, that we would have to organize the conference in such a way that major funding would not be necessary.

From this requirement follows one of the principles that may have been most important for how the Gatherings in Biosemiotics have always transpired. Without major funding it has been impossible to invite any big shots to come and emit their brilliance upon us, implying that everybody would come on his own account and participate on equal footing. Perhaps this

[2] ISHPSSB stands for International Society for the History, Philosophy and Social Studies of Biology.

principle more than anything else has contributed to create the open-minded and egalitarian atmosphere that everybody tells us has always characterized the Gatherings in Biosemiotics. It's amazing how a simple reframing of normal conference procedures can generate wholly unexpected effects, but a contributing factor to the good climate may also have been the general open-mindedness of people that cannot feel at home inside the narrowness of prevailing reductionist thinking in biology. Be this as it may, the fact remains that these meetings have generally taken place in an extraordinarily friendly and egalitarian atmosphere.


*Figure.* Participants of the first Gatherings in Biosemiotics, 2001 (1 Vefa Karatay, 2 Andreas Roepstorff, 3 Elling Ulvestad, 4 Yagmur Denizhan, 5 Stefan Artman, 6 Tom Ziemke, 7 Claus Emmeche, 8 Jyoo-Hi Rhee, 9 Jan T. Kim, 10 Jacob Havkrog, 11 Alexei Sharov, 12 Wolfgang Hofkirchner, 13 Tommi Vehkavaara, 14 Dominique Lestel, 15 Jesper Hoffmeyer, 16 Søren Brier, 17 Abir U. Igamberdiev, 18 Kalevi Kull, 19 Andres Luure, 20 Anton Fürlinger, 21 Mette Böll, 22 Anton Markoš).
(Photo by Don Favareau.)

Up to the first 'Gathering' in Copenhagen May 2001 we, the organizers (Claus and myself), were of course tremendously excited about how this project would proceed: with no big names to attract attention and with everybody having to pay his or her own expenses, would anybody at all find it worthwhile to come to Copenhagen and discuss biosemiotics? In fact, we hadn't needed worrying. We received more than 30 abstracts from scholars representing 16 different nations (Austria, Brazil, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Italy, Norway, Russia, Sweden, Taiwan, Turkey, USA) and a wealth of different approaches of high quality[3].

My welcome speech at the first Gatherings in Biosemiotics in Copenhagen was short, and I quote here a passage that may give the flavour of our ideas: "The point is that ever since Darwin definitively made it clear that man is just another animal, although a very peculiar one, it has been unbearable that the humanities and the natural sciences could in no way establish a basic common understanding. One side reduced man to pure object, the other to pure subject." In the end of the speech I paid tribute to the great attendance and observed that I was well aware "that people assembled here are not necessarily in total agreement with the biosemiotic idea, but I take it that we are most of us willing to admit that these questions are worthwhile to pursue". By the term "the biosemiotic idea" I referred to biosemiotics as envisioned by Tom Sebeok and like minds[4]. The Copenhagen gathering was a great success and we were happy to announce that next year there would be a second Gatherings in Biosemiotics in Tartu, Estonia with Kalevi Kull as the organizer.

The 2002 conference in Tartu was also a great success with even more papers presented than in Copenhagen. But here we also encountered our first real confrontations. One of the papers presented attempted to use biosemiotics as a tool for legitimizing the alleged healing effect of homeopathy[5]. It was one of the unfortunate experiences we already had in the 1990s that the term

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3 All abstracts are available at http://www.nbi.dk/~emmeche/pr/gath.2001.div/gath.2001.abs.html

4 At the time it had not yet occurred to me that others might conceive of biosemiotics along very different lines of thought.

5 The fact that not a single atom of plant extract would be left in the highly diluted solutions used in this kind of therapy, and that the healing effect therefore would presuppose an absurd ability of water molecules to remember the pollen they were formerly exposed to, made no impression on the presenter. It always strikes me that adherents of this theory never seem to consider the possibility that if water molecules were indeed capable of remembering absent pollen, then why shouldn't they remember all other kinds of things? Imagine for instance that every time you drink a glass a water some of the water molecules will, statistically seen, at another time have passed through the intestinal system of Adolf Hitler. Who knows which bad vibrations this passage might have effectuated? If water molecules were indeed capable of remembering things life would be very unpredictable.

"biosemiotics" apparently attracts all kinds of New Age babble, and the lesson of having biosemiotics mixed up with homeopathy prompted us to advise a stricter selection procedure for future gatherings in order to prevent this kind of unscientific speculation from slipping through. But a more serious confrontation also appeared at this meeting for the first time. While most if not all participants in Copenhagen had taken for granted that biosemiotics approaches an understanding of life that had been instituted in the writings of people like Tom Sebeok, Thure von Uexküll, Myrdene Andersson, John Deely – not to speak of Kalevi, Claus and myself – Marcello Barbieri, who was here present for the first time, forcefully defended a conception of biosemiotics that is very much at square with Peircean-inspired conception of these writers. As is well-known to members of ISBS, Marcello Barbieri claims that code rather than sign action (semiosis) constitutes the fundamental grounding for biosemiotics. I think it is fair to say that by far most of the participants in Tartu heavily disagreed with Marcello on this issue as I certainly did – and still do – myself. But dogmatic definitions were never part of the conceptual matrix that lay behind the call for these meetings. On the contrary, dialogue and exchange of views were seen as the raw meat for scientific development, and by letting Marcello present his views also at the following Gatherings in Copenhagen (2003) and Prague (2004) this pluralistic nerve was clearly honoured.

It is not the aim of this brief account of the early events in our gatherings history to also follow the development up to the present time. I am too much involved personally in this development to be able to make a decent historical sketch. But allow me to finish my little story with a short account of the organization behind the Gatherings and a warning in this context. Experience has taught us that the very anarchistic way of organizing our biosemiotic community that was instituted through the first meetings could not fully be maintained. Not only did we have to construct a strict system for the selection of abstracts to be presented at the Gatherings, but as more and more people were accommodated in our society the question of organizational rules became pertinent. After the meeting in Prague 2004 a group of people that had been active in our meetings from the very beginning decided that we had better organize ourselves as an international society, the ISBS (Favareau 2005), and in the following years this same group of founders (the so-called executive committee) took care of the few necessary decisions, mostly concerning questions of where upcoming conferences should be located and the election of an advisory board to take care of the selecting of abstracts. In 2007 we had to build a more bureaucratic constitution in order to handle the economic contributions from Springer, and our society became registered in

Singapore (where the vice-president happened to be located). However, this constitution has never been used in the daily practical affairs since everybody considered it a pure formality, and in fact everything went on without any organizational changes.

It has now become clear that this anarchistic way of running the society can no longer be maintained. We need a constitution that delineates a democratic procedure for how decisions should be made. While writing this I very much hope we can establish a functional set of constitutional clauses at our general meeting this summer in Tartu. The problem is that the "Singapore constitution" in its present form is bureaucratic and inconvenient for the purpose of managing a scientific society like ours.

The danger I see before me for future Gatherings in Biosemiotics is the belief that our group is split up into different 'schools'. For all I know this idea has very little reality: we all diverge in our views of the field along multiple dimensions, and the claim that we belong to this or that 'school' is in a sense quite offensive. None of us have a one-dimensional set of views that easily fall into one or another class. So my warning is this: Let not this talk of schools poison our usually open-minded discussions at the Gatherings.

The reason why anarchistic ways of organization are so attractive is that as soon as we set up rules those rules takes on a life of their own. I therefore think that in general a society's welfare is inversely proportional to the number of "rules" it has been forced to introduce. Let us keep the rules to a minimum.

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# A letter from March 15, 2001

THOMAS A. SEBEOK

Date: Thu, 15 Mar 2001 08:45:52 -0500 (EST)
From: thomas sebeok <sebeok@indiana.edu>
To: Jesper Hoffmeyer <hoffmeyer@mermaid.molbio.ku.dk>
Cc: kalevi@zbi.ee, Claus Emmeche <emmeche@nbi.dk>
Subject: Re: Gatherings in Biosemiotics

Dear Jesper, Kalevi, Claus:

I was immensely pleased and flattered to read your most cordial invitation, so I cannot tell you how much I would like to be with you at this occasion. Having said this, I think I had better stick to my decision, announced publicly last June in Imatra, to restrict my overseas travel to just one more Atlantic crossing, namely, to stand behind a commitment I made many months ago to teach an intensive course on the subject of nonverbal communication this coming April/May, climaxing with an international conference on „Semiotics and the Communication Sciences" at the recently established University of Lugano.

I mention the latter because I shall devote my own contribution to a Memorial Essay for my late friend Heini Hediger, who spent most of his life as a director of a string of Swiss zoos, notably that gem, the Zurich zoo, and devoted his scholarly career to the study of the behavior of animals in captivity (zoos, marinelands, circuses, and the like). He was variously, though discreetly, linked to J. v. Ue., as I make clear.

I framed my paper (which is even now being printed) with such background that I possess, based on protocols I have collected over many years, with professional animal trainers. My remarks, heavily illustrated with images collected by Hediger himself, will be appearing shortly in a little pamphlet. When they appear in this preliminary format, I will get some copies to you in the hope that you can display them at your Copenhagen Gathering. A more extended version, with a Swiss semiotic orientation, will eventually be published by the host University of Lugano in a book of proceedings. In the longer run, I may, further, publish in

some venue my voluminous, but hitherto unpublished animal training protocols.

Physically -- although I am now in my 81st year, but in good shape -- it would have been possible for me to attend your meetings, because, after Lugano and a very brief trip to Italy attendant on the publication of a book of mine in Rome and another about me in Milano, I was supposed to be at the annual Budapest meetings of the Hungarian Academy of Sciences, ending very shortly before mid-May. But I think I had better conserve my energies for my research and writing, and restrict further travel within North America, notably Canada, where I retain both scholarly and administrative reponsibilities.

You might consider a future „Gathering" in Toronto. If you would like me to mention this there to the powers that be, let me know: I shall next be there between March 22nd & 28th. Again, with utmost appreciation for your kindness and consideration, and wishing you a productive,

Cordially = Tom

On Thu, 15 Mar 2001, Jesper Hoffmeyer wrote:

> Dear Tom
>
> As you will probably know Kalevi, Claus, and I are orgnizing a
> meeting in Copenhagen which we have called Gatherings in
> biosemiotics (you can look up the details at
> http://www.zbi.ee/~uexkull/biosemiotics/index.html)
>
> The idea was to have a regular (annual) opportunity to meet and
> discuss ideas in the biology end of biosemiotics. From the
> beginning
> we decided this was a low budget, I would say no-budget,
> event, so
> that we would not depend on laborious and, in fact, unlikely
> fundings. And also, this would guarantee that people would
> come only out of a serious interest in these matters.
>
> Now, this □rst 'Gathering' seems to become quite an event.
> Several interesting approaches, which I didn't even know
> of beforehand, have been announced.
> We have presently received 27 abstracts from many
> different countries, even Canada and US.
>
> So I am increasingly sad that we haven't been able to
> invite you.
>

> However, in case you already are in Europe during this
> period (May 24 - 27) - as I remember you quite usually are -
> Claus and I will □nd the means for covering
> your travel and hotel expenses. We cannot offer business
> class, but then inside Europe flying times rarely
> exceed 2 hours.
>
> Is this a possibility?
>
> We would leave it to yourself to decide the extent of your
> contribution. We would be happy just to have you giving
> lustre to the event, but also of course it would be very
> nice to have a full lecture, or a shorter presentation
> (appr. 25 minutes) as you prefer.
>
> With warm regards
>
> Jesper
>

# Twelve years with the Gatherings in Biosemiotics

DON FAVAREAU
National University of Singapore, Singapore

"Dear Friends..."

History will record that these were the very first two words spoken at the very first talk of the very first Gatherings in Biosemiotics, on an overcast May morning in 2001, by the botanist and biosemiotician Kalevi Kull.

It is hard for me to convey how strange and somewhat shocking it was for me to hear such words spoken in the context of an academic setting back then – or how auspicious and absolutely fitting that they seem to me now, in retrospect.

Yet this was not to be the only novelty awaiting me during that first, and most unforgettable, meeting at the University of Copenhagen's Institute for Molecular Biology (in the very room, my hosts soon noted, that Wilhelm Johannsen first introduced the word "gene" into the discourse of science in 1909). Rather, with the successive talks of each new speaker, a new and profoundly revolutionary world of thought seemed to be coming into being right before my very eyes.

An American graduate student pursuing a joint degree in philosophy of mind and the neurobiology of language, I had been struggling for years to find an explanation of biological 'mindedness' that, in the words of Thomas Sebeok and his colleagues, "avoids crashing into the philosophical roadblock thrown up by forced choices between realism and idealism, as though this exclusive dichotomy were also exhaustive of the possibilities for interpreting experience".[1]

Happening upon Jesper Hoffmeyer's *sui generis* masterwork, *Signs of Meaning in the Universe*, in April 2001 was thus a life-changer for me – and as I have learned since, it has been for so many others. And as I have recounted elsewhere (Favareau 2007), my reading of this incredible volume progressed

[1] Anderson *et al.* 1984.

no further than page 40, where Jesper compares the problem of "self-reference in a system" to that of the perpetual creation of "a map which is so detailed that the cartographer and the map that he is making are swept up into it", when I immediately put the book down and logged on to the Internet to find out how I might contact this subtle and profound thinker.

For Jesper's elegant little analogy so perfectly captured the paradox that contemporary neuroscientific theory both entailed and yet, it seemed to me, seemed to be simultaneously denying and/or attempting to run away from – i.e., the understanding that it is in the very nature of a "sign" relation to always and ineliminably possess both an internal *and* an external, as well as a mediating – or *interpretant* – mode of being. And that were any one of these three aspects of being missing – which is to say, not fulfilled biologically, culturally or consequentially – nothing resembling *information, representation, signification* or *meaning* could possibly exist in our world of physical-chemical being.

And in one of the happier coincidences of my lifetime, the first hit that came back for my web search of "Jesper Hoffmeyer" was the webpage for the upcoming First International Gatherings in Biosemiotics, to be held at the University of Copenhagen, Denmark just three weeks hence. Clicking the e-mail link at the bottom of the page, I explained that while I realized that the deadline for paper submissions had passed some months ago, I was only now finding out about this fascinating project of 'biosemiotics' and asked if there would be any way at all that the organizers might consider accepting the paper on mirror neurons and intersubjectivity that I had just written, such that I might attend this conference.

The e-mail reply that I received a few hours later, I realize now in retrospect, was classic Jesper Hoffmeyer: "The deadline for the abstracts has passed," he wrote to me, "but if you feel that you must come, I suppose that we can make a space for you."

Under-stated but eminently hospitable, this, I was to learn, was the Danish way. And now, twelve years later (to the day, in fact, as I am writing this on May 24), I can still recall most vividly the first time I laid eyes on the people who were, in fact, to become such "dear friends" and intellectual colleagues to me in the ensuing decade.

Cell biologist Anton Markoš was next to speak after Kalevi Kull, as I recall, and he was followed by the sociologist Thierry Bardini, systems theorists Yagmur Denizhan and Vefa Karatay, semiotician and literary analyst Han-liang Chang, and animal ethologist Dominique Lestel... and this was just the opening session! For over the course of the next three days, the assembled

group of about 40 scholars – all of whom stayed for every session, and who debated amongst themselves rigorously, animatedly and respectfully – were treated to talks by biologists Søren Brier, Luis Bruni, Claus Emmeche, Anton Fürlinger, Jesper Hoffmeyer, Alexei Sharov and Abir Igamberdiev; physicist Peder Voetmann Christensen, philosophers Stefan Artmann, Andres Luure and Tommi Vehkavaara; anthropologists Myrdene Anderson, Peter Harries-Jones and Andreas Roepstorff; linguist Tuomo Jämsä; psychologist Wolfgang Hofkirchner; roboticist Tom Ziemke; and semioticans Frederik Stjernfelt and Edwina Taborsky. The conference was memorably concluded with an only somewhat tongue-in-cheek talk by molecular biologist Elling Ulvestad on "the implications of the just now developing field of biosemiotics for the study of the yet to be developed field of astrobiology"!

As has been often reported, approximately forty researchers and scholars from eighteen different countries were present at that initial Gatherings, with backgrounds ranging from physics and molecular biology to robotics, animal ethology, psychology, sociology and philosophy of language and of mind.

What has been less widely reported upon – though what is immeasurably more important – was that few of those researchers had actually met one another before, and yet the entire conference was carried out in a spirit of overwhelming good-will and respectful mutual puzzlement and enlightenment. There was no end of theoretical disagreements and alternative approaches advanced as to how to understand biological "sign" processes – but there was no hostile antagonism, dogmatic intransigence, nor vain and self-serving displays of intellectual one-upmanship that, as an American academic, I had always known to be the "default" style of such conferences.

Rather, inspired directly by the "under-stated but eminently hospitable" ethos of our Danish (and Estonian) hosts – Claus, Jesper and Kalevi – the *First International Gatherings in Biosemiotics* set the standard for all subsequent Gatherings to strive to live up to. Indeed, without actively "planning" it as such, the elements that made that first Gatherings so memorable, productive, and enjoyable – no parallel sessions, the equality of speakership, the camaraderie of open discussion over beer-fuelled meals in beautiful surroundings, and most of all, the recognition that there are others who share the same discomfort with the mainstream view of things, yet who are still willing to not shut the discussion down prematurely by resorting to "replacement dogma", but instead to together explore new paths, to learn from one another's perspective, and to slowly but surely improve upon the way that "sign" relations are understood (or misunderstood) in both biology and culture.

"Dear friends" indeed, to find ourselves embarked together upon such a journey!

Accordingly, as subsequent Gatherings in Biosemiotics have taken place, the list of colleagues and Gatherings regulars has grown and grown. *The Second International Gatherings in Biosemiotics*, held at the university that Thomas A. Sebeok dubbed "a singular Mecca-like field for us pilgrims labouring in the domain of semiotics"[2] – this year's very own Tartu University, now home to both the Thomas A. Sebeok Library and the world's first PhD granting program in Biosemiotics – saw the introduction of molecular biologist and embryologist Marcello Barbieri, who would go on to do such ground-breaking work in setting up both the journal *Biosemiotics* and the Springer Book Series in Biosemiotics; zoologist Aleksei Turovski and animal ethologists Timo Maran, Stephen Pain, Morten Tønnessen and Mette Böll; biologist and semiotician Sergey Chebanov; musicologist Mark Reybrouck; information scientists Christoper Menant and Toshiyuki Nakajima; philosopher of science, John Collier; and head of the then just opened Jakob von Uexküll Archives at the University of Hamburg, Torsten Rüting.

Convened with opening remarks by semiotician Mihhail Lotman, son of the renowned Juri Lotman, and concluding with a private guided tour of the Tallinn Zoo by zoologist and Estonian television celebrity Aleksei Turovski himself, the Second International Gatherings in Biosemiotics – under the meticulous direction of now Full Professor of Biosemiotics, Kalevi Kull – inaugurated yet another annual tradition to the Gatherings: that of the local and biosemiotically relevant "excursion" – three, in this case, for in addition to the guided tour of the Tallinn Zoo, attendees to this Gatherings also visited the historic home and workplace of Estonian biologist Karl Ernst von Baer (1792–1876), as well as the summer house, in Puhtu, of legendary proto-biosemiotician Jakob von Uexküll (1864–1944).

2003 saw a return to the University of Copenhagen for *The Third International Gatherings in Biosemiotics*, and here we were joined, for the first time, by animal musicologist Dario Martinelli; cell biologist Mia Krause; psychologist Alfred Lang; molecular biologist Mogens Kilstrup; philosophers Stacey Ake, Adam Skibinski, and Mads Vestergaard; semiotician Juipi Chien; Peirce scholar João Queiroz; biologist Christian Baron; and an entire contingent from the interdisciplinary Department of Philosophy and History of Sciences at Charles University in Prague, led by cell biologists Anton Markoš and Fatima Cvrčková, and including Filip Grygar, László Hajnal, and Karel Kleisner. Our excursions included a guided tour of the enzyme processing sectors of the Danish biotechnology company Novozymes, as well as what was billed

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[2] Sebeok 1998.

on the programme as "an excursion to a famous 'ecosemiotic experiment' in the middle of Copenhagen": the world-famous ex-military base turned autonomously governed commune, the "free-town" known as Christiania.

*The Fourth International Gatherings in Biosemiotics* took place in the oldest and most beautiful university in the Czech Republic, Prague's Charles University, which was founded in 1938 and has been in continuous operation since. Hosted by cell biologists and philosophers of science Anton Markoš and Fatima Cvrčková, and featuring a convocation speech by faculty mentor Zdeněk Neubauer, the annual International Gatherings in Biosemiotics had by this time already developed a steady core of 'regular' attendees, made up of the majority of scholars listed in the first three Gatherings above. To this already quite impressive and increasingly tight-knight group, the 2004 Gatherings added cognitive scientist Yair Neuman; semiotican Kaie Kotov and biologist Charbel El-Hani; landscape ecologist Almo Farina; and applied philosopher of biology Günther Witzany. Also making their initial appearance as speakers at this Gathering were the philosophers Olaf Breidbach, Ulrich Krohs, Jiří Neustupa and Andreas Weber; molecular biologist Mehmet Ozansoy, and biochemist and philosopher Lenny Moss. This was also the Gatherings at which the establishment of the International Society for Biosemiotic Studies (ISBS) was first proposed in a nearby pub.

By the following year, the ISBS was up and running, biosemiotics had established an official presence on the Web, and *The Fifth International Gatherings in Biosemiotics* was hosted by Marcello Barbieri and Almo Farina at the University of Urbino in the beautiful Marche region of central Italy. Notable first-timers to the Gatherings community at this conference included the roboticists and philosophers Noel and Amanda Sharkey; geneticist Hernán A. Burbano; information scientist Gérard Battail; molecular biologist Marcella Faria; embryologist Johannes Huber; psychologist Ingolf Schmid-Tannwald; biochemist Eugenio Andrade; ecosemioticians Maricela Yip and Pierre Madl; neuroscientist Alessandro Villa; and philosophers Assen Dimitrov, Arantza Etxeberria and Marila Lázaro. This Gatherings also marked the year in which Marcello Barbieri edited and published the first *Journal of Biosemiotics* with Nova Publishers, comprising largely of papers first presented at the Gatherings in Biosemiotics.

2006 saw *The Sixth International Gatherings in Biosemiotics* take place in the idyllic Austrian town of Salzburg, under the direction of *Telos Philosophische Praxis* founder Günther Witzany. Held at the University of Salzburg's Center for Advanced Studies and Research in Information and Communication Technologies and Society, and covered extensively by the Austrian press

and radio, the Sixth International Gatherings featured talks by geneticist Randy Jirtle; cell biologists Nickolaus Bregsen, Albert Duschl, Peter Eckl, and Mario Gimona; physicist Robert Logan; communications scientist Erich Hamberger; botanists František Baluška, Peter Barlow and Jacqueline Lück; systems engineers Argyris Arnellos, Martien Brands, Thomas Spyrou and John Darzentas: and philosophers Hellmut Löckenhoff, John Pickering, and Konrad Talmont-Kaminski. Memorably, this was also the conference attended by Catherine Cotton of Springer Science Publishers, at the invite of Marcello Barbieri, and from which both the Springer journal *Biosemiotics* and the Springer Book Series in Biosemiotics were birthed. An unforgettable excursion to the breathtakingly beautiful Salzburg Alps concluded the conference, and its proceedings were published the following year in a volume entitled *Biosemiotics in Transdisciplinary Contexts*, edited by Günther Witzany and published by Umweb Press.

By the beginning of 2007, *Introduction to Biosemiotics: The New Biological Synthesis*, edited by Marcello Barbieri and featuring a collection of writings from many of the scholars most regularly presenting at the Gatherings, had already come out in hardcover, and the influence of this interdisciplinary project was beginning to be felt across more and more scholarly domains. Not surprisingly, then, *The Seventh International Gatherings in Biosemiotics*, held at the University of Groningen in the Netherlands, and hosted by Professor of Culture and Cognition, Dr. Barend von Heusden, saw the arrival of yet more 'newcomers' who today seem like having been with the project and the community of biosemioticians from the start. These include complexity theorist Victoria Alexander; semiotician and philosopher of science Eliseo Fernández; linguist and cognitive scientist Stephen Cowley; and interaction analyst Charles Goodwin. Attending also, but not presenting, were long-time Gatherings attendees, the radiologist Robert Cantor and SETI social scientist Douglas Vakoch, as well as soon-to-be regular presenter, neuroscientist Franco Giorgi.

*The Eighth International Gatherings in Biosemiotics* was held at the University of the Aegean, on the gorgeous island of Syros, Greece. Hosted by systems engineers Argyris Arnellos and John Darzentas, this iteration of the Gatherings featured afternoon breaks where biosemioticians of all nationalities could be seen floating in the waters of the sun-dappled Aegean Sea, and at night-time discussing the finer points of sign biology at an outdoor seaside bar or restaurant, underneath a vast canopy of stars. Eight years into the project now, the presenter's list was full of regulars. But still scholars whose work would turn out to be vital to the development of biosemiotics were

attending for the first time. Notably at the Eighth International Gatherings, we had the pleasure of hearing talks for the first time by cultural theorist Wendy Wheeler; psycholinguist and dynamic systems theorist Joanna Rączaszek-Leonardi; biophysicist Koichiro Matsuno; neuroscientist Franco Giorgi; cell biologists Michal Schmoranz and Jana Švorcová; roboticist Ryad Benosman; and semioticians Alexander V. Kravchenko, Jonathan Hope and Pierre-Louis Patoine. The conference concluded with a special video presentation recorded for the Gatherings by neuroscientist and bioanthropologist Terrence Deacon – followed by yet another unforgettable outdoor meal provided by our hosts.

Charles University in Prague was once again the site of *The Ninth International Gatherings in Biosemiotics*, once again hosted under the auspices of the Department of Philosophy and History of Science by cell biologists and philosophers of science Anton Markoš and Fatima Cvrčková. Linguists Natalia Abieva and Prisca Augustyn; psychoanalyst Anna Aragno; semioticians Paul Cobley and Sara Cannizzaro; primatologist David Leavens; botanists Helena Lipavská and Ted Baenziger; philosophers Isabel Ferreira, Martin Neumann, and João Carlos Major; cell biologist Robert Prinz; anthropologist Marco Stella; and computer scientists Elisabeth zu Erbach-Schönberg, Dennis Görlich and Peter Dittrich all made their initial appearances at a biosemiotics Gatherings at this conference, which also featured a group-wide discussion on the definition of the term 'meaning' within biosemiotics. Yulia Volokitina closed the conference by detailing her fascinating project of establishing a Russian-language site on the Internet for biosemiotics, and commemorative engraved pilsner glasses were given to each attendee as a memento by our gracious hosts!

Held in 2010, *The Tenth International Gatherings in Biosemiotics* took place in Braga, Portugal under the auspices of the Faculty of Philosophy of the Portuguese Catholic University in Braga. Hosted by philosophers João Carlos Major and Alfredo de Oliveira Dinis, the first day of the conference saw the publication of both *Signifying Bodies: Biosemiosis, Interaction and Health*, edited by Stephen J. Cowley, João Carlos Major, Sune V. Steffensen and Alfredo de Oliveira Dinis and published by Catholic University of Portugal Press, as well as the fourth volume in the Springer Book Series in Biosemiotics, *Essential Readings in Biosemiotics: Anthology and Commentary* (Favareau, ed.), which brings together work from the earliest proto-biosemiotic analyses of Charles Peirce and Jakob von Uexküll with seminal contemporary biosemiotics texts by contributors to the annual Gatherings – and every attendee to this conference was given a complimentary copy of the former volume upon entering the conference hall.

Once again, the roster for this Gatherings featured dozens of familiar names – yet once again, the ranks of practicing biosemioticians swelled not just in quantity, but far more importantly, in quality, with the addition to the biosemiotics community of such first-time Gatherings speakers as philosophers Susan Stuart and Gerald Ostdiek; semioticians Charls Pearson, Vinicius Romanini, and Shuo-yu Charlotte Wu; animal ethologists Tomáš Kočnar and Filip Jaroš; psychologists Clara Costa Oliveira and Maria Rita Leal; roboticist Siohoi Ieng; linguist Angelo N. Recchia-Luciani; communication scientist Patrick Vyncke; biocybernetician Maciej B. Pokora; and systems biologist Dennis P. Waters.

And last year, in 2011, our beloved annual conference was held for the first time outside of Europe. Hosted by complex systems theorist Victoria Alexander and the Dactyl Foundation for the Arts and Humanities, *The Eleventh International Gatherings in Biosemiotics* was held at Rockefeller University for Biomedical Research in New York City, USA – and once again, the high level of discussion and engagement was heightened even further with the addition of such first-time Gatherings participants as semioticians Susan Petrilli and Augusto Ponzio; science writer Dorion Sagan; biochemist and systems theorist Jan-Hendrik S. Hofmeyr; primatologists Daniel C. Mayer and Leonard A. Rosenblum; cognitive scientists Liz Swan and Louis J. Goldberg; Artificial Intelligence developer Joachim De Beule; philosophers Jonathan Beever, Luciana Garbayo, Jeffrey Goldstein and David Rothenberg; sociologist Eugene Halton; medical scholar Thomas Lawrence Long; educationist Gary Shank; biomedical imaging expert Dolores A. Steinman; architect Tim Ireland; immunologist and philosopher Hidetaka Yakura, and animal ecologists Tina Roeske and Ofer Tchernichovski. The conference ended with the showing of rare film footage of an interview with neurologist, psychologist and protobiosemiotican Friedrich S. Rothschild (1899–1995), with commentary provided by psychologist and historian Astrid Thome. Legendary biologist and an inspiration to many biosemioticians, Lynn Margulis (1938–2011) was also in attendance at this iteration of the Gatherings, which took place just five months before her untimely death.

Today, of course, you hold in your hand the programme for *The Twelfth International Gatherings in Biosemiotics*, held once again in that Mecca of biosemiotic development, the University of Tartu. This Gatherings, too, promises to be as fecund and enjoyable as each of the eleven prior iterations – yet for me, personally, marks the end of (at least one phase of) an amazing journey. For with this, my twelfth consecutive Gatherings in Biosemiotics, I officially step down from the position I have held as Vice-President of the ISBS since its

inception in 2004. Twelve years brings a lot of changes, and in my compiling of this short history of the Gatherings, one may notice that I focused not so much upon specific ideas, nor upon the conventional 'markers of success' that the community of biosemioticians has attained – though there is surely no lack of either – but instead upon the steady accretion of new community members that have joined the original group of "dear friends" over the course of the last dozen years, and have now, hopefully, become dear friends to one another as well.

We read of how the ancient Greeks realized the deep connection between friendship and the advancement of wisdom, and yet today the world of inquiry that they initiated is full of "academic disciplines" where unceasing combat and self-advancement, zero-sum thinking, and a deep distrust of, and rivalry with, one's supposed 'colleagues' is the norm. The Gatherings in Biosemiotics – indeed, the very *project* of biosemiotics as initiated by Thomas A. Sebeok in the manifesto cited at the outset of these remembrances – was designed specifically to oppose that odious model of intellectual barbarism, and to replace it with a community of inquirers who, *united in that very inquiry,* would also function as a community of friends. Twelve years on, I do believe that the majority of people in the community of biosemiotics have tried exceedingly hard to stay true to this vision – and that it has been the upholding of the spirit that was introduced at the outset of the original Gatherings in Biosemiotics, more than any other single factor, that has contributed most effectively to their success in doing so.

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# Programmes of the Gatherings in Biosemiotics 1–12

# The 1st Gatherings in Biosemiotics Copenhagen, Denmark May 24–27, 2001

CLAUS EMMECHE

One sign of the continuity between the zoosemiotics of Tom Sebeok and the biosemiotics of the Tartu–Copenhagen axis is a preoccupation with the history of their respective fields, and their narrators' own roles as actors here. Maybe I'm unfair to Tom, whose total work I admire and have learned so much from, but let me confess one thing. What bemused me, having been lucky to hear Tom's voice and stories in places like Toronto, Tartu, Copenhagen, and Imatra, some of the pre-gathering stages for informal or formal biosemiotic sessions, was his style of presentation, in which he was able to develop almost his whole thesis, point, or take-home-hypothesis in a contribution to a symposium by fleshing it out upon a skeleton consisting of anecdotes about his own ways and merry strollings through his semiotic web of names in semiotics, linguistics, ethology, biology and many more fields. It is clear to me that in offering a few comments upon the first programmes for the Gatherings in Biosemiotics, I cannot follow the honourable path of Sebeok in commenting upon this the way he would do, as I am not as old-and-experienced as he was when he displayed this eminently erudite style, and I haven't arrived yet at the stage where I begin to remember what I did yesterday, a year ago, or ten years ago, with the same precision, and I haven't yet learned how to tell a story about a past I don't exactly remember in detail as if it happened yesterday.

One important feature of these first meetings wholly dedicated to biosemiotics that I think established a minor tradition (see also Jesper's nice story piece and Don's short history) was that all of us would follow all presentations, that is, even though we could have squeezed the meeting into a two day event by making some sessions parallel, that wouldn't have worked, since one of the nice things that emerged from the Gatherings meetings was a feeling of comprehension. That is, even though people came with a wide variety of disciplinary backgrounds and special expertises, the open and informal atmosphere that was enacted clearly meant that a feeling of coherence appeared, suggesting that we were all on the same track towards something bigger, maybe closer to a fulfilment of a theoretical biology that would be, at the same time, a handy tool for understanding the complexity of living nature.

As an organizer it was nice to see that all the announced people in fact came and presented their stuff (except Tiberiu Mustata from the US who had to cancel[1]), and looking back, it's also nice to see how many of those who presented papers at the 1st meeting continued to be a part of the newly emerged community (or perhaps "cross-disciplinary research network" is a better term) of biosemiotics. The 2001 meeting took place in the old botanical auditorium in Gothersgade street, with its old-fashioned drawings of herb anatomy on the back wall and a nice view to the Botanical Garden, and a bust of the geneticist Wilhelm Johannsen who coined the phenotype/genotype distinction 90 years before biosemioticians gathered here to discuss the interplay between analog and digital codes. As you can see from the programme, we simply (and nerdishly) stopped with an "End and farewell" at mid-Sunday, without any collective touring, which first became instituted next year in Estonia. However, we started the meeting with a 'social' part in the "Søjlehallen" (the pillar room) in the Sølvtorv-building (formerly a part of a poly-technical higher education institution founded by Hans Christian Ørsted) of the Institute of Biological Chemistry, where Jesper's biochemist colleagues had their daily doings. Here, the participants met upon arrival on Thursday evening to have some catered food, exchange symbolic signs, and drink 10 bottles of white wine, 15 of red wine, and a box of beer (as a collective, not each). I can see from my notes that we also bought 10 bottles of water. It was all very self-organized, relaxed and quite fun. We had no clear imagination of ending up as an international scientific/scholarly society or an abstract-indexed journal; all that only came later.[2]

## References

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1 Also Marcello Barbieri, Sabine Brauckmann, Sergey Chebanov, Frederik Stjernfelt, and Andreas Weber, who sent their abstracts but cancelled or could not come for various reasons.

2 See also the review of the 1st Gatherings, published soon after the event (Emmeche 2001). Proceedings of the Gatherings have been published as a special volume of the journal *Sign Systems Studies* (Emmeche *et al.* 2002b), with an introductory note by the editors (Emmeche *et al.* 2002a).

## Programme

*May 24*
Evening: Social gatherings.

*May 25*
Session: The status of biosemiotics as a field of research
(chair: Claus Emmeche)

Jesper Hoffmeyer – Welcome note

Kalevi Kull – Biosemiotics means biology

Anton Markoš – An attempt of a hermeneutics of the living

Thierry Bardini – Does junk DNA break the genetic code metaphor?

Vefa Karatay, Yagmur Denizhan – Evolution of the "window"

Han-liang Chang – Naming animals in Chinese writing

Dominique Lestel – Human/animal commmunications, language and evolution

Session: Peirce and other approaches to biosemiotics (chair: Kalevi Kull)

Jorge de Barros Pires – The universality of sign in Charles S. Peirce Semiotics

Tommi Vehkavaara – How and why to naturalize semiotic concepts for biosemiotics?

Edwina Taborsky – Energy and evolutionary semiosis

Søren Brier – Intrasemiotics

Myrdene Anderson (moderator): General discussion

*May 26*

Session: Agents sensing sense, qualia and umwelten (chair: Claus Emmeche)

Alexei A. Sharov – Pragmatics and biosemiotics

Tom Ziemke – Robosemiotics

Luis Emilio Bruni – Does "quorum sensing" imply a new type of biological information?

Donald Favareau – Beyond self and other: The neurosemiotic emergence of intersubjectivity

Jyoo-Hi Rhee – Qualia: From the mind-body dichotomy to the biosemiocybernetic paradigm

Anton Fürlinger – Is movement the "highest" code?

Session: Historical and philosophical perspectives (chair: Jesper Hoffmeyer)

Stefan Artman – Three types of semiotic indeterminacy and their relevance to biosemiotics

Claus Emmeche – Biosemiosis, downward causation, and function in the organism

Wolfgang Hofkirchner – Biosemiosis in the context of self-organization

Tuomo Jämsä – Like a sheet of paper: The interplay between sign and meaning in nature

Abir U. Igamberdiev – Semiotic structure of living systems: imprints, codes and language games

Andres Luure – Understanding life: Trans-semiotic analogies

Nightime Group discussion on determinism and experimentation

Don Favareau – The fallacy fallacy

***May 27***

Session: Relations between physico-, bio- and anthroposemiosis (chair: Kalevi Kull)

Peder Voetmann Christiansen – Habit formation as symmetry breaking in the early universe

Jesper Hoffmeyer – Life, energy and semiosis

Peter Harries-Jones – Where bonds become binds: The necessity for Bateson's inter-subjective perspective in biosemiotics

Martin Skov – Some problems in neurosemiotics

Frederik Stjernfelt – Symbols and the evolutionary transition from animal to man

Andreas Roepstorff – Thinking with animals

Elling Ulvestad – Evolution, semiotics and extraterrestrial life

End and Farewell!

# The 2nd Gatherings in Biosemiotics Tartu–Puhtu–Tallinn, Estonia June 14–17, 2002

KALEVI KULL

Life, including the academic kind, is related to place. At the second international Gatherings, we thus tried to show the places in Estonia that are related to biosemiotics – through Karl Ernst von Baer, Jakob von Uexküll, local biodiversity and landscape, and zoosemiotic studies. The sessions were held in the White Hall of the University of Tartu History Museum (the former university library). A reception (a garden party) with Estonian food took place in the Baer House in Tartu, and another one at the organizer's home in Tammekuru Street. After the working days in Tartu, we made a bus trip via the west coast to Tallinn. We visited Uexküll's house in Puhtu, with a couple of talks taking place in the open air in front of the building. We walked in a wooded meadow (at Nedrema), in order to demonstrate a place of very high biodiversity. We had our final evening in the Tallinn Zoo with the guidance of Aleksei Turovski.

Aleksei Turovski, an Estonian zoosemiotician and also a great artist, who particularly likes to draw (and also carve from wood) fantastic mythological animals, made a logo for the meeting that was used in the abstract booklet, on nametags, and on the special T-shirt (together with Jakob von Uexküll's and Juri Lotman's portraits). The logo was a stylized ouroboros.[1]

In the introduction to the abstract book (edited by Kaie Kotov and Kalevi Kull) we wrote the following:

> ""The process of message exchanges, or semiosis, is an indispensable characteristic of all terrestrial life forms. It is this capacity for containing, replicating, and expressing messages, of extracting their signification, that, in fact, distinguishes them more from the nonliving – except for human agents, such as computers or robots, that can be programmed to simulate communication – than any other traits often cited. The study of the twin processes of communication and signification can be regarded as ultimately a branch of the life science, or as belonging in large part to nature, in some part to culture, which is, of course, also a part of nature. (Sebeok 1991: 22)

[1] Ouroboros has been used for several years as a major logo for the biosemiotics society, particularly as started by Alexei Sharov, who made the very first homepage for biosemiotics.

This meeting represents a step in our joint effort to understand living beings as sign systems. The Gathering in Tartu also means that the annual worldwide conferences on biosemiotics have turned into a reality. After a very successful first Gathering in Copenhagen – in May 24–27, 2001 – the current meeting is going to develop the ideas of semiotic biology.

In order to maintain the international network, the current abstracts volume includes both the abstracts of the papers presented at the meeting, and several contributions by the authors who attend it in an epistolary way.

The meeting has been organised by the Department of Semiotics of the University of Tartu, Jakob von Uexküll Centre, Tallinn Zoo, and the Biosemiotics Group of the University of Copenhagen."[2]

## References

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Sebeok, Thomas A. 1991. *A Sign is Just a Sign*. Bloomington: Indiana University Press.

## Programme

***June 14***

Opening, forewords: Myrdene Anderson, Mihhail Lotman, Claus Emmeche, Kalevi Kull

Jesper Hoffmeyer – *Scitoi mesoib* – or why the genome is so small

Marcello Barbieri – Organic codes: metaphors or realities?

Anton Markoš, Fatima Cvrčková – Who is the addressee of the genetic text

Stefan Artmann – Four principles of Jacobian biopragmatic

Stephen Pain – Introduction to biorhetorics: applied rhetoric in the life sciences

Frederik Stjernfelt – The core hypotheses of biosemiotics

Kalevi Kull – Biosemiosis: A search for other

Discussion: Organic codes and first principles of biosemiotics

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2 See also brief reviews of the meeting in Kull (2002a, 2002b).

***June 15***

Wolfgang Hofkirchner – The *differentia specifica* of biosemiosis in the perspective of a theory of evolutionary systems

Yagmur Denizhan, Candas Sert – In search of a reconciliation between semiotics, thermodynamics and metasystem transition theory

John Collier – Information expression requires cohesive levels

Claus Emmeche – Biosemiotics and experiential biology

Tom Ziemke – Affordance vs. functional tone: a comparison of Gibson's and Uexküll's theories

Donald Favareau – Collapsing the wave function of meaning: the contextualizing resources of talk-in-interaction

Toshiyuki Nakajima – Construction of umwelt to control probabilities of events in living

Tommi Vehkavaara – An outline of basic semiotic concepts for bio- and robosemiotics and the emergence of umwelt

Mark Reybrouck – A biosemiotic approach to music cognition: event perception between auditory listening and cognitive economy

Andres Luure – The role of relations in semiotics

Sergey Chebanov – Bilateral biosemiotics: a problem of sense on a super-triplet level

Elisabeth Johansson – Biosemiotic perspectives in gasflux models

Christophe Menant – From biosemiotics to semiotics

Discussion: Formalisation in biosemiotics

***June 16***

Edwina Taborsky – A pansemiotic architecture

Søren Brier – Biosemiotics and the Third Culture

Luis Bruni – The global phenotype

Alexander Sedov – Sustainability during development depends on the types of part-whole interactions: logical comparisons of biological systems of various structural levels

Myrdene Anderson – Neoteny and its role in taming and domestication

Mette Böll – The evolution of empathy in social systems

Domonique Lestel – On the expression of negation among animals

Gottfried Süssenbacher – Mythology and evolutionary psychology: on the relevance of prehistoric fire usage for the evolution of human culture, consciousness and language

Aleksei Turovski – The signs of bizarre characteristics in the semiometabolism of animal associations

Timo Maran – Mimicry and mimesis in the bio-semiosphere

Mark Vian – Biotic integrity, ecosemiotic archetypes, and the boundary of self: Some thoughts on the intentional coupling of human and non-human semiotics

Morten Tønnessen – Umwelt ethics

Tiberiu G. Mustata – The semiotic substance of homeopathy

General discussion: Experimental use of biosemiotics

***June 17, Puhtu***

Kalevi Kull – *Genius loci*

Sune Frolund – Teleology and the 'natural history of signification': the implications of Hans Jonas' bioontology for biosemiotics

Torsten Rüting – A project to establish the Jakob-von-Uexküll-Archiv at the University of Hamburg

Ester Võsu – How to stage nature

***Tallinn (Tallinn Zoo)***

Aleksei Turovski – The zoo as a field of reestablishing semiotic boundaries

# The 3rd Gatherings in Biosemiotics Copenhagen, Denmark July 11–14, 2003

CLAUS EMMECHE

In the call for papers to the 3rd Gatherings, we wrote that biosemiotics is "an interdisciplinary field of theoretical and empirical studies of communication and signification in living systems". Of course, it's rather unclear what an 'interdisciplinary field' really is, but all the participants – coming from fields such as behavioural biology, physics, philosophy, linguistics, semiotics, molecular biology, anthropology, neurobiology, cognitive science, systems theory, bioinformatics and cybernetics – seemed to feel quite at home with interdisciplinary work. I think that at the time, speculations had already begun as to what kind of 'field' biosemiotics really was. We had such different backgrounds that at times it seemed to be a miracle that we could communicate (and often we felt that we were speaking different dialects, which we certainly were). It was, and to some extent still is, an open question whether biosemiotics and the Gatherings could age and grow into a more coherent field, or whether it would persist in being a kind of marketplace of ideas or a 'trading zone' (although not quite as well-defined as a meeting point between less than a handful of scientific communities, cf. Peter Galison's notion of a trading zone in his *Image and Logic*, 1997).

As the organizers of the 3rd Gatherings, we (Jesper, Kalevi, Søren Brier and myself) were fully convinced that the very idea behind biosemiotics as a research field – i.e., to study life processes from the perspective of semiotics, and to see life and sign action as inextricably connected – was a fundamental innovation in science and the humanities. However, innovations in science may have implications for the existing body of knowledge and the established ways of knowledge production in a number of different ways, since there are several modes of progress in science. An interesting essay by the sociologist of science M. J. Mulkay (1975; unknown to us at the time) distinguishes three modes or models of scientific development. The *model of openness* is closest to the oft-cherished ideal of 'pure science' in which new ideas are met with an open yet critical mind and seriously considered in a process guided by norms of objectivity, impartiality, universality, novelty and critical scepticism, the norms known after R. K. Merton as the CUDOS norms.

Needless to say that we, the participating researchers gathering again in the Botanical Auditorium, had not experienced much openness from our colleagues in the biosciences. It was Kuhn who radically problematized this model as a true description of progress by pointing out the often dogmatic character of 'normal science' in which scientists are devoted to solving "a limited range of problems rigidly defined by their group", as Mulkay puts it. Here, in this *model of closure*, deeper innovations (more than just another articulation of the established paradigm) have to be brought forth by crisis and a new generation of researchers who will introduce both a completely new way of looking upon the subject matter, a new theory, new values for what count as good questions and procedures, new background assumptions, and new exemplars for showing how to use the theory in practice. If we had any ideas about the possible impact of biosemiotics if it was to survive, grow and flourish, at that time many of us conceived something like a Kuhnian revolution to be necessary.

Only seldom did we have vague glimpses of a third model in mind, which Mulkay calls *the model of branching*. This term may in fact cover more modes of discovery than Mulkay's own examples indicate, but in any case, scientific development in this model neither conforms to the open or closed models, nor to Kuhnian revolutions, but rather to a smoother branching off of some parts of the networks of science by "scientific migrants", as Mulkay calls them – and, looking back, we were indeed all migrants!

> Scientific migrants tend to come from research networks with definite characteristics: networks in which there has recently been a pronounced decline in the significance of results; networks whose members have few or no avenues of research easily available; networks whose members have special competence in knowledge or techniques which have given some indication of being more widely applicable; and networks which have been disrupted, often by events such as war originating outside the research community, and whose members consequently have no firm commitment to an established problem area. (Mulkay 1975: 520)

In retrospect, it is interesting to see that many of the characteristics that Mulkay ascribes to this mode of innovation indeed applied to the later history of biosemiotics, a kind of intellectual entrenchment process or the establishment of a settlement upon the continued Gatherings series, scaffolded by well-known but loosely institutional structures as a society and a journal.

But now I'm far ahead of the events of the 3rd Gatherings, with its extended series of papers, its diversity of topics and rich discussions, and sometimes – as cognition is embodied – corporeal fights about how to understand the adjective 'scientific' when we all wanted to demarcate biosemiotics (as decent research, revolutionary or not) from mysticism, alchemy, tarot card semiotics and what have you.

The social part that finalized the 2003 meeting might be seen as a further move to demarcate an identity for biosemiotics by doing a little boundary work in the field: The first field was Novozymes, a cutting edge biotech industry in Denmark that draws upon the semiotic capacities of molecular recognition to make energy-low 'smart' processing in various industries. From there we went to an 'ecosemiotic experiment', that is, to the freetown of Christiania, another self-governing society, or self-proclaimed autonomous neighbourhood close to the city of Copenhagen, founded by squatter hippies in 1971.

Although biosemiotics is hardly a hippie science, we all would like the field to thrive autonomously, with a high degree of independence from external interests, and as Myrdene Anderson recently aptly expressed (in an email exchange on organizational matters), catching some of the atmosphere surrounding biosemioticians at work and play so well that I'll make her words mine: "I am more comfortable in the *egalitarian apolitical tribal society* that the GATHERINGS stand for. With love and sympathies"...

## References

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Mulkay, Michael J. 1975. Three models of scientific development. *Sociological Review* 23(3): 509–526.

## Programme

***July 11***

Session: Sign action in biosystems (chair: Jesper Hoffmeyer)

Mogens Kilstrup – Substructures in the Peircean sign triad.

Mia Krause – Biological aging and death in a Peircean perspective

Jorge de Barros Pires; José Wagner Garcia – A new leucine zipper conduct in response of microgravity.

Session: Sign, meaning, and codes (chair: Luis Bruni)

Marcello Barbieri – The definitions of information and meaning: Two possible boundaries between physics and biology

László Hajnal – A new model for biology?

Anton Markoš; Fatima Cvrčková – What does *meaning* mean?

Session: Ethology and cognitive zoosemiotics (chair: Søren Brier)

Mette Böll – The evolution of empathy in social systems, part II

Dario Martinelli – 40 years of animal signs: Old and new questions posed by the zoosemiotic research

Kim Rasmussen – Are cognitive ethology and classical ethology mutually exclusive?

Session: Towards an understanding of the Innenwelten of life (chair: Mia Krause)

Filip Grygar – Hermeneutic approach to the phenomenon of the living

Toshiyuki Nakajima – Cognitive processes of constructing internal models of the environment

Claus Emmeche; Frederik Stjernfelt – Sign action and emergent intentionality in bacterial chemotaxis.

***July 12***

Session: Representational tools and theories (chair: Frederik Stjernfelt)

Georg Toepfer – Representing life: Graphical models for the fundamental processes of life

Christophe Menant – Evolution of meaningful information generation through the evolution of life.

Vefa Karatay; Yagmur Denizhan – Relation between evolution and development: A metasystemic approach

Session: Semiosis beyond biology (chair: Kalevi Kull)

Peder Voetmann Christiansen – Energy-bond-graphs: a semiotic formalization of modern physics.

Edwina Taborsky – Interpretive symmetry: The semiotic measurement and formation of reality

Alfred Lang – From Peircean interpretative to generative semiotic: Structure formation and interaction in life, psyche, and culture as conceived in semiotic ecology.

Session: Foundational perspectives (chair: Anton Markoš)

Søren Brier – Similarities and differences between second order cybernetics, autopoiesis, and biosemiotics

Kalevi Kull – Organic needs, and other problems in biosemiotics.

Andres Luure – Causality and functionality: metaphysics and semiotics.

Myrdene Anderson – Plumbing biosemiotics for chords of fundamentals

***July 13***

Session: Uexküllian and Peircean perspectives (1) (chair: Don Favareau)

Han-liang Chang – Notes towards a semiotics of parasitism.

Torsten Rüting – Uexkülls "Institut für Umweltforschung" – biosemiotics in action?

Juipi Angelina Chien – Diagramming as a convergence of C. S. Peirce, Jakob von Uexküll, and Ernst Gombrich

Session: Uexküllian and Peircean perspectives (2) (chair: Myrdene Anderson)

Stacey E. Ake – "Homo semeiosis" – a guess at the riddle of the evolution of human language

Mads Vestergaard – The impossibility of biological physicalism and the necessity of the biosemiotic turn

Stephen Pain – What is the meaning of pheromone to a moth?

Session: The biosemiotics of values (chair: Mette Böll)

Donald F. Favareau – Biosemiotic constructivism and the ethics of irreversibility

Tommi Vehkavaara – Biosemiotics as objective ethics and esthetics?

Christian Baron – Scientific values and biosemiotics

Session: The emergence of symbols and culture (chair: Edwina Taborsky)

Peter Harries-Jones – No representamen without misrepresentamen: Bateson, boundaries and biosemiotics.

Adam Skibinski – Time-binding or cumulative cultural evolution or second-order code-duality or self-coding or can we have one biosemiotic explanation how we became humans?

João Queiroz, Ivan de Araújo, Sidarta Ribeiro – The emergence of referential symbolic process in non-human primates communication: a zoosemiotic analysis based on the Peircean extended theory of sign

***July 14***

Session: Biosemiotics meets Novozymes (chair: Claus Emmeche)

Lene Lange – Novozymes' technologies: unlocking the magic of nature

Thomas Schou Larsen – Coping with complexity: a bioinformatics perspective

Mikako Sasa – From natural diversity to enzyme diversity

Tour of robot facilities (Steffen Ernst)

Jesper Hoffmeyer – The ecosemiotic turn in technology

Luis Bruni – Virulence and health in multitrophic systems. A case for biosemiotic technology

# The 4th Gatherings in Biosemiotics Prague, Czech Republic July 1–5, 2004

ANTON MARKOŠ

I was formally responsible for the organization of two Gatherings that took place in Prague, in 2004 and 2009. As far as I can remember, people were satisfied with the scientific content as well as the overall organization – so I will restrict myself but to some personal remarks that may illustrate the development of the Gatherings during those years. From my perspective, there was a radical difference between the two events.

*"The Fellowship of the Ring"*

The decision for Prague was made in Tartu in 2002, in order to break the rule of regular yearly exchanges between Copenhagen and Tartu. In principle, we copied the pattern I saw at the three previous events: with one plenary lecture in the morning, followed by short communications. The applications and abstracts came to my hands, and the local organizing committee (my colleagues and I) were responsible for putting together the programme and accessory events. As far as I remember, there were no complaints and no serious drawbacks. Personally, as a biologist, I was a little bit disappointed by the fact that a great fraction of participants were plain semioticians, without any interest in problems of biology; there were also too many contributions that could be given the common title "What is biosemiotics?". But all this is part of any discipline that is *in statu nascendi.*

And the naissance was close – of our Society. A very important event took place in Prague. A group of people working in the field (Jesper Hoffmeyer, Marcello Barbieri, Claus Emmeche, Kalevi Kull, Don Favareau, Søren Brier, and myself) met unofficially – in a beer pub, of course. We agreed on the usage of the term "biosemiotics" as a unifying name for describing our doings (dropping, for example, "semantic biology", "biohermeneutics" and similar alternatives). Moreover, we decided to work towards establishing an official base for our activities – to found an international society. This finally happened in 2005, after the Urbino Gatherings.[1]

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[1] See also Favareau 2005.

## References

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## Programme

***July 1***

Opening (A. Markoš)

Zdeněk Neubauer – The scandalness of novelty

***July 2***

Session: Methods and methodology (chair: Tommi Vehkavaara)

Tommi Vehkavaara – From the motives and methods of biosemiotics to experiential existential naturalism

Ulrich Krohs – Why semiotic models may have explanatory power in biology – and why economic metaphors may not

Edwina Taborsky – The interface as the key nodal site of a dynamic semiosis

Myrdene Anderson – The who, what, when, where, why, and how of "violence"

Georg Töpfer – The concept of sign and the concept of function: similarities and differences

Toshiyuki Nakajima – Internal entropy and survivability of living systems

Andres Luure – Functions and roles in biosemiotics

Sessions: Past and future (chair: Torsten Rüting)

Session: Starting from Uexküll

Torsten Rüting – History of biology and Uexküll's biology as ethics for investigators of life

Han-liang Chang – The "Philological Understanding" of Jakob von Uexküll

Session: Along historical paths

Jui-Pi Chien – Baron Uexküll's French connections – Georges Canguilhem, etc.

Mads Vestergaard – Life, difference and biosemiotics (Henri Bergson)

Session: To future projects

Kalevi Kull – Biology of sympathy

Andreas Weber – The wake of consilience produces monsters: Evolutionary psychology, social construction, and a biosemiotic proposal for symmetry

João Queiroz, Charbel Niño El-Hani – On the emergence of semiosis: Toward a multi-level hierarchical approach

Kaie Kotov – Media and the human umwelt: Where does cultural semiotics stand?

José Wagner Garcia, Fernando Pellon de Miranda, *et al.* – COGNITUS project

***July 3***

Session: Life as a dialogue with the world (chair: Aleksei Turovski)

Aleksei Turovski – The signs as arguments in dialogical network of animals associations

Mette Böll – Social is emotional

Tobias Cheung – Merleau-Ponty and the primacy of perception

Stephen Pain – Ants in the pants of the cognitive scientist: Biorethorics and ants

Dario Martinelli – A whale of a sonata: Organisation and form in zoomusicological structures

João Queiroz, *et al.* – The emergence of referential symbolic process in non-human primates: A semiotic analysis based on C. S. Peirce's extended theory of sign

Cornelius Steckner – Environmental misfit in vision and grasp

Film: "Life as a dialogue with the world"

Session: Semiotics of the countryside; "ecosemiotics": Excursion to the outskirts of Prague (guides: Ivan Horáček and Václav Cílek)

***July 4***

Mini-symposium: Information and meaning in biology (acknowledging 100th anniversary from the birth of Gregory Bateson) (chair: Peter Harries-Jones)

Peter Harries-Jones – Gregory Bateson, abduction, and ecosystem communication

Don Favareau – Making the differences that make a difference: The evolutionary and ontogenetic creation of iconicity

Charbel Niño El-Hani, Claus Emmeche – A biosemiotic analysis of the gene concept

Jesper Hoffmeyer – From things to relations

Søren Brier – What is the pattern that connects? Bateson in cybersemiotic perspective

Session: Organism and ontogeny (chair: Lenny Moss)

Lenny Moss

Andreas Weber – Molecular intentionality: Robust embryological networks and "autonomous agents"

Mia Krause, Ala Trusina and Kim Sneppen – Adaptation, differentiation and aging modeled as a dynamical network process

Alexei A. Oskolski – Narrative on "biological sense": an actant model

Thierry Bardini – Mapping Metaphors of Junk DNA

Karel Kleisner – Genes–memes–semes: Towards the new concept of mimicry

Jiří Neustupa – Geometric morphometrics – a promise of structuralistic morphology for the science of life

Luis Emilio Bruni – Signal transduction and categorial perception

M. Mehmet Ozansoy, Yagmur Denizhan – Disease as semiotic misinterpretation. A model study: Parkinson's disease

***July 5***

Session: Information and ontogeny (chair: Marcello Barbieri)

Marcello Barbieri – Steps in the history of life. Information, meaning, interpretation and signs

Fatima Cvrčková, Anton Markoš – Beyond bioinformatics: Can similarity be measured objectively in the digital world?

Alexei Sharov – Why biosemiotic systems are hierarchical?

Almo Farina – Eco-field *versus* habitat: Shifting a paradigm in developing a cognitive ecology

Olaf Breidbach – Internal representations – A prelude for neurosemantics

Vefa Karatay, Yagmur Denizhan – Semiotics of individuation and individuation of signs

Wolfgang Hofkirchner – Cognition, communication, and co-operation in living systems

Günther Witzany – From biosphere to semiosphere to social lifeworlds: Biology as an understanding social science

Agora: discussion forum

# The 5th Gatherings in Biosemiotics Urbino, Italy July 20–24, 2005

ALMO FARINA

The spirit in which we organized the 5th Gatherings in Biosemiotics is summarized in the following introduction by the two responsible parties (Almo Farina and Marcello Barbieri):

> "It is a pleasure and an honour for us to host the 5th Gathering in Biosemiotics in Urbino. The science of signs is increasingly becoming the science of life and we are very much looking forward to seeing the blossoming of its theoretical and practical developments. Perhaps it is not inappropriate that people gather in an old Renaissance town to put the seeds of a new scientific Renaissance. The programme of the Gathering and the abstracts of the communications are a guarantee of excellence and we thank you warmly for your presence and for your contributions. On behalf of Urbino University, of the Faculty of Environmental Sciences and of the Institute of Biomathematics we wish you all a most fruitful meeting and a pleasant stay."

The meeting was a good event in the relaxed atmosphere of the Urbino Scientific Campus, with the dense programme here attached gladdened by good music. In fact, the Music Conservatory "Rossini" of Pesaro introduced three "musical sessions" dedicated respectively to *Fisarmonica Quartet*, *Flute Quartet* and *Flute Quartet*.

An excursion to the Ducal Palace in Urbino, to the Montefeltro landscape and to San Leo "The Castle", which are the three major examples of Renaissance architecture and of territory governance in Central Italy, represented important cultural landmarks at the end of the meeting.

From the distance of seven years there remains intact the enthusiasm with which I am addressing biosemiotics, which seems to me a more diffuse science thanks to the efforts of many of us.

In Urbino, biosemiotics has been incorporated into the ecological curriculum, and the new field of soundscape ecology "uses" biosemiotic principles extensively.

I hope to organize another Gatherings in Urbino, but in the meantime it is in my plan to organize, at the end of 2013, an international conference

on soundscape ecology, which would be a great opportunity to engage biosemioticians by inviting plenary speakers on this matter. Biosemiotics has been utilized to reinforce and to complete the eco-field theory and to develop the hypothesis of the sound-tope, both being important steps in investigating and interpreting ecological complexity and communication networks.

## Programme

***July 21***

Session: Historical problems (chair: Almo Farina)

Don Favareau – Examining the vital signs of biosemiotics

Marcello Barbieri – The mind-body problem – is dualism back?

Tommi Vehkavaara – Biosemiotics as a science and as an existential philosophy

Session: The Scientific framework (chair: Almo Farina)

Kalevi Kull – Semiotics and physics

Stefan Artmann – Consilience and the history of biosemiotics

Session: Semiotic networks (chair: Kalevi Kull)

Fatima Cvrčková, Anton Markoš – Metabolic pathways from wiring diagrams to semantic networks

Cornelius Steckner – The touch of the world

Stephen Pain – The semiotic and cognitive architecture necessary for meaning production in invertebrates

Session: Biosemiotic research (chair: Søren Brier)

Claus Emmeche – Towards a biosemiotic concept of function and semiotic causation

Charbel El-Hani, João Queiroz – Downward determination in semiotic processes

Luis Emilio Bruni – Towards a hierarchical understanding of health

***July 22***

Session: Biosemiotics and information theory (chair: Claus Emmeche)

Gérard Battail – Information theory and biology

Amanda Sharkey, Noel Sharkey – Robots, insects, and emergence

Wolfgang Hofkirchner – What is biological information? A transdisciplinary view

Session: Biosemiotics and molecular biology (chair: Claus Emmeche)

Yair Neuman – The specificity enigma: From mechanics to poiesis

Marcella Faria – RNAs as code makers: A biosemiotic view of RNAi and cell immunity

Session: Epigenetic systems (chair: Don Favareau)

Alessandro Villa – The neuro-heuristic paradigm

Johannes Huber, Ingolf Schmid-Tannwald – Epigenetic mechanisms following mammalian fertilization reveal basic principles of constructivist epistemology

Karel Kleisner and László Hajnal – The pretty carabids in a small world: Inferring biological resemblances from the "small world network": An attempt

Session: Semiotic communication (chair: Don Favareau)

Søren Brier – The biosemiotic paradigm: Is a common philosophy of science reflected description possible?

Günther Witzany – From umwelt to mitwelt: Natural laws versus rule-governed sign-mediated interactions (rsi's)

Vefa Karatay, Yagmur Denhizan – The mediating role of sign processes in the dynamics of becoming

***July 23***

Session: Biosemiotics and language (chair: Anton Markoš)

Tuomo Jämsä – Language and nature

Frederik Stjernfelt – A biosemiotic *Scala Naturae*?

Arantza Etxeberria, Marila Lázaro – On manufactured life and the biology of the impossible

Session: Biosemiotics, art and feelings (chair: Anton Marko)

Mette Böll – The social emotions

Mark Reybrouck – The musical code between nature and nurture: biosemiotic and ecological claims

Session: Ecosystems (chair: Stefan Artmann)

Peter Harries-Jones – Increasing fittedness: Ecology, aesthetics and ecosemiotics

Almo Farina – Semiosis, the common currency of landscapes

Maricela Yip, Pierre Madl – Semiosis aspects of ecosystems of the invasive *Caulerpa taxifolia*

Session: Theoretical biology (chair: Stefan Artmann)

Assen Dimitrov – Nonalgorithmic order

Toshiyuki Nakajima – Managing uncertainty of events by semiosis in living system

Hernàn Burbano – Determinism, indeterminism and semiotic election

***July 24***

Excursion day – Guided tour of Urbino and surroundings

# The 6th Gatherings in Biosemiotics Salzburg, Austria July 5–9, 2006

GÜNTHER WITZANY

At the 4th Gatherings in Prague, I first met Wolfgang Hofkirchner from ICTS[1] in Salzburg, whom I had never met before. Spontaneously, we decided to invite the Sixth Gatherings to Salzburg. When I returned to Salzburg I enquired of Alfred Winter, my mentor and a successful manager of cultural affairs, and he said that he would support the meeting.

When the event started I felt very happy and I was also very glad about the pre-programme with some truly prominent researchers of plant biology (František Baluška, Peter Barlow), cell biology (Nikolaus Bresgen) and a leading expert in epigenetics (Randy Jirtle), all of whom are people outside of biosemiotics, but which, as the Proceedings expressed it in its title, was rather appropriate ("Biosemiotics in Transdisciplinary contexts" – see Witzany 2007).[2]

The whole Gathering was very fine, including the excursion into the Alps and the exciting evening programme and the excellent musician.[3]

At this stage I shared the opinion that biosemiotics as a whole would integrate the results of the philosophy of science discourse of the 20th century, i.e. the pragmatic turn, as has been done by most of the human sciences. As a result this would have led to a coherent scientific method in biosemiotic research and investigations.

In the following year, I noticed that the (hidden) metaphysical, ontological, information theoretical, pansemiotic, naturalistic and mechanistic approaches went on as usual, and no progress in clarifying the methodological foundations took place. At this point I founded my biocommunication theory – a further development of the theory of communicative nature – which is completely independent of Peirce's philosophy or any other "holy ghost" of biosemiotics (mind, consciousness, sign, code...), but essentially needs only the basics of modern communication theory, i.e. the three

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1 Information and Communication Technologies and Society Centre.

2 In connection with the Gatherings, a few local newspaper articles (e.g. Witzany 2006) and a radio programme were produced.

3 See also the review of this meeting in Sign Systems Studies (Witzany, Yip 2007).

levels of semiotic rules, consortial agents of sign users, and context dependency of sign meanings. With these tools in hand, it is a rather exciting procedure to start applying biosemiotics within the biological realm. Without my experiences in biosemiotics this would not have occurred. In this respect, biosemiotics served as a good ladder.

## References

Witzany, Günther 2006. Die Sprache der Bakterien kennen lernen. *Salzburger Nachrichten* 4. Juli: 21.

Witzany, Günther (ed.) 2007. *Biosemiotics in Transdisciplinary Contexts: Proceedings of the Gathering in Biosemiotics 6, Salzburg 2006*. Salzburg: Umweb.

Witzany, Günther; Yip, Maricela 2007. Gathering in Biosemiotics 6, Salzburg 2006. *Sign Systems Studies* 35(1/2): 295–299.

## Programme

***July 4***

Pre-Programme: Biosemiotics in Transdisciplinary Contexts

Morning sessions (chair: Donald Favareau)

Wolfgang Hofkirchner – Introduction

Jesper Hoffmeyer – Gregory Bateson as a precursor for biosemiotics

František Baluška – Neurobiological communication in plants: From molecules to plant synapses

Peter W. Barlow, Jaqueline Lück – L-systems and other symbolic means of representing morphogenetic events in plants

Randy L. Jirtle – Biological consequences of divergent evolution of M6P/IGF2R imprinting

Kalevi Kull – Diversification: Biosemiotic approach

Günther Witzany – The agents of genomic creativity

Afternoon sessions (chair: Wolfgang Hofkirchner)

Nikolaus Bresgen – Signal and context

Erich Hamberger – Signal – Sign – Word: Transdisciplinary remarks on the field of research called (bio-)semiotics

Klaus Fuchs-Kittowski – Biosemiotics, bioinformatics and responsibility: Ambivalence of the effects of the deciphering of the human genome on society and science

Don Favareau – Animal sensing, acting and knowing: Bridging the relations between brains, bodies and world

Albert Duschl – Evolution and mechanisms of mixed analog/digital information processing in living cells

John Collier – Do systems biology and biosemiotics have anything to tell each other?

Ingolf Schmid-Tannwald – Towards a more comprehensive scientific model of man

## Main programme

***July 6***

Session: Semantics in biosemiotics (chair Kalevi Kull)

Stacey E. Ake – From semiotics to biosemiotics: The insurrection of life

Marcello Barbieri – The origin and evolution of semiosis

João Queiroz, Charbel El-Hani – Towards a multi-level approach to the emergence of meaning processes in living systems

Tommi Vehkavaara – Meaning of life

Wolfgang Reitberger – From ant hills to ambient intelligence: Cues for signalling, coordination and persuasion

Konrad Talmont-Kaminski – Active externalism and biosemantics

Session: Methods of biosemiotics (chair: Günther Witzany)

Kalevi Kull – Methods of biosemiotics

Sergej Chebanov – The current situation in modern biosemiotics

Peter Harries-Jones – Editing Biosemiotics in 'Wikipedia'

Helmut Löckenhoff – Integrative biosemiotics: A transdisciplinary systemic approach

Session: Semiotics in biosemiotics (chair: Günther Witzany)

Donald Favareau – How to make Peirce's ideas clear

Cornelius Steckner – Peirce's sop to the Cerberus and the biosemiotic self as the interpretant of object and sign: An experimental appraoch

Alfred Lang – A-dualistic generative semiotic

*July 7*

Session: Applied biosemiotics (chair: Wolfgang Hofkirchner)

Argyris Arnellos, Martien Brands, Thomas Spyrou, John Darzentas – A biosemiotc analysis of serotonin's complex functionality

Almo Farina, Davide Morri, Silvia Scozzafava – The eco-field hypothesis and the human use of resources in cultural landscapes

Timo Maran – Structural and semiotic aspects of biological mimicry

Toshiyuki Nakajima – Evolution of life in the global network of genetic exchange: Sexuality and the universal genetic code.

Günther Witzany – Applied biosemiotics: Fungal communication

Gérard Battail – Impact of information theory on the fundamentals of genetics

Seán O'Nualláin – Genome and natural languages: How far can the analogy be extended?

Session: Biosemiotics and information theory (Chair: Tommi Vehkavaara)

Assen I. Dimitrov – How could nature turn into a manufacture?

Ingolf Schmid-Tannwald, Johannes Huber – Human life: An "endless semiosis" through different human sign-systems

Paolo Manzelli – What means life?

Pierre Madl, Maricela Yip – Biophotonics and information, matter and energy – a non-linear world-view

Dietmar Payrhuber – Information alters matter

Conference Dinner, with an extraordinary music performance by Doris Kirschofer

*July 8*

Session: Evolution, development and sign functions (chair: Jesper Hoffmeyer)

Eugenio Andrade – A semiotic analysis of the interface between evolutionary and developmental processes

Marcella Faria – Signal transduction codes and cell fate

Randy L. Jirtle – Nutrition, epigenetics and disease susceptibility

Mario Gimona – Protein linguistics – a grammar for modular protein assembly?

Yair Neumann – The polisemy of the sign: A quantum computing perspective

John Pickering – Affordances of signs

Session: Biosemiotics and mind models (chair Marcella Faria)

Jesper Hoffmeyer – The awakening of species: Grades of consciousness

Mette Böll – The evolution of consciousness

Robert Logan – Propagating organization and the extended mind model of the origin of language and culture

Rainer E. Zimmermann – Topological aspects of biosemiotics

# The 7th Gatherings in Biosemiotics Groningen, the Netherlands June 6–9, 2007

BAREND VAN HEUSDEN

The 7th Gatherings in Biosemiotics, which was held in Groningen in 2007, brought together an impressively varied group of scientists and scholars. Apart from the 'usual suspects', who guarantee a firm core and continuity, there were several newcomers, as well as a number of Dutch colleagues who caught the opportunity to interact, through presentations and discussions, with 'hard boiled' biosemioticians.

This is certainly one of the important advantages of 'travelling gatherings': it allows 'locals' to get in touch and acquainted with, and eventually also very enthusiastic about, an approach that combines the study of nature with that of culture through the study of semiotic processes.

One of the things that comes to mind immediately when recalling the Gatherings in Biosemiotics in Groningen in 2007 is the ubiquity of Don Favareau – he was definitely the driving force, first through the Internet and later 'on the ground', behind these Gatherings. His experience and effectiveness were of an immense help to us as organizers and he decidedly set the tone for the event.

I also recall some quite heated debates, in which Don Favareau, Marcello Barbieri, Jesper Hoffmeyer, Kalevi Kull, Frederik Stjernfeldt and Claus Emmeche figured prominently – and one in particular on the 'intelligence of evolution' which was triggered by the theme of another conference that Jesper Hoffmeyer had attended before coming to Groningen.

There was one lecture that stuck to my mind for a very long time. It was given by Stephen Pain, an independent scholar, and it was about sponges ('Sponge: On the Cusp of an Integrated Semiotics') – it was impressive, not only because of the topic, but certainly as much because of the spectacularly witty and erudite presentation.

Thus during those three days, back in June 2007, we were more or less secluded in the Groningen Academy Building. A quick glance at the programme makes it clear how broad the scope of the meeting was, both in terms of the topics addressed and in terms of the backgrounds and affiliations of the participants.[1] But this is probably as it should be in biosemiotics: the

[1] See also a review by Yair Neuman (2007).

study of semiotic process on all levels of life and complexity necessarily involves a very broad spectrum of disciplines, epistemologies and characters. That is probably the gist of it.

On Saturday, those who had not left yet 'recovered' a little, enjoying an excursion to the 'Ommelanden' – the countryside around the city of Groningen. We visited the Menkemaborg, a 17th century mansion surrounded by a beautiful park. The walks through the house and the park provided the opportunity for most of us to round up some last arguments and tackle a few issues left unfinished.

Biosemiotics was not and still isn't an established discipline at the University of Groningen, but through our study of culture and cognition, with particular reference to the arts, we certainly do hope to be able to contribute again in the future to the biosemiotics project.

## References

Neuman, Yair 2007. The 7th Gathering in Biosemiotics: A review. *Sign Systems Studies* 35(1/2): 301–303.

## Programme

***June 6***

Session (chair: Kalevi Kull)

Claus Emmeche – Biosemiotics and the biological sciences – a Kuhnian perspective

Marcello Barbieri – Organic codes and evo-devo

Eliseo Fernández – Signs, instruments and self-reference in biosemiotics

Session (chair Claus Emmeche)

Donald Favareau – *De anima* and *De interpretatione*: Aristotle on life and signs

Victoria Alexander – Teleology, emergence and poetics

John Pickering – What's wrong with vitalism?

Session (chair: Yair Neuman)

Frederik Stjernfelt – Roots of biosemiotics in German thought

Nicole Rossmanith – Exploring semiosis through concept formation

Barend van Heusden – Getting rid of the sign

Session (chair: Marcello Barbieri)

Gérard Battail – Genomic error-correcting codes in the living world

Gemma Bel-Enguix, Dolores Jiménez-López – From the genetic code to a biomolecular-based linguistics

Marcella Faria – DNA organization: Boundaries, territories and islands

***June 7***

Session (chair: John Pickering)

Gottfried Süssenbacher – Prehistoric fire usage – the prime origin of memes?

Mette Rakel Böll – The molding of moods

Martien Brands – Medical diagnosis in a biosemiotic perspective

Session (chair: Victoria Alexander)

Hellmut Löckenhoff – A transdisciplinary invitation to socio-semiotics

Stephen J. Cowley – The biosemiotics of imaginary codes

Charles Goodwin – The multi-modal organization of human action

Session (chair: Barend van Heusden)

Almo Farina, *et al.* – Exploring the semiotic nature of bird soundscapes

František Baluška, *et al.* – Synaptic concept in an expansive mood

Stephen Pain – The sponge: on the cusp of an integrated semiotics

Session (chair: Luis Bruni)

Yagmur Denizhan, *et al.* – Magnetotactic bacteria as a challenge for semiotic description

Raymon Bruce – Where is the sign? the single cell as an urmodel of perception

Arno Goudsmit – Self-referentiality and sensitivity in living beings

***June 8***

Session (chair Marcella Faria)

Toshiyuki Nakajima, *et al.* – Encounter probability in proto-semiotic systems

Sergey V. Chebanov – Biosemiotics and biohermeneutics

Session (chair: Yagmur Denizhan)

Rob Withagen – Evolutionary analysis of the information-based theory of perception

Andreas Reichelt – Motor control approaches to goal-directed behavior

Cornelius Steckner – When a baby points at a flower: sign and environment

Session (chair: Jesper Hoffmeyer)

Walter Riofrio – Enquiries about the emergence of cognition in evolution

Luis Emilio Bruni – Is the umwelt in the associative cortex – or vice-versa?

Yair Neuman – Memory: a bio-semiotic perspective

Session (chair: Don Favareau)

Morten Tønnessen – Umwelt transition and the umwelten of domesticated animals

Jesper Hoffmeyer – Biosemiotic design is "intelligent"

Kalevi Kull – A biosemiotic theory of evolution

# The 8th Gatherings in Biosemiotics
# Syros, Greece
# June 23–28, 2008

ARGYRIS ARNELLOS

The 8th Gathering in Biosemiotics was organized by the Department of Product and Systems Design Engineering of the University of the Aegean in Syros, Greece. The event lasted for four hot and sunny summer days, where presentations of meticulously prepared works were combined with good food and joy at the beaches.

The welcome party was full of conference participants dining and discussing on a very colourful and festive atmosphere. Most of them had already arrived, and the truth is that they couldn't believe that they should attend, early in the morning of the very next day, the conference at 9 a.m.! The conference was held at the Cultural Center of Hermoupolis, near the central square.

The conference programme was full and in-depth (as always), with 43 talks of almost 30 minutes each, and with Kalevi Kull being very strict on keeping time within limits. A striking characteristic of the gathering was the plurality of different perspectives and applications of biosemiotics, with works ranging from the modelling of basic biological processes of signal transduction to others discussing biosemiotics in wine-tasting.

Neither biosemiotics, nor semiotics as such, are primary topics of research in the Department of Product and Systems Engineering. However, the concept has been substantially studied and used in both postgraduate programs (MSc in Design of Interactive Systems and MSc in the Design of Health Systems – Holistic Approach to Medicine). Postgraduate students from both programs attended the conference and had the opportunity to discuss several issues with many of the people whose theories they were taught and had been studying in the previous semesters.

The dinner took place at the *Faros Village Hotel*, in a small village just 20 minutes outside the town, during a sweet night and a full moon that many took advantage of for swimming and playing like small children in the pool. And yes, you do remember correctly: Marcello was also in the pool, playing, laughing, and having a good time.

After the last day of talks and after Terrence Deacon's asynchronous remote presentation (i.e. a 'powerpoint' presentation with his recorded voice following

the slides), Don had an interesting surprise for everybody. His talk was a collage of all other talks that were given at the conference, aiming to demonstrate the plurality of the field as well as its multidisciplinary and interdisciplinary nature. I remember that we were all not only emotionally but also mentally touched by his inspiration, since this was the simplest thing we could do to present a fine resume of what had been taking place during the last four days.

The conference closed with a round-trip guided group bus excursion to the *Medieval Settlement of Ano Syros* and to the *Historical Center of Hermoupolis*, which lasted from early in the afternoon until late in the evening. I wasn't sure how interesting this excursion would be, but to my surprise it turned out to be a great success, which made me very happy. After that, it was time for me to rest, but not much, just for a while. Then, and for the next couple of days, many of the attendees were scattered in the several villages of the island, enjoying the sea and the summer weather, while others took advantage of the timing and visited other islands.

I'd like to believe it was truly a many-sided gathering in all respects.

## Programme

***June 24***

Kalevi Kull – Biosemiotic concept of species

Marcello Barbieri – Three types of semiosis

Tommi Vehkavaara – The failure of evolutionary epistemology: A lesson for biosemiotics?

Luis Emilio Bruni – Hierarchical categorical perception and semiotic integration

Eliseo Fernández – Biosemiotics and self-reference from Peirce to Rosen

Jesper Hoffmeyer – A biosemiotic approach to a theory of meaning

Wendy Wheeler – "Felt in the blood, and felt along the heart": Going backward to o forward – layers of biosemiosis and the logic of abduction in aesthetic and scientific creativity

Yair Neuman – Why do we need others?

Argyris Arnellos, Spyros Vosinakis, João Queiroz, Charbel Niño El-Hani, John Darzentas –Biosemiotic modeling of signal transduction in B-cell activation: Implications for simulation methods

Thierry Bardini – What does it mean for biosemiotics if there is no more "junk" on DNA?

Mette Böll – Investigations of the social subject

***June 25***

Stephen Cowley – Language and physics: Implications for biosemiotics

Joanna Rączaszek – Symbols as constraints in biological systems and natural language: A psycholinguistic perspective on Pattee's framework

Alex Kravchenko – Linguistic semiosis and the bounds of human cognition

Charbel El-Hani, João Queiroz, Frederik Stjernfelt – Firefly *femmes fatales*: A case study in the semiotics of deception

Timo Maran – How should an egg look like? Some semiotic observations of brood parasitism

Jacqueline Lück, Peter W. Barlow – Context and variability as problems in plant development and biosemiotics

Han-liang Chang – Semioticians make strange bedfellows! Or once again: 'Is language a primary modelling system?'

Jui-pi Chien – Can Saussure's Orangery manuscripts shed new light on biosemiotics?

Victoria Alexander – The poetics or semiotics of purpose

Jana Švorcová, Anton Markoš – Organic codes at the level of chromatin

John Collier – Control in biological systems: Where do need semiotics and not just control theory?

Gérard Battail – Applying semiotics and information theory to biology: A critical comparison

***June 26***

Myrdene Anderson – The play of a metaphor in ecosemiotics: footprints, handprints, mindprints

Marcella Faria – Representation in biology – expanding the landscape

Almo Farina – Exploring the cognitive landscape of the Robin (*Erithacus rubecula*) wintering in a Mediterranean region

Gennaro Auletta – Biological systems as integrating a processor, a regulator, and a decider

Sergey Chebanov – Alternatives of biosemiotics

João Queiroz, Claus Emmeche, Kalevi Kull, Charbel El-Hani – Semiotic approach in biology: Relating theoretical bases to applied models

Karel Kleisner – Eye for eye: On the evolution of semantic organs by means of signification

Mehmet Ozansoy, Yagmur Denizhan – endomembrane system as a representation of the extracellular medium

Michal Schmoranz, Zdeněk Neubauer – A conversation of forms – bacterial colony as a symbol of teamwork and a pure aesthetic evidence

Thibaud Debaecker, Ryad Benosman – A practical model of the retina codification and its applications in localization and camera networks

Franco Giorgi – A biosemiotic approach to neurophenomenology

Jonathan Hope, Pierre-Louis Patoine – Does a glass of white wine taste like a glass of domain Sigalas Santorini Asirtiko Athiri 2005? A biosemiotic approach to wine-tasting.

***June 27***

Walter Riofrio – A proposal on biosemiotics

Ingolf Schmid-Tannwald – Interpersonal relationship in everyday life: a semiotic model

Martien Brands – Does biosemiotics assist in understanding complex medical interventions?

Vanessa Carvalho dos Santos, João Queiroz, Charbel Niño El-Hani – A Peircean semiotic approach to alternative RNA splicing and cellular signaling pathways: Implications for the concepts of gene and genetic information

Vefa Karatay, Yagmur Denizhan – Individuation as a general framework for semiosis

Terrence Deacon – The general theory of evolution[1]

Don Favareau – Examining the vital signs of biosemiotics in 2008

Peter Harries-Jones – Ecosemiotics and the collapse of ecosystems

[1] Terrence Deacon had sent in a video presentation.

# The 9th Gatherings in Biosemiotics Prague, Czech Republic June 30 – July 5, 2009

ANTON MARKOŠ

*"No man ever steps in the same river twice"*

The five years between the two Prague meetings can be characterized by incessant activity. The Society had been established, and thanks to the inexhaustible Marcello Barbieri, we got a base at Springer: the journal *Biosemiotics* and the book series complemented the journal *Sign Systems Studies* and books published in Tartu. My greatest personal disappointment was with my role in 2009: instead of being the organizer of the Gathering, I was supposed to organize the catering only; we had no say concerning the programme. I was not present for the Salzburg and Groningen events, and my second-hand information suggests that there were some "ideological" problems concerning some presentations: as a result, the Executive committee took over the organization. Apart from other things, they dropped the plenary lectures, leaving only short communications. I was naïve in supposing that compiling the programme itself would be, as five years before, the duty of the organizers. Of course, it is up to the Society to approve the programme, but alas, they took over *all* the initiative: two days after the abstracts deadline – even before I was able to look at them – I was presented a *detailed* programme of the gatherings. My role was only to send letters of acceptance or refusal to the authors. No plenary lectures, 20 minutes for everybody, yet extremely crowded, with no time left for longer discussion or informal personal meetings: just an endless train of short presentations. I did not succeed with suggesting parallel sessions, neither was I allowed posters for those presenting technical papers. Frustrated, I decided to insert at least two introductory lectures at the very beginning – one of them mine. But this was an abortive effort: I was speaking to people saying hello to each other and to new incomers to the hall, not paying much attention to the speakers.

Maybe I am wrong in criticizing the decision: I know from my colleagues and students that they have enjoyed all the meetings, and established many contacts and friendships; after all, this is the goal of such events. Yet I was disappointed at seeing leading figures of the field (Hoffmeyer, Barbieri, Kull... ) presenting but short contributions, lost among the flood of students

and postdocs. Just before the gatherings, the book *Biosemiotics* by Jesper Hoffmeyer had appeared – and there was no time to reserve for the presentation it deserved. To illustrate that the frustration was not only mine: after the official closing of the gathering, when everybody was about to leave, Marcello Barbieri rose up and asked people to stay – and he gave an extra lecture he had had no opportunity to deliver in regular time.

Well, my glance back may sound quite pessimistic, but such were my feelings after the second gathering in Prague…

## Programme

***June 30***

Timo Maran, Karel Kleisner – Semiotic selection, cooption, and good old Darwin: Is there a common basis for the explanation of mimicry, sexual selection, and domestication?

***July 1***

Eugenio Andrade – Evolution by natural abduction

Kalevi Kull – On consortia, umwelten, and biophony (and the ecological codes)

Marcello Barbieri – On the definition of meaning

David Leavens – Ape pointing: A case study in distributed cognition

Natalia Abieva – Indexical species: acquisition of external semiotic competence in human evolution

Fatima Cvrčková – Context-dependent meaning in plants: a model for non-animal semiosis

Stephen Pain – The barnacle and the whale: A fable of semiotic explanation

Irena Pátková – Reading bacterial messages

Erbach-Schönberg – Generating signal transduction codes with an evolvable network representation of cells

Jana Švorcová – The hourglass, the zootype and the phylotypic stage

Michaela Zemková – Linguistic metaphor of life – potential and limites of its application in analysis of different texts

Michal Schmoranz – Becoming a semantic object. Bacterial colony as a bio-aesthetic model

Ted Baenziger – Phytosemiosis in orchids

Group Discussion on "How to define the term 'meaning' in biosemiotics?" (moderator: Don Favareau)

***July 2***

Stephen Cowley – From biomechanisms to interpretation

Martin Neumann – The semiotic construction of social reality

Marco Stella – The Invention of the Clever Hans effect: Was Sebeok right?

Ryad Benosman – Neuromorphic asynchronous images: Toward a new paradigm of image-based semiosis

Maciej Pokora – Link between common *yes–maybe–no* head gestures and directional properties of human vestibular system

Paul M. St. Pierre – Biosemiotic neurobiology of finger-snapping as end-effector sonic signaling process

Prisca Augustyn – Workshop: Uexküll translation project

Myrdene Anderson – Information – vague, general, curious, spurious

Eliseo Fernández – Biosemiotics and the relational turn in biology

Robert Prinz – Cells as semiotic systems practical and quantitative implications

Fabio Bacchini – Biological cluster and properties as real signs

Sara Cannizzaro – Flexible models: on differentiation, systems and biosemiotics

Tamara Popowski – A Derridean approach to the biosemiotic problem

***July 3***

Peter Harries-Jones – All over the map: Heterarchical topology for Bateson's context and meta-context

Alexei Sharov – Partitioned semiosphere: barriers of communication and relativistic epistemology

Dominique Lestel – How to make sense of animal complex semiotic activities?

Isabel Ferreira – Towards a biologically-motivated approach to meaning

Jerry Chandler – A natural number system for biosemiotic and medical signals

João Carlos Major – Neuronal versus relational man

Marcella Faria – Cell-matrix adhesion complexes and their dynamic assembly: The poetics of cell migration control

Franco Giorgi – Receptor oligomerization as a mechanism controlling cellular semiotics

Morten Tønnessen – On contrapuntuality: Semiotic niche vs. ontological niche: The case of the Scandinavian wolf population

Maria Dmitrieva – Directions in interpretative biosemiotics

Anna Aragno – The biosemiotic roots of psychoanalytic metapsychology

Martien Brands – Metaphor comprehension in patient doctor interaction: A biosemiotic perspective.

Andres Luure – The semiotic threshold and the threshold of life

***July 4***

Thierry Bardini – How can Simondon's relational ontology contribute to biosemiotics?

Argyris Arnellos – Emergent representations, digital-analog forms and biosemiotics: Integrating the tools to model complex phenomena in living organisms

Jonathan Hope – *Umwelträume* and multi-sensory integration

Mark Reybrouck – Musical sense-making between nativism and empiricism: An evolutionary approach to musical semantics

Gérard Battail – Living versus inanimate: the information border

Yulia Volokitina – Reconstruction of a Russian-language site in biosemiotics

# The 10th Gatherings in Biosemiotics Braga, Portugal June 22–27, 2010

JOÃO CARLOS MAJOR

The 10th annual Gatherings in Biosemiotics took place in Braga, Portugal, at the Faculty of Philosophy of the Portuguese Catholic University. The event was organized by João Carlos Major and Alfredo de Oliveira Dinis in collaboration with the International Society for Biosemiotic Studies.

The gathering received contributions from scholars from all over the world. It included interventions from countries such as Austria, Germany, Italy, Portugal, Taiwan, Czech Republic, Estonia, United States of America, Singapore and even Brazil.

It was, indeed, a truly international meeting. For the first time, Braga had the opportunity to receive the most productive minds in the field of biosemiotics. The event constituted an oasis of sharing knowledge, and provided connections between scholars that, eventually, resulted in published papers.

Coronating the efforts of the biosemiotic community, the book *Signifying Bodies: Biosemiosis, Interaction and Health* (Cowley *et al.* 2010) was published for this gathering. With contributions from several influential scholars, it was a truly collaborative book aimed at promoting the relationship between psychology and biosemiotics.

To this meeting, Donald Favareau came with the freshly printed, monumental *Essential Readings in Biosemiotics* (Favareau 2010). No doubt this is a major achievement and a historical cornerstone for both biology and semiotics.

Of course, the gathering had a social component. The first day welcome party took place in the Nogueira da Silva Museum, where the participants learned about the history of Braga, and met each other. The social component included a trip to Bom-Jesus cathedral, an icon of religious devotion in Braga. There, participants felt the religious side of the site. During this trip the scholars also visited a water-moved elevator, considered as another icon of Braga.

At the end of the Gathering, as is custom, there was a social dinner. The finest plates of Portugal were introduced to the international biosemiotic community and, considering the comments, everybody enjoyed the Portuguese cuisine.

The event was an opportunity for knowledge sharing and strengthening of social ties. As a result, the biosemiotic community won with the gathering.

## References

Cowley, Stephen J.; Major, João C.; Steffensen, Sune V.; Dinis, Alfredo (eds.) 2010. *Signifying Bodies: Biosemiosis, Interaction and Health.* Braga: The Faculty of Philosophy of Braga Portuguese Catholic University.

Favareau, Donald (ed.) 2010. *Essential Readings in Biosemiotics: Anthology and Commentary.* (Biosemiotics 3). Dordrecht: Springer.

## Programme

***June 23***

Session. Chair: João Carlos Major

Donald Favareau – Celebrating a milestone in biosemiotics – but certainly not standing still

Jesper Hoffmeyer, Claus Emmeche, Donald Favareau, Kalevi Kull – On signs and codes

Kalevi Kull – Biosemiotics has to study what the organisms know: The case of adaptation

Maria Rita Leal – From signal to sign... The facts

John Collier – Immediate and final interpretants in the immune system

Alexei Sharov – Functional information: towards synthesis of biosemiotics and cybernetics

Session. Chair: Kalevi Kull

Günther Witzany – Biocommunication of cancer cells

Luis Emilio Bruni – Heterarchical semantic congruence

Tommi Vehkavaara – A road to empirical biosemiotics – better formed concepts?

João Queiroz, Charbel El-Hani, Frederik Stjernfelt – Notes on the semiotics of biological mimicry

Frederik Stjernfelt, Charbel El-Hani, João Queiroz – On the emergence and evolution of dicisigns in biological mimicry

Eliseo Fernández – Living is surviving: Causation, reproduction and semiosis

***June 24***

Session. Chair: Karel Kleisner

Michaela Zemková – The linguistic measure – what does it say about language and evolution?

Natalia Abieva – Biological and social levels complementarity in human communication

Han-liang Chang – The biological foundation of Roland Barthes's 'Writing Degree Zero'

Marcello Barbieri – On the origin of language

Paul Thibault – On the relationship between first-order languaging and second-order language

Marcella Faria – Common cues in endothelial and axon guidance or patterning codes in nervous and vascular systems

Session. Chair: Natalia Abieva

Alfredo Dinis – Mind beyond the brain? The 'extended mind' debate

Peter Harries-Jones – Swarm intelligence: Biodiversity and biosemiotics

Angelo Recchia-Luciani – Exaptation as re-signification

Margus Ott – The question of the self

Gerald Ostdiek – Cast in plastic: Semiotic plasticity and the pragmatic reading of Darwin

Andres Luure – On needs

***June 25***

Session. Chair: Jesper Hoffmeyer

Karel Kleisner, Tomáš Kočnar – Eye color and facial shape form one semantic ornament: On the semiotic co-option of iris color

Franco Giorgi, Roberto Maggio, Luis Emilio Bruni – Are olfactory receptors really olfactive?

Filip Jaroš – Coat patterns among felids – function or sign?

Morten Tønnessen – We the living: The reception of Uexküll in Norwegian ecophilosophy

Patrick Vyncke – Fitness cues and fitness indicators: Can evolutionary psychology and biosemiotics become complementary sciences?

Shuo-yu Wu – Autopoiesis and interpretive semiosis: Translation as a biological phenomenon

Session. Chair: Marcella Faria

Dennis Waters – Von Neumann's theory of self-reproducing automata: A useful framework for biosemiotics?

Siohoi Ieng, Stephen Pain – A biosemiotic formulation of survival strategies for robots

Stephen Pain – Semiotic appraisal in invertebrates

Gérard Battail – Identity, species, order

Peter Barlow – To life on Earth: Messages from the Moon

Isabel Ferreira – Interactive bodies: The semiosis of architectural forms – a case study

Edward Baenziger – Alpha and Omega: The oldest and newest example of interphylogenetic semiotics – the orchid

***June 26***

Session. Chair: Donald Favareau

João Carlos Major – From biosemiotics to health

Clara Costa Oliveira – Suffering, education and health (biosemiosis and health)

Susan Stuart – Enkinaesthesia, biosemiotics, and the ethiosphere

Charls Pearson – "My dog uses intensional logic"

Vinicius Romanini – Grounding biosemiotics: how Peirce's semeiotic explains Uexküll's concepts of umwelt and self-world

Marco Stella – The invention of the Clever Hans effect: Was Sebeok right?

# The 11th Gatherings in Biosemiotics New York, USA June 22–25, 2011

VICTORIA N. ALEXANDER

The 2011 conference in New York was the first Gatherings in Biosemiotics on American soil, but it followed advance guard presentations by Jesper Hoffmeyer and Don Favareau in 2006 at the Dactyl Foundation. Dorion Sagan and Lynn Margulis also spoke at that conference and learned about biosemiotics for the first time. Initially, Lynn's reaction was, well, a reaction: "Cells don't use signs!" Nevertheless, she kept the back door of her mind ajar, and by 2011, Lynn had become, not quite a convert to biosemiotics, but a willing listener. She drove down from Amherst to spend a day with us. During the dinner, Lynn sat next to the ever-gracious host Kalevi Kull. Before the main course was served, he had convinced her to attend Tartu. She would have been here with us were it not for her untimely death in November.

Although everyone was very kind to compliment me on the organization of the meeting, it's not true that I am a good organizer. The coffee service was kind of crappy. There were no frills. As an environmentalist, I am always reluctant to distribute more paper and plastic items than is absolutely necessary. I didn't provide note pads or tourist brochures, and I rationed out the plastic name badge holders. However, everyone said the diversity of the attendees, the intensity of the discussions during breaks, and the quality of the presentations made it an extraordinary gathering.

One of the highlights, for me, was getting caught up in a gay parade with Marcello, Don, Jesper, Søren, Kalevi, Paul, and Myrdene on our way to dinner in the West Village. It was the day gay marriage was approved in New York State. I couldn't have planned a better NY-themed site-seeing excursion. One can depend on NYC to provide material for colourful memories. Another highlight for some was the Manhattan registration experience. (There were two registration locations: Queens, which I manned, and Manhattan, manned by my eccentric assistant Ben.) Ben decided (without informing me) to move the registration desk from the nicely-appointed lobby we had chosen to his cramped apartment. Several people who registered at that location were delighted by the unusual and informal circumstances. One registrant, who was asked to take over the desk while Ben took a shower, said it was like

"Registration Noir". It was mostly newcomers who happened to register at that location. Although I tried to apologize profusely for Ben's decision once I found out about it, they all said there was no need as Ben had made them feel really welcomed into the biosemiotics family.

The presentations were some of the most diverse that ISBS has ever seen, and it was one of the largest of the Gatherings, with forty-three presentations and about a dozen people who came just to listen. We had a high percentage of non-members and new members at the New York meeting. In all, I think the 2011 Gatherings in Biosemiotics was pretty successful in terms of spreading the word and bringing more people into the fold.

## Programme

***June 22***

Don Favareau – Eight theses on biosemiotics

Gerald Ostdiek – The objective artifice: Social performance and the pragmatic semiotics of Constantin Stanislavski

Kalevi Kull – Biotranslation

Vinicius Romanini – Perception grounds communication

Eugene Halton – Virtuality, effacement, and symboling

Natalia Abieva – Ambiguity in Iconic and indexical relations

Victoria Alexander – Mysterious objects: Integrating biosemiotics with complex systems science

Jeffrey Goldstein – Generalizing from the potency of linguistic context for biosemiotic theory

Alexei Sharov – Evolution of natural agents: Preservation, development, and emergence of functional information

Almo Farina, Rachele Malavasi, Nadia Pieretti – Soundtope: The acoustic consortium of bird communities

Louis Goldberg, Leonard A. Rosenblum – Analysis of a simian semiosphere

Dolores Steinman, David A. Steinman – Computer biosimulations as tool of translation and communication

***June 23***

Paul Cobley – Codes, communication and interpretation

Dennis Görlich, Stefan Artmann, Peter Dittrich – Cells as semantic systems

Liz Stillwaggon-Swan, Louis J. Goldberg – The search for meaning in biosymbols and computer codes

Marcello Barbieri – Names and nominable entities

Jan-Hendrik Hofmeyr – Fragile, yet persistent: Biosemiotics and self-fabrication

Joachim De Beule – Agency and the creation of meaning

Mark Reybrouck – Musical sense-making between nature and nurture: An ecosemiotic and psychobiological approach

David Rothenberg – Animal music, animal aesthetics

Tina Roeske, Philipp Sprau, David Rothenberg, Gary Marcus, Ofer Tchernichovski, Marc Naguib – Melody and rhythm in nightingale song

Jonathan Beever – Toward a biosemiotic approach to environmental ethics

Peter Harries-Jones – Meaning rationalism and an algebra of aesthetics

***June 24***

Stephen Cowley – Languaging, writing systems and codes

Prisca Augustyn – Meaning in nature and semiotic modeling

Susan Petrilli, Augusto Ponzio, Julia Ponzio – Communication, modeling and dialogism in the biosemiotic sphere

Søren Brier – How biosemiotics can produce an evolutionary theory of conscious experience and intersubjective meaning production in communication

Eliseo Fernández – Energy, semiosis and emergence: The place of biosemiotics in an evolutionary conception of nature

Franco Giorgi, Luis Emilio Bruni, Roberto Maggio – Semiotic selection of misfolded oligomeric receptor proteins in bacteria and germ cells

Pierre-Louis Patoine – Organic life in fictional environments: A biosemiotic approach to immersive video gaming

Myrdene Anderson – Making sense out of "sustainability"

Dorion Sagan – Thermosemiosis: the thermodynamic background of meaning-making in an energetic cosmos

Daniel Mayer – Semiosis and anticipation

Sara Cannizzaro – Cybernetics, Soviet semiotics and the quest for homology: The interdisciplinary past of Thomas Sebeok's biosemiotics

Astrid Thome (film) – Interview with Friedrich Salomon Rothschild

***June 25***

Gary Shank – The semiotics of PS 101

Morten Tønnessen – Integrated biological individualism and the primacy of the individual level of biological organization

Luciana Garbayo – On signaling games of adaptive morality: Biosemiotic considerations

Tim Ireland – Space as a creative phenomenon: A biosemiotic approach to spatial configuration

Thomas Long – Pain as sign and symptom: A semiotic analysis of nursing clinical practice and research

John Collier – Immediate interpretants in the immune system

Hidetaka Yakura, Alain Leplège – On the information transfer in immune cell signaling

Anna Aragno – The marriage of psychoanalytic methodology with the biosemiotic agenda

# The 12th Gatherings in Biosemiotics
# Tartu, Estonia
# Juiy 16–21, 2012

KALEVI KULL, TIMO MARAN, SILVER RATTASEPP

The 2012 annual gathering of the biosemioticians of the world has attracted more submissions than ever before. Thus the work of the program committee (Anderson, Bruni, Cobley, Hoffmeyer, Kull, Maran) was not an easy task.

Our Tartu group organised the Gatherings ten years ago. At the time, in 2002, we put an emphasis on Baerian-Uexküllian sites and the biodiversity of the Estonian ecosystem. Although meanwhile a whole new generation of scholars has grown up, we decided not to repeat these walks. Most of the meeting will take place in the very centre of Tartu, in the building next to the main building of the University of Tartu. Since 2011, this has been the home of the Department of Semiotics, with an excellent semiotics library, including the memorial collection of Thomas A. Sebeok, taken over from Bloomington, USA.

Although on July 18 we shall be in the countryside for half a day, at Leigo (about 40 km south of Tartu), surrounded by lakes and hills so characteristic of South-Estonia, the majority of our time together will be spent in the university.

The Gatherings is organised by the International Society for Biosemiotics Studies, together with the Department of Semiotics of the University of Tartu, Jakob von Uexküll Centre, and the Estonian Semiotics Association.

The Gatherings includes two satellite meetings, or pre-seminars – "Biosemiotics and the study of culture", organised by Timo Maran, and "Language and life", organised by Stephen Cowley. After these, the main program is scheduled for four and a half days. The thematic variety of presentations appears to be rather expansive this year. To emphasise this diversity, the sessions in the main programme were provided with unique titles. Perhaps high (bio)diversity is still a pecularity of Estonia: there is no singular truth, nor two or three, but rather a multitude of concording views in biosemiotics.

## Programme

***16 July***

Pre-conference seminar "Biosemiotics and the Study of Culture"

Kadri Tüür – Zoosemiotic theory in the analysis of nature writing

Timo Maran – Biosemiotic criticism: Modelling the environment through literature

Raquel Rennó – Waste, innovation and emerging life forms

Morten Tønnessen – In the gaze of the other: Describing cultural affordances by conducting comparative umwelt mapping in animal studies

Natalia A. Abieva – Concrete vs. abstract semantics in mental images

Farouk Y. Seif – Semiotic animal in a transmodern world: Hovering between zoosemiotics and anthroposemiotics

Grzegorz Kapuscinski – Dog – human communication: Semiotic phenomenon on the verge of nature and culture

Louise Westling – Cultural sedimentation parallels biological sedimentation: Embedded histories in Merleau-Ponty and Hoffmeyer

Deana Neubauer – George Eliot's hermeneutics of sympathy as a prefiguration of Hoffmeyer's semiotic freedom

Silver Rattasepp – The philosopher and the leaf insect

Roundtable. Biosemiotics and the study of culture – possibilities, problems, perspectives

***17 July***

Research cluster "Language and life"

Openings of the main programme

Jesper Hoffmeyer – The semiotics of human nature

Jana Švorcová, Anton Markoš – The language of life

Peter R. Wills – Genetic information, mechanical interpreters and thermodynamics: The physico-informatic basis of biosemiosis

Donald Favareau – Including absence

***18 July***

*Foundations*

Andreas Weber – There is no outside: A biological corollary for poetic space

Kalevi Kull – Modelling of semiosis: Juri Lotman's legacy

Susan Petrilli, Augusto Ponzio – Morris, Sebeok and beyond: From biosemiotics to semioethics

*Philosophical*

Tommi Vehkavaara – Senses of significance and meaning in the models of biosemiotic sign

Louise Westling – Merleau-Ponty's ontological bridge between biosemiotics and culture

Timo Maran – Are ecological codes archetypal structures?

*Developmental* (in Leigo farmstead)

Franco Giorgi, Louis Goldberg and Luis Emilio Bruni – The egg as a semiotic gateway to reproduction: Digital and analogical communication in the oocyte-egg-zygote transition

Gerald Ostdiek – Scaling life: Developmental semiotics in infancy and beyond

Myrdene Anderson, Katja Pettinen – Trans-somatic mindfulness

*Evolutionary* (in Leigo farmstead)

Alexei Sharov – The origin of mind: Transition from protosemiosis to eusemiosis

Katya Mandoki – Evolition: A reassessment of Rothschild's biosemiotics

***19 July***

*Codes*

Marcello Barbieri – Code semiotics – a new science of life

John Collier – Codes and their interpretation in endobiosemiotics

Joachim De Beule – Overcoming the tragedy of the commune in the Hawk-Dove game through conventional coding

*Endosemiotic*

Argyris Arnellos, Alvaro Moreno – Internalization of functions as a model of minimal semiosis in autonomous systems: Towards a scientific biosemiotics

Fatima Cvrčková – Periphrasis and paraphrasis in cellular regulatory pathways

Jan-Hendrik Servaas Hofmeyr – Modelling the cell as a formal system that writes its own production rules

*Zoosemiotic*

Almo Farina – Acoustic patterns of the Red-billed Leiothrix (*Leiothrix lutea*), an invasive species in the Mediterranean scrublands

Filip Jaroš – Felids, their coat patterns, camouflage and signs

João Queiroz, Frederik Stjernfelt, Charbel Niño El-Hani – Dicisigns in mimicry

*Human-animal*

Riin Magnus – The semiotic challenges of the guide dog and blind person team

Nelly Mäekivi – Communication in zoos and communicative zoo

Karel Kleisner – Seeing each other: An international comparison of the eye colour effect on perception of trustworthiness, dominance and attractiveness

***20 July***

*Processes*

Victoria N. Alexander – Creativity: The negation of self-reference through misinterpretation

Daniel Mayer – Hymenomorphism

*Information*

Kathrine Elizabeth Anker – Bio-logos: Asking for the logic of life through a study of artificial life art and biosemiotics

Vinicius Romanini – Biosemiotic information

Yagmur Denizhan – Information in biological individuation

*Historical*

Han-liang Chang – Iconicity and mimicry: The classical legacy and Peirce, and its biosemiotic aftermath

Davide Weible – Augustine and the ape: A biosemiotic investigation into the nature of life

Sergey Chebanov – Results of the development of biosemiotics

*Medical*

Marco Annoni – Meaning in medicine: Toward a biosemiotic model of placebo effects

Mette Miriam Rakel Böll – Neural and behavioural semiotics of fear

***21 July***

*Continuity*

Krystyna Bielecka – Symbol grounding problem and causal theory of reference

John Pickering – Why biosemiotics cannot solve the symbol-matter problem

Eliseo Fernández – Semiosis and phase transitions in biology: The place of biosemiotics within a genuinely evolutionary conception of nature

*Distributed*

Didier Bottineau – Making sense out of one's own actions: The case of human language

Stephen Cowley – Interactivity: Origins and consequences

Paul Matthew St. Pierre – Pointing, reaching, grasping, and tapping as self-signifying gestures: End-effectors, from pebble tools to smart devices

*Paradigmatic*

Ramsey Affifi – Not pedagogy but "biogogy": On linking biosemiotic and education research

Daniil Berezhnoy, Vera Serkova, Kira Nikolskaya – Semiotics as an instrument for animal cognition research: Experimental study

Sara Cannizzaro – Biosemiotics as systems theory: An investigation into biosemiotics as the grounding for a new form of cultural analysis

*Uexküllian*

Morten Tønnessen – On the notion of induced semiosis, with emphasis on anthropogenic semiosis

Ondřej Bradáč – Reflection of Jakob von Uexküll's thoughts from the point of view of Czech theoretical biologists and philosophers from Charles University of Prague

Torsten Rüting – Uexküll's contribution to an interdisciplinary concept of vision and knowing

# III. ABSTRACTS FOR THE 12th GATHERINGS

# Pre-seminar I
# Biosemiotics and the Study of Culture

## Introduction

The research interests of biosemiotics – sign processes in and between biological organisms – go far beyond the human cultural sphere. At the same time there are noticeable historical and cross-disciplinary relations between biosemiotics and several humanities, such as anthroposemiotics, linguistics, philosophy and human communication studies. To discuss connections and cross-influences between biosemiotics and the disciplines that study human culture, the Department of Semiotics at the University of Tartu organises a one-day seminar that precedes the conference Gatherings in Biosemiotics 12.

The seminar takes as points of departure the following questions: (1) how does biosemiotics influence the study of culture, given the biosemiotic understanding that human culture is surrounded by a multitude of other semiotic systems; (2) how can biosemiotic theories and methods be applied in various humanities; (3) in which ways is biosemiotics encumbered by its terminological and historical roots in the humanities; (4) is biosemiotics a global or a local science, considering the local peculiarities of cultural and natural environment; (5) what are the potentials and dangers of transdisciplinary hybridization, as expressed in biosemiotic criticism or literary biosemiotics, biohermeneutics, biosemiotic ethics, and others.

The pre-conference seminar will include 10 individual presentations and a round-table "Biosemiotics and the study of culture – possibilities, problems, perspectives".

*Timo Maran*

## Concrete vs. abstract semantics in mental images

NATALIA A. ABIEVA
Herzen State Pedagogical University, St. Petersburg, Russia

Of all biological species, humans demonstrate an unparalleled capacity for abstract thinking that enables them to develop complex sign-systems for information exchange. They successfully combine biological and socio-cultural semiosis, thus expanding their cognitive and communicative abilities to an unprecedented degree. Archaeological artefacts such as stone tools can be traced to the prehistoric times of *Homo habilis* (ca. 2.5 million years ago), being the earliest evidence of specifically human and intentionally created sign systems for social use. Over this course of time communally relevant codes have multiplied continuously. As of 100 000 years ago *Homo sapiens* successfully operated numerous sign systems among their more elaborate tools. The so-called cognitive explosion that occurred around 40 000 years ago showed a sudden increase in different types of manufactured artefacts, including prehistoric art. It was at about that time that, according to many specialists (Johansson 2005), our species acquired verbal communication. The recorded history that began about 6000 years ago shows a steady and continuous increase of semiotic competence in all fields of communal life – information exchange in human societies has become more varied and intense ever since. Human cultural evolution has passed several stages: pre-orality, orality, literacy and computer-mediated literacy (the latter still being in progress at the moment). Every new step introduced new codes that were incorporated into the existing ones, providing people with extra forms and channels of communication. Even at a glance it is evident that human cultural evolution demonstrates a steady tendency towards the intensification of abstract mental activity.

External sign-systems (language, tools, rituals, sociocultural patterns of behaviour, etc.) constitute a communally-shared total semioticon used for interpersonal communication. One of the key traits of all human cultural artefacts is their artificial and intentional character, which specifies human cognition and communication. According to C. S. Peirce's classification, the sign-systems created by humans can be divided into *iconic* (pictures, photos, realistic sculptures, onomatopoeia, etc.), *indexical* (knocks on a door, doorbells, etc.) and *symbolic* (natural and artificial languages – numbers, chemical and physical symbols, Morse code, etc.), all used as media in different communicative acts to unite people, coordinate their actions and help to realize

common goals. Icons and indices are usually described as simple or primitive signs of an analogue type that possess concrete semantics by preserving in their forms isomorphic characteristics of the denotates, while symbols are treated as difficult and complex, demanding high levels of mental abstraction to operate them. Deacon (1997) has demonstrated the hierarchical interdependence of icons, indices and symbols, the latter resting on the foundation of the analogue sign and being the most abstract of all. Despite the fact that the cultural signs listed above can be referred to as either analogues or symbols, nevertheless all of them are products of mental abstraction and intentional reflection, the degree of abstractness being different though. It is not quite correct to describe cultural icons and indexes as bearers of concrete semantics – their interpretation involves associative mechanisms that trigger processes with which the mind *classifies, sorts, orders, and organizes* facts, i.e. relies on the mental abilities that are included into higher-order abstraction. The question is – how could such specific abstract thinking develop inside the animal mind?

Archaeological evidence shows that the general logic of cultural evolution was from iconic and indexical artefacts of material culture to more intricate and complex forms of symbolic signs systems. In the course of time, symbols have become more and more indispensable in human communication, having taken the leading position among all cultural codes. The second key trait distinguishing humans' semiotic capacity is the ability to communicate via different codes *off*-line – when communicants are distanced in time and space. The hypothesis is that specifically human abstract thinking developed from the semantic form of interaction with the objects of the environment when the living organism operates the analogue (iconic and indexical) mental representations perceived *on*-line.

All external codes are rooted in internal mental processes of individuals, and there must exist some interior mechanisms of linking analogues and symbols. According to the dual-coding approach (Paivio 1971), all mental representations can be divided into pictorial and verbal, all together forming a mental lexicon that can be taken for the internal semioticon, because mental representations function as signs in information processing. In terms of evolution, mental images (internal icons and indexes) are definitely older, and abstract semantics had to mature within them before symbols were born. Even under the condition of so-called concrete thinking and semantic communication (Millikan 2004) via analogues, an individual has considerable competence in abstract categories and logical propositional thinking. Mental images are of a semiotic character as they substitute real objects and stand for them in mental processing. Even in the situation of *on*-line interaction, decision-

making relies not only on the spontaneous images of the objects perceived at the given moment, but on a sum of previously perceived and processed images stored in the memory of the individual. Visual perception initiates associative links in the memory, bringing out representations that ensure recognition of the objects and modalities accompanying them (Kosslyn, Tompson, Ganis 2010). That information deposited in the mind in analogue form is of abstract character as it contains the generic and most relevant data about the object. Due to learning, it is stabilized and constitutes the individual's knowledge acquired during his life-time. This interior abstract imagery is the foundation for externalizing in analogue form the codes communally relevant for information in early *Homo*.

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## Dog-human communication: Semiotic phenomenon on the verge of nature and culture

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Communicative interaction between man and dog is a unique natural phenomenon. For centuries a useful, at times indispensable assistance and a handy tool for man in many fields, currently the dog has become, in Western civilisation in particular, a companion, whose main task is to communicate with man. *Canis lupus*, on the other hand, is the only species which has acquired that extent of the

capacity to decode communicative activity of another species – *Homo sapiens*. Indeed, communication between man and dog is a unique phenomenon in this context, as it constitutes a communicative interaction beyond the traditional distinction of nature and culture, symbolic communication and non-symbolic behaviour. The subject of the presentation is an analysis, from the semiotic perspective, of these relationships as a cross-section of classical semiotics, whose subject and context is the cultural activity of man, and biosemiotics, with semiosis as a universal phenomenon of the animate world.

## Biosemiotic criticism: Modelling the environment through literature

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Biosemiotic criticism is the study of literature and other manifestations of human culture with an emphasis on the biosemiotic understanding that life is, down to its most fundamental levels, organised by sign processes (Maran, forthcoming). Such an approach means contextualizing human cultural activities within the environment that is semiotic because of natural signs embedded into material objects, and because of semiosic and communicative activities of other species. Manifestations of human cultural activities can be described in such a framework as being comprised of several layers of modelling process (Sebeok, Danesi 2000). In their relations with the environment, humans share with other animals zoosemiotic modelling, where signs are distinguished by the organism's species-specific sensory apparatus and aligned with its behavioural resources and motor events (Sebeok 1991). Verbal anthroposemiotic modelling is unique to the human species, and may link further to higher poetic, artistic, ideological or religious forms of modelling, denoted as 'secondary modelling systems' in the Tartu-Moscow school of semiotics (Lotman 1967). Whereas structuralist schools support the arbitrariness of the linguistic sign and the independence of literary representation from the environment, in the Peircean biosemiotic approach language is partially grounded in the material environment by iconic and indexical relations. Nature writing in this context can be considered as a sum of modelling activities of different levels, or in other words, every piece *of nature writing is essentially a model of the human relationship with nature, both*

*in its present state and as it is anticipated in the future.* By their modelled nature literary works can feed back to the human involvement in the environment and shape the material structures of the world.

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## George Eliot's hermeneutics of sympathy as a prefiguration of Hoffmeyer's semiotic freedom

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In recent accounts of biosemiotic history (Favareau 2010; Deely 2001) much emphasis has been put on the developing concept of sign and sign interpretation in relation to the argument that living organisms, from the most simple to the most complex (in humans for example) are sign making and sign receptive creatures, thus entailing a fundamental continuity between the natural and cultural world which Hoffmeyer has described in terms of semiotic freedom. However, this continuity has been prefigured in the nineteenth century by the Victorian writer George Eliot (1819–1890), who articulated the link between nature and culture through her concept of sympathy, which stems from her organic understanding of the natural world and its application to the interpretation of aesthetic practice as advocated by German Romanticism.

In this paper I shall look at the influences exerted on Eliot's thought by German Romanticism in order to show how these have informed her understanding of nature's creativity and human creativity in art as being related and interdependent, thus helping her develop the concept of sympathy as a

sign interpreting faculty, or rather as responsiveness and reciprocity in living systems, which echoes Hoffmeyer's concept of semiotic freedom.

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## The philosopher and the leaf insect

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Philosophy is sometimes thought of, among other things, as a poetry of concepts, its key activity being the imaginative generation of conceptual thought. This art of forming, inventing, and fabricating concepts is tasked with providing answers to the question, "how and what else can we think?"

However, even in this mode of imaginative thought, nonhuman animals barely register in the philosophical landscape as being worthy of consideration as sources and examples of such novel possibilities for philosophical ideas. Much like Ranciere's poor shoemakers, animals are to be drawn and measured, talked about and down to, but not invited into philosophy proper. Differences between philosophical ideas seem to disappear the moment the discussion turns to address animals.

With this in mind, the presentation will provide a series of musings on philosophical topics generated by placing particular species of nonhuman animals before the thinker's gaze: the dialectics of preying, the in-so-far-as cat, the embodiment of the death of living nourishment in leaf insects, and the praying mantises whom we all love.

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## Waste, innovation and emerging life forms

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According to Kull, "Ecological knowledge is not sufficient to understand or solve the ecological problems which humans face, since these are consequences of certain deeply semiotic and cultural processes, intertwined with ecological and biological ones" (Kull 1998: 366). The notion of residue or waste may be used not only as an adjective to the constitution of a material form, but also as a concept of elements that don't belong to a codified system, contemplating the possibility of connection and new configurations of fragments from apparently distant semiotic systems. The different manner in which waste or residual codes can be appropriated requires an intense ability of adaptation as well as the creation of new languages, by making systems more complex. Such flexibility towards adapting to environmental changes enables the expansion of living organisms and a new understanding of ecology. Living forms are altered not only in biology labs, but also by the changes humans generate in the environment. Although these are well-known events, these changes are considered casual mutations that should be ignored or "corrected" as deviations from the norm. The paper aims to analyse the generation and appropriation of material and informational waste by living organisms through the work of researchers and artists working with biology and technology that explore and expose these "deviations", not only as an ecological issue, but also as an innovative potential.

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## Semiotic animal in a transmodern world: Hovering between zoosemiotics and anthroposemiotics

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The dualistic separation between the realms of zoosemiotics and anthroposemiotics is a fallacy. Although the notion of "semiotic animal" is conceived to overcome the human-animal dualism, still many supporters of zoosemiotics remain anthropocentrically biased. And despite the fact that the late works of Darwin have radically changed the scientific perception and conceptualization of animal semiotics, the dualism remains distorted toward human idiosyncrasy.

Phenomenologically, however, zoosemiotics and anthroposemiotics are an integrated reality that cannot exist without both. In a transmodern world – which is characterized by diaphanous perception, cognitive revolution, inter-connectivity, and cultural metamorphosis – zoosemiotics is implicit in anthroposemiotics and vice versa, in mutually transparent, co-evolutionary semiotic processes. Diaphanous perception, which is the quintessential feature of transmodernity, is inclusive of modernity and postmodernity, and it does not reject the characteristics of either. Ironically, transmodernity has roots in an age-old tradition characterized by reciprocity between zoosemiotics and anthroposemiotics.

Human beings as semiotic animals are capable of developing awareness, relationships, and mediation toward semiosis with more-than-human systems. In this sense, the human species has an unlimited semioethical responsibility toward others – not just toward other cultures, but also toward more-than-human systems. Such awareness must be developed for the full recovery of the ethical dimension of semiosis that embraces not only humans but also more-than-human forms of life.

This paper attempts to recover the primordial relationship between human and more-than-human systems. Certainly, this recovery of integration has the potential to foster cultural transformation and environmental renewal in a world we as semiotic animals co-inhabit and co-interpret.

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## In the gaze of the other: Describing cultural affordances by conducting comparative umwelt mapping in animal studies

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The umwelt theory of Jakob von Uexküll is well known in biosemiotic circles. However, not many have undertaken to develop umwelt methodology as foundational for comparative studies. Umwelt theory can, for example, be applied to describing the manifold affordances of human constructions, artefacts, etc. from a non-human point of view. Whenever umwelten are discussed, the focus tends to be on each particular, "species-specific" umwelt. The human umwelt is thereby characterised as being fundamentally different from any animal's umwelt. But in the age of the Anthropocene – the global era of anthropogenic development – countless animals and other creatures regularly encounter human constructions, artefacts and waste (indeed, numerous life forms have adapted to such occurrences). How do the products of human civilization manifest themselves in the umwelten of other creatures?

This topic – which could also in some measure be conducted by way of a comparative study of humans as umwelt objects in non-human umwelten – can be organised in terms of four major categories, enveloping human products as perceived by non-humans

(1) in urban and household settings,
(2) in agriculture,
(3) in wildlife settings,
(4) in "the shadows of human civilization" (think of rats thriving in our sewage systems, etc.).

Some of these categories may overlap somewhat. In combination they represent the way our culture *qua human products* appears in the umwelten of non-humans – in the gaze of the other.

## Zoosemiotic theory in the analysis of nature writing

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Several theoretically-oriented ecocritical debates (Phillips 2003; Clark 2011) have pondered the question of interdisciplinarity: would ecocriticical analysis of nature writing benefit from informed interdisciplinarity (as designated in Love 2003)? If not, then what is the specific ecocritical method? If yes, then what are the other disciplines that need to be bonded with?

From a yet wider approach to methodological issues (Duranti 2005) it could be asked whether it is necessarily interdisciplinarity that is to be striven for? Perhaps it is trans-disciplinarity? The latter also implies a need for wider institutional co-operation that definitely is not a purely methodological issue. In any case, the pre-requisite for applying either of these approaches is still the definition of one's own disciplinary identity. Perhaps, then, it is informed theory-building (as expressed in Lynham 2002) that we need in order to conduct viable research.

In relation to the options mentioned above, my question is whether semiotics can be regarded as an all-embracing disciplinary identity and a foundation for theory-building which the development of ecocritical theory would benefit from relying upon. My particular examples stem from personal experiences in analysing Estonian nature writing by applying zoosemiotic theory (e.g. Tüür 2009). The traps, threats and benefits of such an approach are discussed in the presentation.

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## Cultural sedimentation parallels biological sedimentation: Embedded histories in Merleau-Ponty and Hoffmeyer

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This paper will demonstrate how Maurice Merleau-Ponty's philosophy of language anticipated the insights of biosemiotics as described by Jesper Hoffmeyer in *Biosemiotics: An Examination into the Signs of Life and the Life of Signs* (2008) and his recent essay "Semiotics of Nature" (2010). My particular focus will be on the species memory sedimented in human languages and cultural artefacts. Merleau-Ponty's chiasmic ontology describes a world in which we are individuals formed by differentiation within a spatial and temporal pulp, carrying in our bodies the history of our kind (1968: 114). Human language, literature, and art are our species' modes of self-reflection, or coiling back upon, the embedded histories of our various communities in ways that help us define and adapt to emergent realities. Hoffmeyer describes the interpretive activity of organisms at the biological level as functioning in similar ways for evolutionary natural selection. The biological lineage "maintains – and continuously updates – a selective memory (the momentary pool of genomes) of its past that in most cases will be a suitable tool for producing individuals capable of dealing with the future" (Hoffmeyer 2010:

33). Preservation and continual reinterpretation of cultural works, such as Homer's epics and Shakespeare's plays, enables the embedded histories of Europe and the Mediterranean world to shape the narratives and poetry of our own era, much as our bodies carry our particular biological inheritance forward. For Merleau-Ponty, the physical, visible world is not separate from the invisible world of ideas: "no one has gone further than Proust in fixing the relations between the visible and the invisible, in describing an idea that is not the contrary of the sensible, that is its lining and its depth" (Merleau-Ponty 1968: 149). Human language and literature, as well as other cultural behaviours, share features with other semiotic systems, e.g. ape and canine vocalizations and body language, beaver constructions, and structures made by bower birds. However, human cultural artefacts carry self-reflection and deliberate preservation to a degree not likely found in other semiotic systems.

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# Pre-seminar II
# Language and Life: The double interface

## Introduction

*Overview*

The Language and Life (L&L) meeting aims to be a forum where people create, respond to and elaborate echoes from a unifying question:
*What are language and languaging doing to us (as living beings)*?

*Background*

The L&L research cluster emerged from the Distributed Language Group. In this, the cluster's inaugural meeting, a number of invited parties will seek to connect their concerns with biosemiotic traditions. This is a step towards becoming a community with an interdisciplinary agenda. The focus falls on a 'double interface' that is lived by each human being. As part of the ecology, we are each part of a world (including other people) that links our evolutionary history with skills based on using techniques that link social institutions, artefacts and verbal patterns. Our lives are thus lived and mediated: each of us enacts a double interface. Therefore, as what lies beyond the skin changes, so do we. Oddly enough, if acknowledged, this is usually related to abstract concepts, such as 'economy' or 'discourse'. By contrast, our focus is on direct implications for the world of the living (and ourselves).

*Theoretical framework*

The distributed perspective on languaging and language breaks with both lay views and their scientization in linguistics. Language is *not*, we say, a set of words and rules (or constructions): such views fall foul of written language bias. By challenging 'code views', the distributed language movement aims to transform the language sciences.

On a distributed view, language is rethought around three central claims:

(1) Language animates the public world. As part of the ecology it is inextricable from human action and perception. As we act and think, we engage in *languaging*.
(2) Language and languaging are dialogical: as Bakhtin saw, to speak is to act by calling up the voices of others. This is equally true of silent thinking.

(3) Languaging is situated whole-bodied activity (that can be described by many measures) and is also *heard* around verbal patterns. Though speakers of a given community can repeat 'the words actually spoken' in local language(s), they cannot replicate neuro-behaviour – languaging never recurs. Language is therefore both situated and *non-local*: its patterns conform to the laws of physics without being strictly physical.

*Consequences*

The distributed perspective allows for many interpretations and developments: it claims only that language is both dynamical and symbolic; whole-bodied human activity can often be perceived as having a verbal aspect. Both verbal patterns and language-activity exploit many time-scales. However, in examining how languaging affects people-in-the-world, much depends on how biosystems constrain dynamical processes (as has been described in, for example, biosemiotics, ecological psychology and enactivism). Like other living systems, persons act as part of a world-environment which, of course, influences how other persons develop, learn and perceive. However, since language is also verbal (it echoes second-order constraints), techniques based in cultural history can be used to shape and enhance other modes of action-perception. Unlike other living systems, human actions connect up an abstract 'reality': culture and technology constrain how we develop, learn and perceive. This gives us a second interface.

The distributed perspective is broad (L&L is one of ten research clusters).[1] Our focus on the double interface arises because, with literacy, technology and information processing, human agency is exerting a growing influence on all life-forms. This appears to be a truism if the world is seen as reflected in discourse (whatever that is). However, on the distributed view, the bidirectional links of language and life are more far-reaching and intricate. Above all, it is emphasised that as the world changes, it impacts on both the ecology and human agency. In challenging the transparency of discourse, we turn to our theme: What are language and languaging doing to humans and other living beings? And that, of course, is an open question: while our lives matter to us, our practices favour/eliminate many kinds of living beings.

The link with biosemiotics is that we treat language as part of action/perception (and neural processes): rather than separating what Thomas Sebeok called first and second order modelling systems, we are concerned with their co-function – the effects on (and at) the human 'double interface'.

[1] See the Distributed Language group homepage at www.psy.herts.ac.uk/dlg/, and a list of key publications at www.psy.herts.ac.uk/dlg/dist-lang-links.html.

At this inaugural meeting, we are concerned with way-finding. Since language has an important collective dimension, our aim is to generate synergies and questions. We plan to build on group discussions animated by these Language and Lifers: Stephen Cowley (Hertfordshire, UK), Leo van Lier (Monterey Institute of International Studies, USA), Didier Bottineau (Paris West University Nanterre La Défense, France), Don Favareau (National University of Singapore, Singapore, Singapore), Gerald Ostdiek (Charles University, Prague, Czech Republic), Joanna Rączaszek-Leonardi (University of Warsaw, Poland), Susan Stuart (University of Glasgow, UK), Paul Thibault (University of Adger, Kristiansand, Norway), Morten Tønnessen (University of Stavanger, Norway), Ekaterina Velmezova (University of Lausanne, Switzerland), Dennis Waters (Genome Web, New York, USA).

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*Stephen Cowley*

## Main Programme

## Not pedagogy but "biogogy": On linking biosemiotic and education research

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Self-study in education research (which includes autoethnography, narrative inquiry, action research and other forms of practitioner inquiry) can be extended beyond the pedagogy of the classroom to include human relations with other species. De-anthropocentrizing education research depends on overcoming the division between humans, as subjects of learning and teaching relationships, and other species, as irrelevant, mechanical background processes. To do so, education theory and research would profit from approaches to life developed in biosemiotic theory. Biosemiotics, the study of the creation, interpretation, and interaction of meaning in life's signs, has made important advances in recovering the organism as subject, overcoming the same ontological presuppositions that materialistic, deterministic biology shares with anthropocentric education theory. However, the connections between education theory and biosemiotics have not been well elucidated. Some foundational concepts (such as umwelt, triadic sign processes, code-duality) and methodologies developed in biosemiotic theory can help re-centre the educator within a larger field of educative relations. I also argue that biosemiotic research may profit from first-person approaches developed in education research. Biosemiotic researchers are often situated within the very semiotic landscapes that they are studying and thereby modify the meaning-making activities of the very organisms they study. This is particularly true for zoosemiotic studies but is likely true even beyond this subfield. Self-study methods developed in educational research can deepen reflexivity and responsiveness through attending to biosemiotic research itself as a significant interspecific educational experience.

## Creativity: The negation of self-reference through misinterpretation

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In Peirce, as well as in the work of many biosemioticians, the semiotic object is sometimes described as a physical thing with material properties. I argue that

to the extent that we can avoid this kind of characterization, we may better integrate the various fields that interact with biosemiotics. I claim that the "semiotic object" is always ultimately the objective of self-affirmation (of habits, physical or mental) and/or self-preservation; it is never an actual physical thing. If "semiotic objects" are immaterial – effects more than things – their similarity to "emergent objects", "intentional objects", and "objectives" is more obvious, and we can better integrate the various fields from which these similar concepts derive. If signs are self-referential in the way I describe, then it can only be through self-mistaking (not self-negation as others have proposed), that learning, creativity and purposeful action are possible via signs. Furthermore, if we understand that semiotic objects are self-referential, we can better define an "interpretation" as a response to something as if it were a sign, but whose semiotic object does not, in fact, exist. If the response-as-interpretation turns out to be beneficial for the system after all, there is biopoiesis. When the response is not "interpretive" but self-confirming in the usual way, there is biosemiosis. While the conditions conducive to fruitful misinterpretation (e.g. accidental similarity of non-signs to signs and/or contiguity of non-signs to self-sustaining processes) might be artificially enhanced, according to this theory, the outcomes would be, by nature, more or less uncontrollable and unpredictable. Nevertheless, biosemiotics could be instrumental in the manipulation and/or artificial creation of purposeful systems insofar as it can describe a formula for the conditions under which new objectives and novel purposeful behaviour may emerge, however unpredictably.

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## Trans-somatic mindfulness

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Conventional biological models of the body echo a number of Cartesian dichotomies that assume developmental trajectories unfolding with a high degree of predictability. Engrained in that paradigm is the notion that evolutionary phylogenetic biological and developmental ontogenetic somatic

processes can be captured through linear, mechanical models that measure or even manipulate materiality, leaning increasingly on technology. Alongside these reductionist inclinations, models of linguistic meaning-making bog down in familiar models of grammar and brainmind localization of function. Meanwhile, emotion and other lived experience – as evidence of being and becoming within a mindfulness moment and within an umwelt – remain alienated from both physical and mental frames, stranding many other processes as well.

Here we explore a biosemiotically-informed approach toward an integration of meaning and materiality that addresses the manners in which the body experiences and portrays forms of intelligence, and how meaning-making fails to be contained within any convenient spatial or temporal units of analysis, from organs to organism to species and beyond. We focus on emerging evidence of meaning permeating and dissolving a medley of systems: experiential, linguistic, cultural, and biological.

The human habits of being in the world thrive on sensorial and neurological distinctions as ways of making sense of ourselves, our significant others, and our various environments, and by extension, the worlds beyond those of conspecifics – inclusive of imagined phenomena. Hence, meaning-making embracing mindfulness is not exclusive to the domain of human language games but also pertains to the behavioural, biochemical, and arguably aesthetic signs present among other living things and within the ecology at large.

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## Bio-logos: Asking for the logic of life through a study of artificial life art and biosemiotics

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Claus Emmeche (1994), in a study of artificial life and biology, poses the question: "What is the potentiality of life"? But what would be the most basic concepts in a contemporary definition of life?

Artificial life art explores the boundaries between biology and technology, and in so doing provokes current understandings of the organism as a living system. In this paper, I will combine a semiotic-hermeneutical approach to architect Phillip Beesley's kinetic sculpture *Hylozoic Soil*, with a theoretical, biosemiotic approach, focussed upon the dynamic relation between endo- and exosemiosic processes. In my reading, I view both artwork and biological organism as "text" (Kull 2002). Theoretically, I will look for discrepancies between the concepts of "mechanical process" and "information processing" versus "meaning making", as concepts central in defining living systems in both A-Life art and biosemiotics. This further evokes questions concerning the role of consciousness in "wet", organic matter.

The aim of this presentation is to introduce how contemporary technology-based art can deliver symbolic conceptualizations, which provoke current understandings of organic life and subjectivity. I will demonstrate the centrality of a semiotic framework, while philosophically seeking to conceptualize processes that are understood as basic to what it means to be living. My overall field is trans-disciplinary subjectivity studies, and the role of consciousness in the biological organism at large.

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## Meaning in medicine: Toward a biosemiotic model of placebo effects

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People are simultaneously biological and cultural entities. Accordingly, the ways in which meaningful stimuli are perceived, communicated and interpreted in clinical settings may have a decisive impact on the efficacy of medical treatments and patients' quality of life. As a growing number of researches on "placebo effects" demonstrate, meaning-mediated responses can be induced to modulate symptoms across several medical conditions and therapeutic contexts. However, two crucial issues are now at the forefront of any research aiming at assessing the role of meaning in medicine. The first is the necessity of rephrasing the misleading concept of "placebo effect" as to allow for the distinction and classification of different kinds of meaning-responses. The second issue, instead, impinges on the difficulty of reintroducing the concepts of meaning and agency within a theoretical paradigm in which explanations are given in terms of causal interactions between molecular substrates or visible neuronal correlates, and in which the production of new evidence relies on large-scale randomized clinical trials. In this respect, I will contend that a biosemiotic model based on Peirce's theory of signs provides a superior alternative to other approaches currently adopted to conceptualize meaning-mediated responses. In particular, I will argue that Peirce's conceptual triads of sign-object-interpretant and icon-index-symbol can be used not only to elaborate a working model to deconstruct the concept of "placebo effects" into its diverse basic components, but also as a source of theoretical insights for reconsidering the global role of meaning responses in medicine.

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## Phenomenology of psychoanalytic data: A biosemiotic framework

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Adopting a definition of 'biosemiotics' as referring to a hierarchy of meaning-forms when applied to a psychoanalytic model of mind, this paper presents a broad range of bio-semiotic phenomena, processes, dynamics, defences, archetypal and internalized interpersonal patterns, that in psychoanalysis commonly fall under the heading, the "unconscious."

Reconceptualised as interpretive data within the purview of a psychoanalytic discourse-semantic, this biosemiotic framework posits an epigenetic continuum of human meaning-organizations originating at basic organic levels, moving upward through biological, psycho-somatic and affective expression, proto-semiotic transmissions, represented forms, and finally to explicit linguistic signs and complex symbol systems.

In addition to assuming an uninterrupted epigenetic continuum crystallizing in hierarchic organization, this framework accentuates the multi-layered and increasingly condensed quality of higher, more elaborate organizations of meaning in human communication, drawing attention to persisting biological undercurrents in implied sense, intent, and motivation, all of which impact on repressive/defensive mechanisms.

Drawing from previous works in which my goal was to update Freud's first topographical theory of mind, we present the phenomenology of unconscious 'data' for the purpose of introducing a diverse range of non-linguistic signifying forms from which psychoanalysts infer mental processes and 'interpret' meanings. An important underlying premise regarding psychoanalytic data and its relation to the basic biosemiotic 'agenda' is that, until it is grounded in an updated developmental theory of mind inclusive of pre- and proto-

semiotic-forms, the term "sign" is merely an abstract linguistic 'label' rather than a mental *act* with antecedent developmental stages manifesting meanings through different forms and modes of expression. Drawn from the yields of the psychoanalytic semantic, our revised metatheory provides insights into the sensory-emotive origins of these unconscious layers of non-linguistic signification, thereby expanding our understanding of the formative attributes of the 'semiotic function' in human evolution.

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## Internalization of functions as a model of minimal semiosis in autonomous systems: Towards a scientific biosemiotics

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Hoffmeyer (1998) stresses the importance of 'inside exterior' and 'outside interior' as two conceptual categories that are reflected in the real world at

the relation between inside (the system itself) and outside (the environment) of a system. In this way, living systems are interwoven with the environment, although they are asymmetrically differentiated. The respective 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, and furthermore they specify its autonomy and its identity. As Moreno and Barandiaran (2004) suggest, such an in-out dichotomy, at its most basic level, is the basis for the formation of several such asymmetries at higher levels of organization. From a more biological point of view, Rosslenbroich (2008) suggests that the increase of autonomy, as a central aspect that characterizes macro-evolutionary innovations, should be considered as emancipation from the environment, based on an evolutionary shift between system-environment relationship, so that the generation and stabilization of intrinsic functions within the system is enhanced. We present several cases of spatial separation from the environment and of the internalization of functions in the phylogeny and ontogeny of living systems (the passage from prokaryotes to eukaryotes, cases of endo-symbiosis, endo-cytosis, etc.) as features of an increasing autonomy, and we discuss their semiotic nature. We then present a minimal model of internalization of functions in protocells (Arnellos, Moreno 2012) and we argue it can account for minimal semiosis in autonomous systems. Finally, we discuss the reasons why said model could provide the basis for a scientific biosemiotics.

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## Code biology – a new science of life

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Systems biology and the modern synthesis are recent versions of two classical biological paradigms that are known as structuralism and functionalism, or internalism and externalism. According to functionalism (or externalism), living matter is a fundamentally passive entity that owes its organization to external forces (functions that shape organs) or to an external organizing agent (natural selection). Structuralism (or internalism) is the view that living matter is an intrinsically active entity that is capable of organizing itself from within, with purely internal processes that are based on mathematical principles and physical laws. At the molecular level, the basic mechanism of the modern synthesis is molecular copying, the process that leads in the short run to heredity and in the long run to natural selection. The basic mechanism of systems biology, instead, is self-assembly, the process by which many supramolecular structures are formed by the spontaneous aggregation of their components. In addition to molecular copying and self-assembly, however, molecular biology has uncovered also a third great mechanism at the heart of life. The existence of the genetic code and of many other organic codes in nature tells us that molecular coding is a biological reality and therefore we need a framework that accounts for it. This framework is code biology, the study of the codes of life, a new field of research that brings to light an entirely new dimension of the living world and gives us a completely new understanding of the origin and the evolution of life.

## The integrated and the interactive realms in relation to biosemiosis

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After a presentation at the 10th Gatherings in Biosemiotics in 2010 concerning the presumed effects of the lunisolar tidal force upon plant behaviour, the question was asked: "Where is the signal?" Subsequent consideration of behavioural activities in various organisms (plants, crabs, iguanas, mice, gerbils, etc.) in relation to lunisolar tidal variation has indicated that what

was presented at the Gatherings, as well as the question which followed, were rooted in a 'Newtonian' approach to science which posits cause and effect, and is allied with theory-oriented experimentation. However, it is possible to consider scientific investigation from another perspective, which contrasts with the former approach: the perspective of 'exploratory experimentation' (Ribe, Steinle 2002). Here, the emphasis is on using experiments to discover the conditions or influences which are necessary for the phenomenon under study to become manifest, and to explore the nature of the links between related observations. In some ways, these two strategies, the Newtonian and the Exploratory, are akin to the Apollonian and Dionysian ways of science described by Albert Szent-Györgyi (1972). The initial problem, therefore, of how the Moon can 'signal' to life on Earth might benefit from this alternative, exploratory attitude. Then, not only might this guide the relevant observations about plant and animal behaviour towards an acceptable, and necessarily novel, hypothesis, but also might indicate how such behaviour casts light on the boundaries of biological organisation, which either permit or exclude biosemiosis.

Behavioural patterns are often directed towards an organism's search for energy. This applies not only to plants, which search for light, minerals and water, but also to both marine and terrestrial animals, which search for alimentation. In relation to the time-courses of this foraging behaviour of marine animals, the marine tides are widely supposed to play an important regulatory role, setting the times of activity and rest. Foraging activity is similarly regulated by natural rhythms of light and darkness. Marine tidal cycles stand proxy for rhythmic variations in the lunisolar tidal acceleration, which is evidenced in the wave of deformation that travels over Earth's spheroidal form, resulting from the gravitational attraction between the Earth and the Sun and Moon. This force may be estimated in terms of minute variations in Earthly gravitational acceleration ($m\ s^{-2} \times 10^{-8}$). Because the lunisolar 'gravimetric' tide (as we may call it) cannot be annulled, it can never be proved beyond doubt by experimental means that any temporal pattern of diurnal biological activity is not due to a corresponding temporal variation in the geophysical gravimetric tide. Studies of biological rhythms do, however, attempt to annul many other candidate entraining influences, such as night/day cycles. Shore-dwelling crabs, for example, can be removed from their native tidal environment and placed in constant, free-running conditions in the laboratory, e.g., in continuous low-level light and constant temperature. Yet under such conditions crabs continue to display activity patterns that appear to track the rhythm of the marine tides to which they were previously

exposed. These transplanted laboratory crabs had, therefore, either preserved a detailed memory of their native marine tidal timing, or else they were subject (like their native marine environment) to the inescapable lunisolar gravimetric tide. Because, as already mentioned, it is not possible to interfere with or interrupt the gravimetric tide, the problem of what factor – marine or gravimetric – regulates animal activity seems insoluble. Nevertheless, two lines of recent evidence can be singled out which argue for a lunisolar involvement in behavioural rhythms.

Firstly, crabs will shed eggs in the constant environment of the laboratory. When these are fertilised, larval development will proceed. The free-swimming larvae, in turn, display a diurnal pattern of vertical migration within a water column. The rhythm of swimming upwards and then downwards follows that of the marine tide in the nearby location from which the progenitors of the larvae were collected (Zeng, Naylor 1996). However, because the larvae had never directly experienced any marine tide during their life, it is conceivable that they are responding solely to the local rhythm of the lunisolar gravimetric tide, as detailed analysis of the data indeed indicates (Barlow, in preparation).

Secondly, a completely different set of observations was made in Brazil. It related to the temporal pattern of spontaneous, ultra-weak emission of photons from germinating wheat grains (Gallep *et al.* 2012). This biophoton emission is naturally rhythmic; and this rhythm is synchronised with the co-locating gravimetric tide, experienced at the observation site. Then, in a subsequent experiment, wheat grains were translocated from their source in the Southern hemisphere to the Northern hemisphere. Biophoton emissions were then recorded during simultaneous germination tests in both the Northern and Southern locations. In these tests, the respective rhythms of emission were synchronised with the rhythms of the gravimetric tides at each location.

From each of these sets of observations it may be inferred that there is (a) no retention, or memory, of a rhythm – as in the case of the wheat grains, and (b) no inheritance of a biological analogue of the marine tide, or some other rhythm – as in the case of the crabs. The biological rhythms are not inherent to the respective organisms, but seem more likely to be imposed upon them in accordance with the rhythmic orbital motions of Earth and Moon around the Sun.

The rhythmic, biological events mentioned earlier show up at the level of organs (e.g. leaf movements and root growth variations in plants) and organisms (activity patterns in animals and biophoton emissions). Yet, they all may trace back to events at a common, cellular or sub-cellular level, possibly in the form of movements of quantal molecular aggregates into and out of cells

via exosomes. In animals, the quantal aggregates and exosomal structures may also correspond to the neuronal synaptic vesicles and their contents (Beck, Eccles 1992) and, hence, be related to animal neuromuscular locomotory activities. In plants, the aggregates are units of $10^8$ water molecules, and their transcellular movements translate into variations of cellular volume. The rhythmic movements of these quantal aggregates are hypothesised to be governed by processes lying within the domain of quantum physical theory (Dorda 2010; Barlow, Fisahn 2012), and may show analogies with the Quantum Hall effect. It is within this quantum domain that Sun-Moon-Earth orbital motions exert their effects upon biorhythms.

The fact that organisms respond to lunisolar gravitational forces suggests that a very primitive phenomenon is operating upon them – a force that was present at the dawn of life itself. The writer and scientist, J. W. von Goethe, was the first to propose the notion of such a primitive factor within the scientific domain: he called this an *Urphänomen*, or Primal Phenomenon. The lunisolar tidal force and all that is contingent upon it may comprise such a primal phenomenon. The experience, by an organism, of the variable gravimetric tide within its own structure, and the manifestation of this, now organic, variation within its pattern of activity, is an expression of the organism's integration within what might be called a 'systemic tetrad', or holon, of Organism–Sun–Moon–Earth. Put another way, and to paraphrase a statement of Henri Bortoft in connection with the topic of 'wholeness', the universal (i.e. the holon) is seen within the particular (i.e. the experience), and the particular is a living manifestation of the universal (Bortoft 2010: 22). Thus, the answer to the question of where the signal of the putative lunisolar-driven biological rhythm is located (and where its receptor is located, also), is that it is both nowhere and everywhere. The rhythm is within the fabric of the holon.

Goethe remarks that "The difficulty is [...] to recognize a primitive phenomenon [i.e. the *Urphänomen*] in phenomena that are conditioned and concealed [in] a thousand different ways" (Eckermann 1998). Hence, taking into consideration not only the above-mentioned theoretical ideas but also the observations of organismal behaviour in relation to lunar phases and orbital movements manifested in the gravimetric tide and its amplitudal variation, it is evident that the world of biology is comprised of two interpenetrating and co-located realms. The first realm is of primal phenomena, the second is of derived phenomena. The former, as noted, lies in the particularities of the organism within its universal holon. The latter realm is one in which organisms and their components interact amongst themselves and their immediate environment, or umwelt, which they themselves help to create. It is, moreover, a realm in which

biosemiosis displays its power to bring into being the higher organisational levels from which clans, societies, nations, and so on, are formed.

The interpenetration of the two realms often renders the primal phenomena 'invisible' under the cloak of the derived phenomena. This is a difficulty which Goethe noted. And it is a difficulty in interpreting the published time-courses of diurnal activity of crabs, for whereas activity patterns receive some entrainment from the umwelt, such as periods of light and dark, and the timing of the high and low marine tides, the manifestations of the primal lunisolar regulatory phenomenon, which interlocks with the marine tidal rhythm and the resultant derived biological phenomena, can only occasionally and partially – and tantalisingly – be glimpsed; and, it may be said that these glimpses are revealed by exploratory experimentation. Under free-running conditions in the laboratory, however, the native umwelt is reduced and the outcome of the primal phenomenon more clearly manifests – except, that is, in those cases where the properties of the umwelt have penetrated the organism so deeply that they have been assimilated into the expression pattern of certain genes (Whitehead *et al.* 2009)!

Primal phenomena are also embedded within the morphogenetic processes which bring about the development of organic form. Newman *et al.* (2006), for example, discuss such phenomena; these manifest as free diffusion, reaction-diffusion systems, oscillations, gradients, and other physico-chemical features relevant to the morphogenesis of multicellular organisms. Into this category of primal phenomena could be placed also the autoreproductive origination of cellular patterns. With respect to plant tissues, these patterns can be formalised via L-systems, as was discussed in a preliminary session to an earlier Gatherings in Biosemiotics (Barlow, Lück 2006). In addition, such a mode of autonomous biological patterning contributes to the branching structure of whole plant bodies. Interestingly, in this connection, the primal phenomenon encapsulated by the L-systems not only for cellular branching, but also the branching of plant parts has, as its outcome, what Goethe would recognise as an *Urpflanze* [primal plant], to use his term. Moreover, the transformations inherent to L-systems lead towards what Goethe gathered into his *Versuche die Metamorphose der Pflanzen zu Erklären*. One important derived phenomenon attendant upon morphogenesis, and which is linked here with the umwelt and biosemiosis, is observable in the plasticity of form, of which plants offer many excellent examples.

Thus, in conclusion, we are left with questions about (a) whether primal phenomena had a role in the origin of life; (b) whether they give rise to derived phenomena and, if not, then (c) whether primal phenomena can be, or have

been, coerced, or assimilated, into co-operation with derived phenomena; and (d) whether this latter question about assimilation is relevant to the explication of life. The genetic code may be one momentous example of this assimilation of the primal into the derivative state. Biosemiosis is a derived phenomenon, and is clearly integral to the development of the above-mentioned holon of the systemic tetrad. In this respect, biosemiosis is a vital process for furthering the evolution of high levels of organisation – of societies on Earth, and beyond, within the Cosmos.

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## Barbieri's organic codes, genomic error-correction, and semantic feedbacks

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Conserving genomes need error-correcting codes in order to make them resilient to casual errors, organized as nested component codes successively established during the geological ages. Barbieri defined organic codes as sets of unidirectional correspondence rules between sequences made of elements otherwise unrelated, as exemplified by the oldest one, the 'genetic code'. Their rules result from conventions as arbitrary as the semantic relations between words and objects in human languages.

Establishing each new organic code resulted in a major transition in life evolution. Error-correcting codes result from imposing constraints to a set of sequences. Those used in communication engineering are conveniently defined by mathematical equalities, but constraints of any kind can be contemplated. Biological sequences incur physical-chemical and linguistic constraints which similarly endow them with error-correcting ability, thus defining 'soft codes'. Organic codes necessarily involve soft codes which moreover assume a nested structure, since they were successively established during the ages. The concepts of genomic error-correcting codes and of organic codes thus converge, although their respective starting points, information theory and molecular biology, were very different.

The concept of semantic feedback is introduced for explaining how molecular mechanisms established and maintain organic codes. It accounts for the stability of the 'genetic code', its universality and conservation, and explains why the establishment of other organic codes endowed genomes with further linguistic properties and improved error-correcting ability, while enabling the evolution of life.

## The closed-loop coding-decoding concept as joint between biosemiotics, cybernetics and biophysics

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The comparative analysis of biosemiotics, cybernetics and biophysics is performed on the theoretical basis of the informational closed-loop coding-decoding control (CL-CDC) concept. Today biophysics is not only physico-chemical biology, but according to Aristotle's conception of physics, has become a fundamental bio-theory of life and living systems. Miller's living systems theory alleges that space and time, matter and energy, information and entropy, are conceptual factors in different levels of life's organization (Miller 1978). The essence of life and living systems is their organization on the basis of bio-informational technology. The biosemiotician Jakob von Uexküll's umwelt scheme is a typical cyber-CL-CD control structure for linking the environment with the organism (Uexküll 1920). That coding procedures are the general principles of living cells' functional organization is recognized by biosemioticians and biologists (Barbieri 2003). Kalevi Kull discusses the commonalities between biophysics and biosemiotics in the terms of traditional physico-chemical biology (Kull 2007).

The biophysics of the twenty-first century marks the beginning of radical changes. Biophysics is transforming into a fundamental life science, as the organized systems of bio-technologies. The last decades of research point to a conceptual turn in biology toward technology. "Conceptually at least, biology is becoming technology. And physically, technology is becoming biology" (Arthur 2009). Another word for this is "Wetware: a computer in every living cell" (Bray 2009). The techno-engineering approach to the interpretation of wildlife was already visible in Aristotle's physics, as in his statement – "technology mimics nature." Aristotle explained physics as living and non-living nature. Non-living nature has been interpreted in *dynamis/potente, energeya*, and for living nature interpretation was a necessary *entelecheia* – purposeful, goal-oriented activities involving life force. Descartes forwarded the point of view that living organisms are inherently dual – brain and mind, body and soul. Śniadecki's approach to living matter asserts that the essence of life consists in the functional and organizational skills that determine the appropriateness of a special "*organizing force*" (Śniadecki 1804). Today we call it a specialized information technology (genetics, molecular signals, hormones, neuro-networks, pheromones, sound signals, etc.) that helps control the

animal's organs – the technological means for managing the behaviour of living organisms. Later, Johannsen coined the genotype-phenotype distinction, which today is understood in terms of information management by means of CL-CDC procedures. Schrödinger studied the basic element of life, the cell, and concluded that "life feeds on negentropy," and that "the known laws of physics are not sufficient to explain life."

Negentropy brought the idea that the living organism in a limited space can reduce its own entropy to increase its functional organizational skills at the expense of environmental resources. It shows that life is organized as a functionally targeted technology system, controlled by the special structure of biological information-technology (genetic, hormonal, nervous), by means of closed, cyclic (recursive) operations in the coding-decoding circuits of CL-CD systems. The bio-info technologies that determine the essence of life are always made from material-signals (*hard*) and intangible (*soft*) technologies. The *hard-soft* concept eliminates the misunderstanding between physicists and cyberneticists on the concept of information, as well as between biologists and biochemists.

The quality reductions of entropy, which are the organizational skill-enhancing properties of the system, are acquired by information technology. The essence of the organized system is to help fight against the second law of thermodynamics. This bio-engineering technological approach was already seen by the pioneers of bioinformatics (Gamow, Yčas 1956). Biosemiotics recognizes life as a self-productive technology system (Sharov 1999). Such an integrated life science that combines physics (atoms), chemistry (molecules), cybernetics (information control), organizational skills and technology into a coherent scientific system is a fundamental science of our time, leading to the future convergence of Nano-Bio-Info-Cogno-Eco (NBICE) technologies. It is the future of basic science – biophysics (Kirvelis 2010).

The concept of biosemiotics was introduced by the human sciences, because researchers were disappointed with the open coding-decoding of Shannon's information theory, which rejects the semantics of coded signals. Meanwhile, the concept of closed coding-decoding (CL-CDC) joins information-signals and physical processes in functionally organized semantic procedures. The CL-CD concept organizes a unified system based on cybernetics as semiotic systems with semantics.

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## Semiotics as an instrument for animal cognition research: Experimental study

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The main, irreducible difficulty in the research of cognitive processes in either men or animals is caused by the impossibility of their direct observation. However, I. M. Sechenov (1878), going far ahead of his time, proposed the linguistic method as the instrument for cognitive processe investigation, because it concentrates on the language – the basic cognitive mechanism and system of signs representing the information.

Taking this idea as a basis and using semiotic concepts we develop the systemic-informational approach (Nikolskaya 2005), which states that the experimental environment is a bearer of signs, and the animal is a bearer of sign-operating rules. The animal's goal is to recognize three types of information: syntactic, semantic and pragmatic, and the experimenter should find out how the animal has done it. To create the sign system we have virtually marked every spot of experimental environment with a symbol and developed a matrix of signs representing the environment. Thus, animal behaviour is represented as the forming text. A full spatial "alphabet" has been considered as an initial matrix of the syntactic information. The symbols coding operant elements, defining the structure of the task, we have referred to as the semantic information, and the set of animal operant actions had been treated as the pragmatic information.

The experimental data, acquired on different animals including fishes, reptiles, rodents, predators, primates, testifies that the semiotic approach allows us to observe the dynamics of cognitive activity organization, individual differences in the manifestations of cognitive abilities and the properties of the psycho-emotional pattern and memory functioning in a normal state and during various functional and pathological influences.

## Symbol grounding problem and causal theory of reference

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The symbol grounding problem in AI and robotics concerns both the theoretical and the practical possibility of the creation of an artificial cognitive system that exhibits autonomous semantic abilities that assure a connection between symbols/concepts and their referents. As Floridi and Taddeo's (1990) analysis of semantic autonomy demonstrates, the activity of the system possessing that autonomy must be compatible with the *zero semantic commitment condition.*

The most basic problem with causal theories (such as early Wittgenstein's theory of meaning, Kripke's causal theory of names or Field's project of conceptual-role semantics) is that they have problems with reference, and they either stipulate some form of direct connection (causal or not) between the symbol and the referent, or simply leave the reference undetermined. The same difficulties appear in projects that were supposed to show how to solve the grounding problem, as suggested by Harnad (1990), Taddeo and Floridi (2007) and Steels (2007).

I will focus on the inevitable difficulties that every causal theory of reference faces, using some examples from robotics and A.I. as the detailed development of solutions to the philosophical issue of reference in terms of causal connections. I argue against a quite popular claim that the symbol grounding problem has been solved thanks to a sensorimotor approach to meaning (Varshavskaya (2002) inspired by Brooks (1990) or Billard and Dautenhahn (1999)), to show some crucial difficulties for the causal theory of reference concerning higher-order levels of representation, learning abilities, social coordination and their evolutionary development. I suggest that only by going beyond the simplistic causal story may we have a plausible solution to the grounding problem.

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## Biosemiotics: Enhancing on the concept of chemical systems

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Biosemiotics – the science of signs and symbols and how living organisms interpret them – is a fascinating study especially within the context of system-environment interactions. Erwin Schrödinger may have unwittingly started the discourse that triggered the birth of this trans-disciplinary science when he asked *What is Life?* in 1944. Several attempts have been done to answer Schrödinger since then and different frameworks and theories have been made (Favareau 2006). From the series of studies and theories, Battail (2010) came up with the proposal that information should be taken as the third component of chemical systems, particularly those called living systems.

The introduction of information as a third component of a chemical system, particularly in a living chemical system, neatly wraps up a good elementary answer to Schrödinger's basic question of "How can the events in space and time which take place within the spatial boundary of a living system be accounted for by physics and chemistry?" Then the question emerged, whether introducing information as a third component of a chemical system "gives the signal" that chemistry is an everyday occurrence and will thus make chemistry more understandable and more appreciated by freshman chemistry students. This paper reviews biosemiotics and reports on how a "chemical system" version of the human body helped revise students' view of chemistry, the "terror science".

Although the objective of the study was to find a strategy to help students appreciate chemistry more, the study posited a new thought: was the new concept highly appreciated because students recognized that information is an inherent component of a living chemical system, or was it because it was completely new that all were enthusiastic about its novelty? Qualitative indicators showed that appreciation for chemistry skyrocketed with this approach. However, while it would be easy to conclude that the objective of the study was met, it has to be admitted that the jury is still out on biosemiotics and would likely stay out for a lot longer.

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## Making sense out of one's own actions: The case of human language

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Human language is commonly considered as (i) a formalism that supplies subjects with lexical distributions and grammatical patterns providing "mental

representations" aimed at schematizing the material world of empirical experience, and (ii) a socially-grounded system of practices that provide subjects with procedures aimed at encoding and decoding representations in intersubjective interaction on the basis of a common set of standard routines. This definition falls short from accounting for crucial elements in the phenomenological construction of languaging as it is experienced by subjects in everyday practice: (i) languaging is not about forms, but about the dynamic production of perceivable effects through motoric actions of the body; to speak is to behave in an intersubjectively interpretable way. Even written texts fall under this definition once reading is taken into account as an uncircumventable phenomenological mediation between the subject and the object; (ii) languaging is not only for intersubjective communication, it is also for inner thinking (endophasia): a mental simulation of the motor / perceptual loop that is instrumental in the conduct and control of the production of meaning. Languaging is best defined as a behavioural system enabling the conduct of semantic processes through embodied action via motoric-perceptual couplings: to speak is to behave corporally (somatically or imaginarily) in such a way as to produce, either for oneself or for others, the perceivable or imaginable events and accidents required for the production of meaning *in a social format*, along the lines of procedural gestures provided as models by social routines grounded in intersubjective interaction. Languaging is not required for the exercise of "intelligence" and "thinking" in general: just perceiving a scene and intervening in it is enough to produce meaning by attributing affordances and values and paving the way for personal inscription in the world through action and well-being. In this respect, the specificity of languaging is that it uses words, which are by definition *segments of quotes abstracted from other speakers' previous speeches* (including one's own), truncated quotes whose dialogic depth and interactive reproduction will be reminiscent of chains of knowledge acquired first and foremost in the context of previous interaction with others (and very secondarily in the context of pragmatic interaction with the objects themselves, which need not exist – hence the possibility of abstraction). Languaging also uses "grammar", a set of vocal operators (morphology), sequential patterns (syntax) and fluctuations in tone, tune and rhythm (prosody) enabling the formation of complex combinatory patterns and conceptual constructions that do not reflect the perceivable "world" (if this means anything) but, rather, reproduce traditional models of elaboration developed in the history of the collectivity practising them. Languaging is thus an "amplifier of intelligence" – it increases the potentialities of biosemiotic processing in a specific ethological domain

of behaviour characteristic of the human species, and each "language" is a relatively closed system – a system of consistent practices characterizing socially formatted biosemiotic vocal procedures in a given human community. The goal of this paper is to present those principles, sketch the connections with biosemiotic tenets, and illustrate the phenomena through examples from a wide range of languages and verbal practices.

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## Reflection of Jakob von Uexküll's thoughts from the point of view of Czech theoretical biologists and philosophers from Charles University in Prague

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The goal of this article is to briefly introduce Jakob von Uexküll's concept of umwelt, described in his books *Streifzuge durch die Umwelten von Tieren und Menschen,* and *Bedeutungslehre* and to confront this theory with its 21$^{th}$ century reflection from the point of view of theoretical biologists and philosophers from Charles University in Prague, Department of History and Philosophy of

Natural Sciences, based on Kleisner and Kliková's anthology *Umwelt* (2006). Another goal of this article is to try to show which parts of Uexküll's thought system can be considered outdated in the contemporary context, and which parts of it can still be inspiring for contemporary biosemiotics and biology in general. In this article I concentrate on parts of Uexküll's paper which are subjects of a possible critical discussion, which is the problem of spontaneity of living beings, the problem of implicit necessity of a transcendental agent behind the score of nature or the question of evolutionary dynamics in the world described by Uexküll's concept. Through the critical discussion, Uexküll's theory is brought into a contemporary context and the possible ways it could influence contemporary biological and biosemiotic thoughts are revealed.

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## Neural and behavioral semiotics of fear

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Fear is a component of a vast amount of behaviours, reported and investigated throughout the animal kingdom. Fear is also a common research object in neuroscience, as it has proven recognizable across species boundaries in both brains and behaviour (e.g. LeDoux 1998; Kandel *et al.* 2000). This talk will highlight the overlaps between the neuronal and behavioural aspects of fear. It will investigate the concept of Hebbian plasticity with the well-known quote "neurons that fire together wire together" in a biosemiotic framework. In addition, the newly generated idea of emotional styles (Davidson, Begley 2012) as well as the somewhat older idea of mirror neuron systems (Iacoboni 2008) will be considered and discussed in a biosemiotic context of interpretation, following an evolutionary trait from fish (Chandroo *et al.* 2004) to human beings. Linkage will be made to such fields as social and affective neuroscience (Davidson, Begley 2012; Iacoboni 2008), human health (Kandel *et al.* 2000; LeDoux 1998), ethology and evolutionary biology, as well as biosemiotics.

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## Biosemiotics as systems theory: An investigation into biosemiotics as the grounding for a new form of cultural analysis

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In 1984, M. Anderson *et al.* stated that semiotics is fundamentally concerned with systems, however "semiotics has seldom dealt with dynamical systems as a whole, those nonlinear, irreversible realities where energy explicitly fuses with information, such as experience, ontogeny and phylogeny" (1984: 25). Hence this paper sets out to explore the relation of biosemiotics to systems theory and cybernetics. The investigation of the 'disciplinary' and historical overlap between theories of modelling in biosemiotics and in systems theory is carried on following the example set by Deely's *Archaeology of Concepts* (Deely 1981). Initially, it is argued that systems theory and biosemiotics share a perspective based on a systems thinking which is grounded in *transdisciplinarity* and in a *dynamical* and *functional* approach to systems. In

this respect it is argued that such a common methodological perspective is an instance of historical continuity. Subsequently, it is argued that cybernetics and biosemiotics' systems thinking fundamentally differ in their take on 'information'. In fact, biosemiotics broadly conceives information in terms of Peirce's notion of *abduction*, whereas cybernetics conceives information in terms of logical *constraints*. Such a methodological difference is argued to be an *uneven development* (Althusser 1965). My conclusion will underline how cultural analysis after a biosemiotics will need to take into account the benefits that both biosemiotics and cybernetics bring to the understanding of cultural systems. In particular, it is hoped that biosemiotics-as-systems theory will mitigate the unscientific character (which amounts to logo-centrism, text-centrism, excessive emphasis on representation and narrowcasting the scope of analysis to unmasking ideology) that seems to characterise contemporary disciplines in the humanities (e.g. media studies) which make an ill use of semiotics.

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## Taste as an indicator of plants' healing powers

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Plants have been used by man as remedies since time immemorial. Although many healing properties were known by tradition, people were often trying to search for some signs how to recognize the virtues of particular plants. On that account, certain theoretical concepts, which help to decode the secrets of the power of plants, were established. Probably one of the more popular ones is the doctrine of signatures – the therapeutic effects were identified

by similarity between a human organ and the plant or some part of it, or by some other analogy. Many studies have dealt with this topic (Foucault 1966; Copenhaver 1990), some from the semiotic point of view as well (van den Broek 1987).

But there is still another theory, no less interesting, according to which the healing powers of plants can be recognized by taste. Taste informs us about the elemental composition of each plant (whether fire, water, earth or air prevails). It is based on the assumption that taste is the basic sense for all creatures, signalling whether something is good for our nutrition or not. There is a spectrum of tastes starting with sweet – which is the most suitable taste for our body and serves as nutrition – and ending with bitter, which is the best taste for medicaments. We will explain this theory in more detail on the example of renaissance herbals; then we will discuss its ancient sources and, on the other hand, compare it with the current situation, where medicine uses many taste-masking strategies to deceive our senses.

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## Iconicity and mimicry: The classical legacy and Peirce, and its biosemiotic aftermath

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In his well-known essay, 'What Is a Sign?' (CP 2.281, 285) Peirce uses 'likeness' and 'resemblance' interchangeably in his definition of icon. The synonymity of the two words has rarely been questioned. Curiously, a *locus classicus* of the pair can be found in Plato's late dialogue the *Sophist*, where the mysterious 'stranger' makes the famous distinction between *eikon* (likeness) and *phantasma* (semblance) (236a,b). For all his broad knowledge in ancient

philosophy, Peirce never mentioned this parallel; nor has any Peircean scholar identified it. There seems to be little problem with *eikon* as likeness, but *phantasma* may give rise to a puzzle. Plato uses two pairs of words: what *eikon* is to *phantasma, eikastikhn* (the making of likeness [235d]) is to *phantastikhn* (semblance making [236c]). In other words, icons come into being because of the act of icon-making, which is none other than indexicality, and the idea coincides with Peirce's discussion of indexization of iconicity. The Peircean example of photographing and the Platonic discussion of painting and sculpturing in the *Sophist* clearly show the physio-pragmatic aspect of iconicity. The paper will reread Peircean iconicity by closely analysing this relatively obscure Platonic text. It will extend the discussion to the biosemiotic advances of iconicity since the seminal essays by René Thom and Paul Bouissac in the early 1980s.

## Results of the development of biosemiotics

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The history of the formation of biosemiotics can be divided into three stages.

1. Prehistory of biosemiotics: a) before the non-anthropomorphic period (until the 18$^{th}$ century); b) the non-anthropomorphic period (from the end of the 19$^{th}$ century to the first half of the 20$^{th}$ century); c) the period after the decoding of the genetic code (in the middle of the 20$^{th}$ century).
2. The initial stage of biosemiotics: a) origin (1960s–1970s); b) self-comprehension and maturing (1980s); c) explosive growth (1990s); d) academization (2000s).
3. The initial period of academic history (2010s).

The results of this development are:

- Expansion of semiosphere borders (displacement of the semiotic threshold and the inclusion of all biological life into the semiosphere) and semiotic borders.
- The formation of semiotically realized biology and the folding of its relations with biology in the perspective of the humanities.
- The appearance of biosemiotics as a kernel of semiotically realized biology and an initial institutionalizing of biosemiotics. Appearance of

corresponding literature (including periodicals), training courses, professional organizations and communities.
- Biosemiotics finds a place among the other variants of semiotically realized biology – biohermeneutics, biophilology, biolinguistics, biopragmalinguistics.
- Reconsideration of the status of natural sciences and a revision of the parity of borders between nature and culture, and areas of knowledge studying them.
- The contribution of biosemiotics to the development of new outlooks in philosophy and religion (including the formation of new directions in philosophy and divinity).
- The influence of biosemiotics on applied areas of human activity (medicine, agriculture, forestry, fish culture, beekeeping, applied ecology, etc.).

As a result, it is possible to say that biosemiotics has begun to play an important role in the deduction of the unity of modern culture by providing connections between nature and culture, knowledge in the humanities and the exact sciences, as well as their different divisions.

## Codes and their interpretation in endobiosemiotics

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Marcello Barbieri (2001) has argued that endosemiotics is different from exosemiotics in biology, contrary to Jesper Hoffmeyer (2008), who has argued that the two have no clear distinction (endo and exo run into each other), and work under the same principles. The basis of Barbieri's position is that he thinks that the existence of organic codes is sufficient to ground semiosis. Naively, one of the characteristics of codes (think Morse code, or computer code) is that there must be an encoding and a decoding, with at least some sort of functional relation between the two. I have argued previously that functionality in biology derives from autonomy which underlies viability. This serves as the ultimate interpretant (in Pierce's sense) for biological endosigns. In examining Barbieri's view, I notice that he claims that the codes connect "two worlds". I think that in doing so he has surreptitiously brought in something very much like encoding and decoding, at least implicitly, and that the "worlds" function as interpretants in his approach. I will expand on this and try to make it more precise with some principles from information theory

and channels that I have discussed before at these meetings (see Collier 2008, 2010 for grounding).

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## Interactivity: Origins and consequences

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Biosemiotics allows processes like protein synthesis to be gradually supplemented by ones resembling reading – as in the adaptivity of bacteria (Markoš, Švorcová 2009). Mutual influences later permit enkinaesthesia or a "situated co-affective feeling of the presence of the other(s), [both] agential [...] and non-agential and, where appropriate, the anticipated arc of the other's action or movement, including, again where appropriate, the other's intentionality" (Stuart 2011: 1). For Stuart, humans, horses and beetles live *with* their world and, in doing so *together*, ants and bees come to exploit eusocial intelligence. With learning, organic memory favours the rise of anticipatory dynamics: organisms exploit interactivity or "sense-saturated coordination that is necessary to much action and coaction" (Cowley 2012). Along with increased brain size, learning and new flexibility, animals come to grasp situations – wolves learn from shared experience (Tønnessen 2011). Interactivity permits affect-based cognition and, in humans, link experience with others to the experience of others. Together, members of *Homo sapiens* gain from eusocial intelligence. By hypothesis, organic coding supplements abductive 'going on'

with enkinaesthesic sense. Interactivity allows us to coordinate in a (partly) shared world where acting is constrained by a normative environment–using, which Donald (1991; 2007) calls mimesis. Human practices give individuals skills that link their experience with the learning of others. Interactivity made humans hypersocial more than a million years before language: later, of course, language exerted cascading effects on sense-saturated coordination, enkinaesthesia and, perhaps, how brains use organic coding to manage coordination with the world.

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## Periphrasis and paraphrasis in cellular regulatory pathways

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In language studies, the term "periphrasis" may mean two different things. For a linguist, periphrasis is a grammatical device, i.e. using several words for something expressed by a single word in another language (usually through inflection). The English phrase "I will come" always means the same as Czech "přijdu". However, periphrasis is also a synonym of circumlocution – a

figure of speech where meaning is expressed by alternative, roundabout or ambiguous means, i.e. a form of paraphrasis. Some euphemisms, or ingenious constructions produced by non-native speakers, are a good example.

Cellular signalling and regulatory pathways investigated by molecular biology could be metaphorically described as "the language of life", and molecular biology itself might thus be understood as a linguistic discipline of a kind. Similar to comparative linguistics, phylogenetic analyses reconstruct ancestral pathways and their evolutionary histories. Surprisingly, also in the world of cellular signalling, phenomena reminiscent of periphrasis, or at least paraphrasis, are found. This can be illustrated e.g. on examples of various aspects of regulation of eukaryotic cell polarity, in particular the structure and dynamics of the actin cytoskeleton and its connection to small GTPase signalling.

I suggest that such cases are analogous not only to periphrasis in the grammatical sense, but also to genuine circumlocution or paraphrasis, whose understanding (not only by humans, but also by the cells themselves) is necessarily context-, history- and experience-dependent. Observed consequences of experimental introduction of genes into unnatural biological contexts (i.e. heterologous or ectopic gene expression) may provide support for this interpretation.

## Overcoming the tragedy of the commune in the Hawk-Dove game through conventional coding

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Two more or less diametrical approaches to understanding life and evolution have existed since the field of theoretical biology was established (Kull 2000). The "phylogenetic" view proposes that evolution essentially reduces to differential reproduction and selection (Dawkins 1976). The "ontogenetic" view reserves a place for development which, although influenced by the genome, also depends on context and on processes of "self-organization", "coding" and "signification" (Kauffman 1993; Kull *et al.* 2009; Barbieri 1985). In order to make progress, what is needed is a more general theory that can accommodate both views. Such a theory should not dismiss the results and methods from either "camp", but rather relate them and show how they can fit together.

One claim from biosemiotics that goes directly to the heart of the issue is that the mechanism of natural selection alone cannot explain all of evolution, but rather should be complemented by a mechanism for natural conventionalization (Barbieri 2008; De Beule 2012). The first mechanism accounts for the gradual transformation of existing species through differential reproduction and the second for the origin and fixation of absolute novelties at higher levels of organization in so called "major" or "metasystem" transitions (Maynard-Smith, Eörs 1995; Turchin 1977). In this paper, I show how this claim from the ontogenetic "camp" can be studied within the framework of evolutionary game theory – a prototype theory of the phylogenetic "camp".

Concretely, I focus on the Hawk-Dove game (Maynard-Smith, Price 1973) and show how the "tragedy of the commune" (Doebeli *et al.* 2004) can be overcome by so called "coders", that is, by agents or players that have the capacity to code. This capacity is defined as the capacity to learn and exploit new, arbitrary connections between signals and meanings (percepts and actions), and it allows a population of coders to establish new conventional codes and increase their selective advantage as a species. Crucially, it is the interplay between evolution by natural selection and evolution by natural conventionalization that determines the outcome of evolution in total. Without differential reproduction, that is, even without population turnover, evolution stops and no conventionalization takes place. On the other hand, without conventionalization, no coordination takes place and no major or metalevel transitions can occur.

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## Information in biological individuation

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Claude Shannon's definition of information as "the amount of uncertainty eliminated by a message" has not only constituted the basis of the contemporary communication and computation technologies but has also shaped the dominant scientific and philosophical perspectives of the modern age. However, its technological success and consequent popularity are accompanied by an increasing criticism evoked by its overtly reductionist nature.

At a closer look, we believe that such a conception of information is reductionist in a two-fold manner. First and quite obviously, it reduces the concept to the amount of uncertainty, i.e. a quantitative measure which ignores meaning and signification altogether, as has been pointed out repeatedly by many thinkers ever since Shannon formulated his definition. Yet a second point is latent in the fact that it reduces the aforementioned uncertainty to a probabilistic measure, a move that can easily escape the attention of a 21st century reader whose understanding has been shaped by this very reduction itself.

As a matter of fact, the inherent reductionism of this definition creates an incompatibility between the concepts of "information" and "system", just the opposite of which is actually needed for a philosophically sound theory

capable of accounting for biological organisation that is the ultimate example of a "system". The aim of this contribution is to search for an alternative ontogenetic framework and a semiotic conception of information within the theory of individuation proposed by the Gilbert Simondon (1924–1989).

## Sign concept adequacy in DNA and protein synthesis grammars

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In this paper I compare the specific DNA or protein synthesis grammars, and biosemiotic sign concepts that imply some type of grammar – I focus on the work of Edward Trifonov, Sungchul Ji, Luigi Luca Cavalli-Sforza, Marcello Barbieri, Jesper Hoffmeyer, David B. Searls, etc. I show how these concepts are different in the expression level modelling. I proceed from the schematic of R. Jakobson's model, with analogues between linguistic levels and parts of DNA and proteins (see, for example, Katz 2008), and I show how the other authors transform this notion. Similarly, I proceed on the plane of meaning – I outline how the concept of meaning moves from a string (which functions as a part of sign, the relationship of DNA–RNA, DNA and amino acids, etc.) or reaction controlled by gene expression to the behavioural response of the organism. In conclusion, I selectively formulate the necessary properties of a process that is understood as a semiosis – such as arbitrariness (primary semiotic concept of the DNA code), or linearity. From these fundamental properties it is clear how it is possible to set down the second articulation plane of DNA/protein synthesis situated in the triplet level, of which the combination of the bases is a distinctive feature. From this trivial point, it is always necessary to proceed with construction grammar of DNA/protein synthesis – no grammar of DNA or protein synthesis, however, works with this assumption.

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## Acoustic patterns of the Red-billed Leiothrix (*Leiothrix lutea*), an invasive species in the Mediterranean scrublands

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In the Mediterranean basin the high number of exotic birds is probably largely favoured by the human regime of disturbance, but the "behavioural flexibility" associated with brain size and foraging innovation seems to be the major determinant for their successful settlement. Red-billed Leiothrix (*Leiothrix lutea*), a species native of Southeast Asia, southern China and the Himalayan regions of India is actually found in different parts of Mediterranean Europe with locally restricted but stable populations.

The reason of its success is not only due to the environmental conditions (favourable climate and vegetation), but a relevant portion of this success may be attributed to its acoustic loudness that could represent an efficient trait to reduce interspecific competition. The acoustic pattern of this species throughout the year has been compared in a Mediterranean scrubland with the acoustic performance of the native birds using the Acoustic Complexity Index (ACI) coupled to an aural species-specific identification. The results demonstrate that about half of the acoustic information produced by the entire bird assemblage belongs to the Red-billed Leiothrix, a species that is acoustically active all year around, and also in July and August when native song-birds are silent. Most likely the acoustic novelty of this species has a differentiated impact on the native bird assemblage, although further experimental evidence is prudentially requested.

## Including absence

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The centrality of the relation 'not' to the action of biosemiosis was perhaps most explicitly first articulated in Gregory Bateson's 1955 paper examining primate communication, "A Theory of Play and Fantasy" (Bateson 1972: 138–148), which is cited early in Jesper Hoffmeyer's *Signs of Meaning in the Universe* (1996) as presenting a fundamental conceptual challenge to modern biology:

i.e. how are we to account for the fact that the only way that any living system can possibly act intelligently in the world is to rely upon a system wherein certain things can only be effectively acted upon by using them as if they were precisely what they are not. Sign vehicles, by definition, are not themselves the things that they signify – and, likewise, that which is signified by a sign vehicle cannot be coextensive with it in its action *as* a sign.

Yet while this understanding of the sign relation goes all the way back to antiquity (and is implicit in the proto-biosemiotics of Uexküll and Peirce as well) both John Deely's 2007 *Intentionality and Semiotics* and Terrence Deacon's 2011 *Incomplete Nature* have recently advanced forceful new arguments about the ineliminable and generative nature of "what is not" upon "what is"... and why "what is known" must, perforce, partake of both these kinds of being. As Deacon and Deely can be thought to be presiding, Janus-like, over a new pathway for the investigation of the roles of signs in life – yet are disciplinarily positioned such that neither is looking at what the other one is seeing – this talk will attempt a synthesis of Deelyean and Deaconian ideas about the semiotic fundament of "absence" for the analyses of biosemiotics.

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## Semiosis and phase transitions in biology: The place of biosemiotics within a genuinely evolutionary conception of nature

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Ever since Darwin and Wallace the idea of evolution has been the leading unifying factor in biological theorizing, acting in cooperation with other key conceptual strands imported from thermodynamics, genetics and molecular biology. Physics, whose explanatory resources underpin those of the special sciences, has in the main remained impervious to evolutionary thought since its seventeenth century rise up to quite recently. The thoroughly ahistorical conception of nature promoted by traditional physics conspired, together with some philosophical preconceptions, against any conceptual unification with biology other than strict reductionism.

This article aims at showing that new developments in both physics and biology offer prospects for a reversal of this situation through a non-reductive unification of physical and biological theories within a truly evolutionary natural philosophy, including cosmology. In contrast to the present situation, there are reasons to expect that such upcoming synthesis will turn out auspicious to the incorporation of biosemiotic ideas as central explanatory resources.

To spell out these reasons I offer first a brief summary account of some remarkable developments in cosmology, particle physics, condensed matter physics, and biology, all of them related to the notions of symmetry breaking, phase transitions and scale invariance. I then indicate how these trends merge with the rise of novel forms of causation (e.g. circular, downward, reciprocal) in systems biology and self-organization theories. Finally I speculate on how the characteristic form of causation in biosemiotic transactions (semiosis) interlocks with those other types of causal relations in living systems.

## Modelling artificial cognition in biosemiotic terms

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Cognition is the capability of every natural or artificial system to evolve in a specific environment, exhibiting what is commonly designated as intelligent behaviour, i.e. adequate responsiveness.

This adequacy of response comprises the capacity to individuate and identify typical environmental features and to react accordingly. But successful responsiveness also involves the system's capacity of intervening on that same environment, creating the most favourable contexts or the capacity of producing new responses when the parameters that define the typical context change. In other words, intelligence could be defined as the ability to act appropriately in an uncertain environment.

In natural systems, intelligence grows over the lifetime of the individual through maturation and learning. Acknowledging this fact is fundamental to a full understanding of the dynamics of the binomium living entity/environment and it is crucial when aiming at the creation of autonomous artificial entities. A deeper understanding of truly situated autonomous systems can be gained by realizing that the concepts of semiosis and umwelt are at the core of the general process of cognition.

Equating these essential biosemiotic concepts with fundamental principles in Autonomous Systems Research, we attempt to show their close interdependency and contribute to the definition of a common theoretical framework capable of providing the grounding to a global approach that encompasses and explains both biological and machine intelligent instantiations.

## Distributed cognition and the problem of impaired social and biological coordination: A reflection on the comatose patient-physician communication

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This paper enquires into how cognition, while at once non-local and physical, can be socially coordinated as physicians carry out the medical evaluation of

comatose patients. Accordingly, I first present and discuss the literature on the problem of comatose patient communication from the biosemiotic and enactivist perspectives. In so doing, I focus on (1) the problem of patient-physician co-action and (2) the problem of understanding communicative uncertainty in biosocially restricted settings from the ecological point of view. In our analysis, we take Andy Clark's principle of ecological assembly (2008) to offer a relevant theoretical basis for modelling the brain ecologically, as it presents brains as opportunistic controllers seeking cognitive and physical routines as a type of "ecological control", through the generalized recruitment of problem-solving resources. Such a principle allows us to model the ecological defective controlling efforts of the comatose brain, with limited and unsatisfactory outcomes. Finally, I consider ways to redesign the communicative environment in order to generate scaffolding strategies that heighten communicative signalling and that facilitate ecological control for comatose patients in ways that can inform sound medical decision-making.

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## First logical steps to a theory of biosemiotic evolution

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In paragraph 65 of the *Critique of Judgement,* Immanuel Kant postulated a non-mechanistic type of causality. Developed by Charles S. Peirce, the logical triad provides a solution to that postulated type of logic. Using the geometric triangle, one can argue plausibly that enzymatic reactions have to be formulated as a logical triad. The analysis of this logical structure shows that it overcomes problems of biophysical notations and allows for a holistic view of the enzymatic reaction.

Additionally, the logical triad can also be used to illustrate the semiotic character of biological systems, such as long-term potentiation or immunological memory. Specificity and storage capability of these systems can consequently be derived as a property of the basal semiosis. However, the characteristics of a single logical triad are not sufficient to describe the

dynamics of such systems. In accordance with Peirce the biological signs must be embedded in a more complex context of meaning.

Such an expanded semiotic system can be applied to describe the basic relationships between genome, transcriptome and proteome. As a first consequence, one has to predict the direct mediation between genome and proteome. In accordance with recent findings in epigenetics and molecular genomics, the semiotic model shows logical deficits of previous interpretations of cellular dynamics. To solve these problems, biosemiotics can predict the existence of non-genetic factors of evolution and the existence of epigenetic learning processes. Therefore, evolution can be interpreted as the development of semiotically organized systems.

## The egg as a semiotic gateway to reproduction: Digital and analogical communication in the oocyte-egg-zygote transition

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Eggs – not "just" genomes – provide the means by which individuals of subsequent generations of complex, multicellular organisms are genetically and historically linked in time. Sexual reproduction begins with the development in the mother's body of a single cell, the oocyte. From this single maternal cell, a fully grown individual will eventually emerge as a qualitative equivalent of parental organisms.

The so-called "self-description" of the fertilized egg does not lie exclusively in the zygote's genome. This self-description is gradually unfolded through the interplay between a digitalized genomic memory and the analogical memory stored in the historical structural organization of the ooplasm – of which the topological distribution of mRNAs is of fundamental importance.

When approaching the question of sexual reproduction in these terms there are two major concerns that need to be addressed. First, how the self-description gets to be structurally organized in the oocyte, and second, how this self-description is eventually communicated and interpreted throughout the oocyte-egg-zygote transition.

As we will show, in this crucial biological process the analogical mode of communication is of primary importance. We examine the maternally

controlled generation of patterns in the oocyte-egg transition – and their meaningfulness during zygotic genome expression – in terms of code duality and digital-analogical consensus, i.e. the dialectic process characterized by the unfolding of hierarchical instances of coding and de-coding based on the interplay of digital and analogical modes of communication.

## Sense as biological category

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In my view, the conceptual apparatus of biosemiotics must include a special category of meaning as sense, which has to be one of the key categories in the foundations of biology. My understanding of sense is a version of semantic realism, where sense is treated as a real entity that exists independently of the sign and its user. Hereinafter this category is referred to as "*smysl*" (transliteration of meaning as sense in Russian). The *smysls* precede biosemiosis. They generate biosemiotic processes and manage them.

The *smysls* under consideration are not set by signs; they are only semantic (integral) by their nature. That is why they do not correspond to the ideas of sense that are presented in the main semiotic conceptions, such as Frege's concept of the sense (*Sinn*) of a sign which is different from its referent (*Bedeutung*) (Frege 1892). Although the *smysl* is a particular type of reality, it is not the object which is related to the sign as in Ch. Peirce's conception.

At the present stage of my study, I avoid providing a direct definition of the *smysl*. Instead I prefer to set it operationally in terms of its function in a hierarchical system, where the *smysls* occupy the highest level, and below are the proper levels of biosemiotic processes and entities. The *smysls* are entities with which an agent (ranging from a cell up to an ecosystem) interacts. The agent and its functioning has two sides: integral semantic but not semiotic, and structural biosemiotic. The interaction of the agent with the *smysl* is a non-semiotic process that occurs without the sign as its mediator. This interaction begets biosemiotic processes and relations. Its results can relate to what J. von Uexküll figuratively called "the creative melody" or "the germ of meaning" (*Bedeutungskeim*) (Uexküll 1940). The *smysl* is the source of this germ. Such an interaction articulates the results of its non-semiotic activity, implementing the transition to biosemiotic processes: to molecular biological processes in

the cell, for example. Along with the fundamental level of interaction, animals and human beings have a secondary level of thinking which is a consequence of the fundamental one. In this level the mental images-signs occur.

Although the *smysls* are non-semiotic, I think it is possible to denote them by biological concepts (e.g. "heredity", "development", "communication", "creation of antibodies", etc.), just as J. von Uexküll by necessity labelled components of animal umwelt by means of human umwelt's language.

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## Explanatory reductionism

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This project aims to demonstrate the difficulty of conceptualizing the relationship of explanatory reductionism between various scientific disciplines. The problem of the physical causal explanation of phenomena in supervenient disciplines (e.g. biology, psychology) is viewed in the context of the philosophy of mind. There is an on-going discussion among many philosophers of mind, often focussed on the pre-eminence of physicalism, a conception that critically emphasises the physical explanation of the traditional problem of the relationship between body and mind.

This paper has three parts:

Part I. Nonreductive physicalism and Jaegwon Kim's critique of this conception.

Section 1. Summarises the basic theses upheld by some authors (Fodor, Putnam *et al.*) in the effort to sustain nonreductive physicalism – a conception that acknowledges the monistic claims of physicalism yet also postulates the nonreductive nature of mental states.

Section 2. Introduces Kim's critique of this approach which displays an interesting parallel between emergentism and nonreductive physicalism.

Analysis of Pepper-Kim's dilemma reveals the fundamental contradiction between upward determination and downward causation.

Part II. Kim's conception of slightly defective physicalism.

Section 1. Sketches Burge's arguments based on anti-individualism, demonstrating the tenuousness of physicalism.

Section 2. Introduces Kim's conception of slightly defective physicalism which claims that, excepting the internal properties of subjective phenomenal mental states, all mental states are physically reducible.

Part III. The author's defence of physicalism and a general universal conception of physical causal explanation.

Section 1. Demonstrates that the prerequisite for the functional reduction of subjective phenomenal states is fulfilled.

Section 2. Upholds that the dilemma of epiphenomenalism and reductionism is generally valid for the relationship between scientific disciplines (e.g. physics and biology; biology and psychology).

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## The semiotics of human nature

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The number of stupidities spread by scientists on human nature is infinite. But as Mary Midgley has once remarked: "If we were to veto every science that has some lunatic exponents, we could quickly empty the libraries" (Midgley 1995: 5). When approaching the question of human nature from a biosemiotic view the first thing to be asked is whether the concept of human nature is meaningful at all. Again it might be wise to follow Midgley (1995: 76): "What is natural, in fact, is never just a condition or activity – inquiry, say, or space around one, or sexual activity, or playing with children – but a certain level, of that activity, proportionate to the rest of one's life". Biosemiotics seems excellently equipped to manage such a diffuse concept of human nature, since its basic unit, the sign, cannot be contained inside either a biological or a social frame. Semiosis painlessly bridges genomic, somatic, developmental and social dimensions of human life.

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## Modelling the cell as a formal system that writes its own production rules

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This contribution describes the outlines of a formal model of the living cell that incorporates three features that are generally accepted as necessary for life: a functional organisation that ensures self-fabrication, a molecular form

of self-representation that can be copied, and an organic coding system that decodes the self-representation. Existing models of the cell, such as Rosen's metabolism-repair system with its associated concept of closure to efficient causation, the autopoietic model with operational closure of Maturana and Varela, Von Neumann's kinematic self-reproducing automata, and Pattee's semantic closure address only one or at most two of these features.

A formal system in mathematics consists of a set of axioms from which a set of production rules produce theorems (propositions, inferences). Such a formal system could model cellular metabolism if axioms are mapped onto nutrients, theorems onto metabolites, and production rules onto enzymes (the efficient causes of the cell). Closure to efficient causation then requires the formal system to have the ability to write its own production rules, which in turn requires an internal representation of these rules and a mechanism for decoding and copying it. The implementation that I shall present has an internal logic that requires of the formal system to have features that map onto phenomena such as protein folding and unassisted self-assembly, which I have previously argued are what makes life as we know it possible.

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## A qualitative-semiotic conception of spatial configuration

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The concept of space is vague. It is a real live thing in our ontology, but whilst 'space' is a property of the world, it cannot be rationalised in the same way that an object can. Physical space is not in physical space, it is not an object (Latour 2012). Alternatively, it is claimed that space is *"a concrete thing with shape and structure"* (Nerlich 1994: 10). Space is thus conceived as a container: a topological perception in which wholes are determined through connection and the relations between points, distinguishing a whole as separate from what surrounds it. It is perhaps the most common approach to thinking about and organising space, but space has mereological properties too. A mereotopological perspective therefore enables us to think and reason qualitatively about spatial configuration (Cohn, Gooday, Bennett and Gotts 1997). From an architectural perspective it enables a formal ontological conception of the way in which a configuration may be effected through agency and function.

Graham Nerlich states that 'what realists see as central to a relationist view of space' is the question: *"what is required for a spatial relation to hold?* (Nerlich 1994: 18). On the premise that no relation is static, but unfolding and changeable, the premise of this study is that a sign is required; understood as a qualitative relation between an entity and an object of attraction. The ensuing action effects change, which feeds back, effecting subsequent actions. A generative process of adaptation and configuration, effected by the structural coupling between an entity and its environment. Looking at biological systems through a semiotic lens (Hoffmeyer 1996, 2008; Favareau 2010), the spatial salience of an entity-in-its-environment is translated into a methodology for spatial configuration. The notion of space as something created through action and being is translated into a property which may be utilised creatively. Drawing on artificial life as a way of modelling natural processes, the making of patterns is replicated into a pattern-maker. In this way the low-dimensionality of space is utilised to approach architectural problems as complex dynamical systems to generate a semiotic body (Hoffmeyer 1994). Rather than flattening problems into something quantifiable, the constraints which make space productive can be manipulated and steered.

A model of spatial configuration is presented, based upon a general theory of niche dynamics (Smith, Varzi 2002). An entity occupying a region of space

is defined by a boundary that distinguishes it from its environment. Perceived as a regulating device, through which information is conveyed between internal and external conditions (Hoffmeyer 2008; Smith, Varzi 2002; Ashby 1957). The boundary defines a structural composition. This differential condition is conceived as a niche, a region of space which is effected through differences. Agency between niches creates neighbourhoods and amalgamations effected through functional intercourse. The model presented consists of a collection of niches (causally relevant spatial forms) which self-organise to aggregate in a cell-like manner; an approach to architectural spatial formation which integrates the perception of user inhabitation (Barker 1968; Hall 1966) and the built environment (Hillier, Hanson 1984; Bollnow 2011) with underlying processes of biological conformation (Camazine *et al.* 2001; Hemelrijk 2005).

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## Felids, their coat patterns, camouflage and signs

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The aim of the paper is to discuss if and to what extent findings of leading (Darwinian) biological approaches, such as ethology and behavioural ecology, could be transferred to the concepts of biosemiotics and vice versa. Thoughts will be illustrated on the empirical material from the ecology and morphology of felids. The work is driven by an ambition to develop a more complex biological theory of camouflage, enriched by semiotic insights into the topic (e.g. Maran 2011). Classical theoretical accounts of the theory of crypsis (Endler 1978) are based on the evaluation of the properties of a predator, prey, and environment. Each object of this triangle is classified by measurable qualities that have the undesirable effect of omitting the highly specific perceptual world of individual participants (umwelt). There is a need to assess Dawkins' vision of extended phenotype by biosemiotic interest in the active role of individual organisms. Finally, we will meet a challenge of felids displaying "signs without a receiver" and discuss the strengths and pitfalls of Portmann's aesthetic morphology (Portmann 1960).

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## Arbitrariness of signs and the cell force as the complementary aspects of cell language

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Cells communicate with one another using a molecular language which is isomorphic with the human language (Ji 1997). Communication is synonymous with information transmission in space and time, and Shannon's channel capacity equation indicates that no communication is possible without dissipating free energy. Thus *information* and *energy* are the two indispensable ingredients for communication both within and between cells. The analysis of the whole-cell RNA metabolic data measured with DNA microarrays from budding yeast undergoing glucose-galactose shift (Garcia-Martinez *et al.* 2004) has revealed two major findings: (i) the genotype-phenotype coupling is quasi-deterministic (reminiscent of the principle of the *arbitrariness of signs* in linguistics), and (ii) the whole-cell RNA metabolic kinetic data fit a 4-parameter mathematical equation (called *blackbody radiation-like equation,* BRE) which is of the same form as the blackbody radiation formula discovered by Max Planck in 1900. It is suggested here that the first finding is related to the informational aspect and the second finding to the energetic aspect of the cell language.

It was quite surprising to find that BRE also fit data from (a) single-molecule enzymic activity and (b) protein folding. An analysis of the various sets of the BRE parameters in a parameter space revealed that blackbody radiation, single-molecule enzyme catalysis, and protein folding processes follow a common trajectory, while the whole-cell RNA metabolism deviates from it. One interpretation of this finding is that, although the molecular interactions underlying blackbody radiation, single-molecule enzyme activity and protein folding are mediated by the electromagnetic force, those in whole-cell RNA metabolism implicate, in addition, another force intrinsic to the cell – the cell force. Thus, the DNA microarray technique invented in the mid-1990s has produced the whole-cell metabolic data that appear to provide the first quantitative evidence for the information-energy dual requirement for the

cell language – *arbitrariness of signs* which maximizes the rate of information transmission (Ji 1997), and *the cell force* which organizes cell metabolism guided by the genetic information stored in DNA (Ji 2012).

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## Seeing each other: An international comparison of the eye colour effect on perception of trustworthiness, dominance and attractiveness

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Eyes are usually considered as an organ of visual perception – sight. In our study, we approach the human eyes as semantic organs to which different meanings can be attributed. The photos of 120 Czech people were presented to Estonian and Czech raters, who were asked to judge them for trustworthiness, attractiveness and dominance in a seven point scale. We did not report any effects of eye colour on attractiveness and dominance attribution in either Czech or Estonian samples. Nevertheless, we found a significant effect of eye colour on judgment of trustworthiness by Czech raters. Brown eyed people were rated as more trustworthy than their blue eyed peers. Interestingly, when the same photos were rated by Estonians, the opposite effect was present. Moreover, we found some imprinting-like effects, i.e. the preference of a particular eye colour was dependent on the eye colour of parents or mating partner. Based on our results, we briefly summarize the knowledge about the effect of eye colour on the attribution of various psychological factors, temperament, and behaviour. The evolutionary consequences of variation in the iris colour of Europeans are further discussed.

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## Modelling of semiosis: Juri Lotman's legacy

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Juri Lotman (1922–1993) established the Tartu (and Tartu-Moscow) school of semiotics in the 1960s. In addition to his pioneering work in semiotics of culture, he developed the theory of general semiotics. We attempt to extract some principles from Juri Lotman's formulations that characterize the core aspects of semiosis (see also Lotman 1990; Favareau 2010; Kull 1999). These include: (1) the principle of code plurality (that one code is insufficient for semiosis, at least two codes are necessary for it; that semiotic dualism is the minimal form of organisation of a working semiotic system); (2) the principle of incompatibility, or nontranslatability (that meaning-making requires an incompatibility of codes; the incompatibility is the source of indeterminacy, non-predictability, and semiotic freedom); (3) the principle of autocommunication, or translation (that autocommunication is the most general form of communication, it must be present for sign interpretation; autocommunication underlies the ability to qualitatively restructure and translate; the primacy of autocommunication is also assumed by Jakob von Uexküll); (4) the principle of semiotic inheritance (that every sign comes from another sign; this is a version of Redi's rule); (5) the principle of semiosphere (or the principle of the relationality of semiotic systems – that semiotic space may be regarded as a unified mechanism; semiosis cannot exist outside of the semiosphere); (6) the principle of non-gradual evolution (in the development of a semiosic system, explosive or disrupted and continuous or orthogenetic processes alternate and co-occur); (7) the principle of modelling (semiotic systems are themselves modelling systems).

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## The body in the mark: The distribution of cognition in early inscribing

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There is a prevailing stance in much educational thinking that children's early cognition of inscriptional systems is primordially a solitary, mental process (Brown *et al.* 1989), with learning involving the accumulation of knowledge over time. However, although there is only a small body of research that looks at the processes involved in the earliest understandings of inscriptional systems, this suggests that such individualist accounts cannot be sustained by the evidence. Kress calls for a more generous understanding of cognition (Kress 1997: xviii), and one that can account for how the very youngest children are able to engage in complex forms of sign making, in which they act independently in diverse, representational environments.

This paper will discuss the findings of one project (Lancaster, Roberts 2006) that investigated systems used by children under three to represent features of their experiential world by means of graphic marks. It found they were always intentional in their mark-making, producing meaningful signs long before they could understand conventional notations, and this was integrally linked to interactive sequences involving adult and child participants, effecting a distribution of intellectual work between participants, actions, objects, environments and events. Linguistic and bodily communication, the recapitulation of shared histories, and joint manipulation of tools, objects, and physical environments were often incorporated into the meaning and the material structure of children's signs.

The focus in this presentation will be on sections of data that show how difficulties presented by the representation of action and movement in a spatial, graphic medium are resolved through gestural and bodily enactment.

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## The semiotic challenges of the guide dog and blind person team

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The interspecific and multimodal exchange of signs that grounds the cooperation of the guide dog and blind person provides rich and valuable material for semiotic research. It is thus not by chance that one of the first applications of biosemiotic theories was in guide dog training (Uexküll, Sarris 1931; Sarris 1935). The current study aims to demonstrate the semiotic side of the post-training interactions between the guide-dog and guide-dog user.

Based on participatory observation and interviews with guide dog owners in Estonia, Germany and a few other countries, I will distinguish between three main types of challenges that the guide dog and blind person teams face when orienting in the city. *Perceptual challenges* are faced if the perceptual capacities of the team do not meet the affordances of the infrastructural and architectural planning of the city. *Symbolic challenges* come from cultural traditions,, social attitudes and legal regulations concerning animals, the status of dogs among animals, distinctions between different functions and roles animals may play in human life. The social consideration of the variety of disabilities belongs here as well. *Communicative challenges* are met if the meaning of what is perceived is to be passed on to the other member of the team and interpreted adequately by the other. The real time work of the team demonstrates how the three types of challenges come to influence one another – e.g., the merely symbolic regulations

may at a certain point be turned into material obstructions, the dog may start to ignore perceptual signs if its host does not respond to the dog's attempts to communicate those. Proceeding from this, I would like to claim that an attentive and flexible combination of different types of semiosis can be considered as one of the keys to successful cooperation between the guide dog and its blind host.

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## Evolition: A reassessment of Rothschild's biosemiotics

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Evolution by random variation and selective retention enables progressive differentiation that challenges the second law of thermodynamics in what Schrödinger defined as "negentropic processes". We search for a single consistent and complete paradigm, so whenever trapped in contradictions or anomalies such as this one, it seems tempting to recruit the idea of God as the great solver of all riddles. Newton made this move regarding the origin of planetary motion, which nevertheless did not compromise the accuracy of classical mechanics' three laws of motion and universal gravitation.

Among those who departed from science and appealed to theological principles for explaining problematic aspects of evolution we can mention Alfred Russell Wallace, Pierre Teilhard de Chardin, Ludwig Klages, Gregory Bateson, Stuart Kauffman, Jakob von Uexküll, and Humberto Maturana. In this paper we will consider the case of Friedrich S. Rothschild, a neurologist and psychiatrist of scientific and humanistic scholarship who co-founded the discipline of biosemiotics. Rothschild not only appealed to but developed a theological perspective of evolution as inner adaptation within transcendental subjectivity to an omnipotent and omniscient God.

The problem with this idea is that it does not solve any riddle at all but rather cancels the possibility of even formulating it. Moreover, the mystery of subjectivity itself is overwhelming enough to further attempt accounting for

a transcendental one. More modestly we may, on the contrary, try to reassess the evolutionary process but from an inverse, secular approach by considering instead the infinitely minute and free agency of each creature at any scale in its determination to live and reproduce. As a deliberate act of will and purpose at each crossroad of evolution, we may denote it as "evolition".

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## Are ecological codes archetypal structures?

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Developing an ecological perspective is both a big challenge and a necessity for biosemiotics. In the present paper I examine the concept of ecological code (Kull 2010) by asking what its properties and functioning could be. My initial suggestion is that codes on the ecosystem level behave very differently than codes regulating human communication or any other intraspecific communication. I suggest three initial characteristics of ecological codes:

1. Ecological codes are distributed and open. Ecological conventions involve different species that have different perceptual organs, umwelten, and different ways of attachment to the environment. Therefore, *no single individual or species has full perception of an ecological code.* Instead, ecological code forms as the sum of memories and experiences of corresponding perceptions.
2. Ecological code is built upon and incorporates the consistencies, constraints and habits existing in a particular ecological community. Ecological code rests on indexical relations (cf. indices in Maynard Smith, Harper 1995: 306) and also uses habitual semiosis, behaviour and action of animals (cf. semethic interactions in Hoffmeyer 2008:

189). *Ecological codes are communal and disperse, with regard to both living agents and environment.*

3. Ecological codes use different memory types (following Jablonka, Lamb 2005), that is, *ecological codes have both cognitive and non-cognitive (or conscious and unconscious) aspects.* A convention can simultaneously depend on different memory types in different organisms that need to come into contact for the convention to become effective.

To sum up the three proposed characteristics, ecological codes resemble archetypal imagery or patterns – dispositions in animals to establish certain types of meaning relations and to link sign processes with actions in particular ways. Abstract mimicry, deimatic displays and semeic body structures (Kleisner, Markoš 2005: 218) will be discussed as practical examples of ecological codes.

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## Hymenomorophism

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Surfaces within surfaces, membranes within membranes, layers within layers: this is how living beings classify, calculate, parse the world. This suggests that sign processes (semiosis) = distinctional calculi. The deep isomorphism

between all instances of layer-produced organization, from societies to cells, further suggests that a nascent language of emergence might be named *hymenomorphism*: the membrane-foundations of knowing and the known; inquiry into form as emergent through nestings of distinctional processes, surfaces, membranes, skins.

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## An introduction to the biosemiotic relevance of contemporary category theory

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Substantial effort and eloquent calls have been made to promote coherence while maintaining diversity within biosemiotic discussions. Of relevance to this effort is the history of category theory, a mathematical domain and framework that has served as an interdisciplinary Rosetta Stone for 60 years, illuminating and inter-relating seemingly disparate issues and discourses in logic, geometry, algebra, and theoretical computer science.

This paper discusses past and contemporary concepts and methods in category theory, highlighting their relevance to biosemiotic issues of self-reference and evolvability. Examples are drawn from both biological signalling and computational systems. Mathematical characterizations of spatio-temporal patterns of communication and interpretation are explored, based on biosemiotic concepts rather than physio-chemical reductionism, in

a manner that aims to be both substantive and accessible to non-specialists. In a rigorous yet visually clear manner, category theory focuses our thinking on transformations and relationships among constituent elements, rather than on their internal structure or "identity", revealing patterns shared by apparently unrelated phenomena.

Beyond its integrative capacities, the mathematical language of category theory may prove particularly valuable in promoting the progress of the biosemiotic programme within the larger scientific community.

## Communication in zoos and communicative zoo

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Any semiotic study that has zoological gardens as research objects needs to include animal and symbolic levels of communication in order to analyse intra- and interspecies communication, as well as interactions with the environment. Different aspects of the zoo are interdependent in shaping the zoo environment for people and other species. Considering the zoo as a communication environment means analysing how environment as medium frames and influences different intra- and interspecies communication situations. On the other hand, zoos are also communicative, i.e. they are designed to impart messages of nature conservation. The zoological garden is thus seen as a place where communication takes place but also as a means to communicate messages. Communication models applicable to the zoo environment should be able to incorporate this dual function of the environment that considers biological ecosemiotics and cultural ecosemiotics. At the same time, features that are common to zoos (e.g. restricted area, exhibit design principles, reconciliation of people's wants and animals' needs, relations between natural and artificial, etc.) should be considered as the basis for discovering and describing the differences between zoological gardens (e.g. species variety, actual exhibit design, means for communicating messages, etc.). This presentation tries to combine biological and cultural aspects of the zoo, to develop a communication model that would enable the description of zoos as places of communication and communicative places.

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## Scaling life: Developmental semiotics in infancy and beyond

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This essay argues that the crucible of biosemiotics is found in 'stored' relations, while the friction of conflicting yet interdependent scales and functions supplies the 'heat' necessary for the bonding process of semiosis to succeed. As Peirce argued and others have since developed, it is heterarchy that matters. And semiosis is in the smelting of potential and consequence into novel origination and ontologically unique functions and structures that defy reduction by crossing multitudes of intertwined and intertwining scales. This is found in molecular, developmental, and evolutionary biology as well as infant semiosis, human psychology and culture, the function of languaging that is the most original feature of our particularly human way of being, and the subsequent range of the distribution of agency within both individual people and populations of humans.

Ivan Havel's spatial, temporal, and cognitive scaling offers a means by which we re-frame the biosemiotic heterarchy to forge a necessary link between S. J. Gould's heterochrony as well as his use of Adolf Portmann's postnatal development, Burton White's developmental psychology, and Colwyn Trevarthen's infant semiosis. All this is inhered within the (now conventional) argument that a focus on biological development need not be Lamarckian, for development serves as selective phenomena on scales that range from

molecular to ecological (i.e., from endosemiotic to exosemiotic) – and back again. We conclude by returning to our scale of things, and the Philosophy for Children movement, to uncover how it is that 'grown up' semiotics depends upon a matured persistence of the mannerisms of infant semiosis.

## Plant as an actor in reading the landscape

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Landscape is studied in various disciplines. Within biosemiotics, landscape could be understood as a living system that consists of many elements that are organized into a sign system or into a text (cf. definition of biosemiotics in Kull 1999: 386). Therefrom a biosemiotic study of landscape could be put as reading the text, i.e. reading the landscape.

The concept of landscape as a text has been widely studied and criticized within social sciences in the last three decades (e.g. Duncan, Duncan 1988). However, it was exclusively used for human reading, in other words for an anthropocentric notion of landscape.

In the poster I will first present the concept of landscape as a text, and after that, plants as actors that structure and organize the world that surrounds them and this way also act as active readers of the landscape. Two examples of spontaneous development of urban green (or *sauvagerie urban*, see Lévesque 2000; for a general discussion of the concept of wilderness see Oelschlager 1991) will be discussed: (1) the abandoned garden colony in Prague-Jarov (the change of social discourse on greenery in Jarov is discussed in Pauknerová, Gibas, Čížek 2010) and (2) a transient area of field-wood in Prague-Letňany.

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## Morris, Sebeok and beyond: From biosemiotics to semioethics

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Before taking an interest in Jakob von Uexküll and his studies in biology, Thomas A. Sebeok had already found important reflections on the relationship between semiotics and biology in Charles Morris (his teacher). In fact, biology is central in Morris's research. This is the case not only in his topical book *Signs, Language and Behavior* (1946), but also in his preceding works, where biology is not only a theme internal to his research and writing, but also appears in the title of some of his texts. But Morris also makes an important contribution to the study of values. In this paper we intend to work on the sign-value relationship in Morris through the role assigned in semiotics to biology not only by Morris himself, but also by Sebeok. In our paper we intend to develop a line of research that connects Uexküll, Morris, and Sebeok and leads into what we have denominated semioethics.

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## Why biosemiotics cannot solve the symbol-matter problem

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Human beings have freedom of choice and evolution produces genuine novelty. How can this be so if the material world, and thus the human body, is 'really, merely' insensate mater in inexorable motion? Pattee and Kull (2009) suggest that in order to resolve this conundrum, which is also the mind-body problem, it is necessary to understand how symbols can control matter.

Pattee also believes that it is here that biosemiotics will make its enduring contribution (*ibid.*: 329).

This paper will claim that even though Pattee is correct, a deeper understanding of the symbol-matter problem will not resolve the mind-body problem or the conundrum of freedom and novelty.

This claim will be supported by a comparison with a heroic failure to solve the mind-body problem. Humphrey (2000) offered a detailed account of how self-awareness may have evolved. He proposed that as nervous systems became more complex, sensory-motor circuitry became internalised and detached from the sensory world. Clear as this proposal was, it failed to address the central issue of qualia. That is, why awareness, of self or of anything, has the subjective quality that we know from direct experience. A re-statement of the mind-body problem as the symbol-matter problem, however helpful, will likewise fail.

Pattee identifies the mind-body problem as just one of four levels of the symbol-matter problem (Patte, Kull 2009: 320). This paper will propose that it is more fundamental than the other levels. Crucially, it will also propose that even if biosemiotics can help to clarify the problem it will remain insoluble without a radical change in our understanding of matter itself.

The paper will offer evidence that this change is occurring, using work by Whitehead, de Quincey and Goodwin. This change removes the barrier between the organic and inorganic domains and marks a fundamental shift in Western metaphysics from the mechanistic towards the organic.

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## Dicisigns in mimicry

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Peirce proposed several typologies of signs, with different degrees of refinement and several relationships to one another. Here we are especially interested in how Peirce's extended theory of signs can contribute to the construction of models that serve as tools for the investigation of biological mimicry. As a corollary to our analysis of firefly signaling (see El-Hani, Queiroz, Stjernfelt 2010), we analyse the capacity of producing dicent symbols (propositions) as a general requisite for a semiotic system to act as a mimic. As it is well known, the semiotic processes involved in biological mimicry most often do not result from learning processes taking place in the individual semiotic system, but from the fine-tuning of inherited capacities by natural selection among variants over hundreds to thousands or millions of generations. Still, the concrete sign exchange takes place within the lifetime of a single individual, and those signals, indicating and describing at the same time, can be conceived of as dicent symbols or dicisigns. This calls for an investigation of the Peircean notion of the dicisign, which is a generalization of the notion of proposition. Peirce's formulation liberates our treatment of propositions from the confines of human language and points to their appearance also in pictures, gestures, etc., and, moreover, generalizes propositions from being a human privilege so as to also embrace simpler dicisigns found in non-human animals.

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## On coding and meaning

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The analogy between DNA and human natural language has been noticed by many (see e.g. Jakobson 1971). However, the ability to draw such an analogy often rested on the propensity to see both biological and cultural information

systems mainly as "coding systems", in which symbolic structures are seen as "standing for" or "mapping" to their meaning. This, in turn, was based on the tendency to reify meaning as amenable to static and discrete description (e.g., in the case of natural language, a set of semantic features or a set of referents). Recently, however, it is increasingly recognized that the most important relation in living and linguistic systems is not between two static structures but rather between a structure and the dynamical events it controls. The concept of "coding" seems insufficient to describe such a relation, and the analogy between the informational systems based solely on this concept becomes a difficult one.

I am thus proposing a revival of the careful distinction between the notion of "coding" and "meaning", leaving the first to describe the relation between discrete structures, while the second for the description of the relation that symbolic structures have with respect to the dynamics of a system. It seems that the latter relation is more important as a property of the universal language, which could be the basis for the above analogy (Pattee 1985). However, an important question is whether both the meaning and the coding relation is needed for a system to function as a language. Examples of coding and meaning are pointed out in natural language and the audience is invited to a) notice a similar distinction in the case of living organisms, and b) ponder the possibility or impossibility of reducing one of the relations to the other.

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## Inability: A suggestion for a stance concerning discourses on animals

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It may be argued – once necessary demonstration is provided – that traditional discourses in the human sciences, and especially in philosophy, are characterised by their lack of attention to nonhuman forms of life. A survey

of the literature on theoretical arguments that introduce a particular species of animals, or, more commonly, "animals" as such, gives ample demonstration to the fact that this introduction of animals serves purposes which are almost entirely disconnected from any actual understanding of the particular ways of life of that animal species. A reference to "animals" as such is used to lend credence to the importance of the ideas being discussed, to demonstrate their uniqueness and relevance by way of a reference to the lack of them in nonhuman animals (be it reason, language, consciousness or a nearly endless list of such markers of human uniqueness). Moreover, far from being strictly limited to this "psychological" (and thus, in most cases, theoretically irrelevant) function of introducing animals, animals-as-lacking-something-human also figure as a demarcation of "proper" humanity, as a mechanism for segregating, delimitating and thereby of defining mankind as such.

Put briefly: theoretical discourse not specifically targeted at understanding life's diversity, but which nevertheless introduces animals into its arguments, is not in fact interested in understanding the specificity of diverse animal species in any meaningful sense. There are no animals in philosophico-theoretical discourse.

With the above in mind, the presentation suggests a particular stance or position that should be taken with respect to "animals", that is, life's diversity – namely, "inability", of "not being able to", a sort of conscious step back from casual judgments on animals, especially if such judgments are, first, about "animals" in their totality, and second, if animals are to be introduced by way of their lacking something thought to be "essentially" human. There is no need to either prop up arguments by reference to a lack in animals, nor is there a need for a constant vigilance with respect to the supposed "true" borders of humanity proper.

A conscious stance of not being able to judge and assess animals in a casual manner will lead to more diverse and more sophisticated theoretical constructions, since they are rid of the need to support themselves by a casual dismissal of nonhuman animals and by constant exhortations of human exceptionalism. The deliberate stance of "inability" is simultaneously a step back in its refusal to discuss "animals" as such and a step closer to the unique specificity of life's myriad forms.

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## Biosemiotic information

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The mathematical theory of information is a useful tool in technology and the study of processes based on discrete changes of states, but does not help us to understand biological phenomena, such as life, evolution, growth, habit-taking and development, all of them intrinsically dependent on some sort of telic and continuous dynamics in the background. Biosemiotics has adopted Peirce's concepts of sign and semiosis to fill this gap, but has not yet accepted Peirce's own concept of information. Peirce's theory of information is, however, a fundamental and necessary ingredient for understanding semiosis as a living process in which a community of interpretants share the form of the dynamic object. Peirce's information is at once bioinformation and the ground of all kinds of biosemiosis. As a result of our own research, we will further show that there might be four types of bioinformation (perceptive, inquisitive, deliberative and scientific). The study of this typology of information might allow for a biosemiotic classification of all living species according to their ability to develop by taking habits, which is the same as internalizing bio-information.[1]

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[1] See also Minute Semeiotic at www.minutesemeiotic.org.

## Uexküll's contribution to an interdisciplinary concept of vision and knowing

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Semioticians claim to deliver a fundamental and interdisciplinary conceptualisation of human knowing. Since media increasingly rely on non-verbal visual sign systems, theories of seeing should combine semiotics and biology of vision. Such a synthetic approach was offered by the biologist Jakob von Uexküll (1864–1944). I will show that his description of seeing is also fundamental for the understanding of his theory of signs. Uexküll's explanations give insight into the physiological process of sign formation and reveal the cybernetic nature of this process. Uexküll's theory of vision thus also helps to understand his famous function-cycle (*Funktionskreis*) as an illustration of sign formation on a basic level. Uexküll also shows how various sensory modalities and bodily functions are integrated, which explains similarities in the perception and production of signs. His theory thus proved relevant to scientists and artists and may foster interdisciplinary ways of knowing for the future.

## The origin of mind: Transition from protosemiosis to eusemiosis

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One of the challenges in biosemiotics is to uncover threshold zones between levels of semiotic organization in evolving organisms (Kull 2009). The origin of mind, which is a tool for classifying and modelling objects, marks an evolutionary transition from protosemiotic agents that use signs to directly control their actions, to eusemiotic agents that can associate signs with ideal objects. In contrast to real objects, which are components of the outside world, ideal objects exist within minds and serve as tools for classifying real objects. Ideal objects are functional subunits within complex material systems (e.g. "brain-objects" in Swan, Goldberg 2010); but their functions are more stable than material implementations. The hallmark of mind is a holistic perception of objects, which is not reducible to individual features or signals. Thus the topology of attractors in the phase space of mind is more important than specific signalling pathways. Each attractor represents an ideal object, and

trajectories that converge to an attractor correspond to possible ways of identifying objects. The initial state of mind in each trajectory is set by a combination of sensorial inputs. Mind can support a higher level of intentionality in agents because goals are represented by ideal objects. Although simple ideal objects can emerge via genetic selection, individual learning is a substantially more efficient mechanism than selection for the development of new ideal objects and improving already existing ones. Epigenetic mechanisms seem to play a crucial role for the origin and function of mind. Chromatin states are repaired after perturbations and thus create a large number of attractors, which serve as rewritable memory signs. A primitive form of mind may exist in a single cell, where the nucleus plays the role of the brain. Thus multicellular brains in animals are communities of cellular "minds" of individual neurons. The ability of agents to classify objects may have originated from their capacity to distinguish states of their own body in order to prioritize various functions. Ideal objects are primitive models that allow agents to anticipate unperceived features of real objects. Within primary modelling systems, ideal objects are not connected with each other, but instead are tailored directly for specific functions. In the secondary modelling system (Sebeok, Danesi 2000), ideal objects become interconnected via arbitrarily established links (e.g. in associative and dynamic models). Language, which is the tertiary modelling system, supports efficient communication of models between individuals. Models are not universal and require testing if applied in unusual situations. Testing of models can be described by commuting diagrams (Cariani 2011), which I modify to include object tracking or manipulation. A model ($F$) is correct if $M(G(O)) = F(M(O))$ for each object $O$ within a given set, where $M(O)$ is an ideal object that results from measurement or classification of object $O$, and $G(O)$ is a result of object tracking or manipulation.

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## Pointing, reaching, grasping, and tapping as self-signifying gestures: End-effectors, from pebble tools to smart devices

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This paper proposes a biosemiotic theory of hand gestures through human evolution, from the Oldowan or Mode One stone tool industry of *Homo habilis* (2.6–1.7 million years ago), through the Acheulean or Mode Two stone tool industry of *Homo erectus* (starting 1.7 million years ago). Throughout their evolution, human organisms have made and operated handheld tools, using coherent hand gestures of pointing, reaching, and grasping, incorporating power grips, precision grips, and tapping gestures, tools that fit in the palm of the hand like a pebble. All these gestures (those of the hand alone and of the hand grasping and employing tools with irregular edges, from choppers, scrapers, and pounders to keyboards and touchpads, and robotic end-effectors) are self-signifying biosemiotically, (1) because they have irregular edges, designed to effect work, that replicate the irregular edges of the asymmetrical human hand, and (2) because they convey information primarily about the operation of the hand or end-effector and the work it performs with handheld tools, ranging, for example, from killing, bleeding, and defeathering a bird of old to tapping out a tweet on Twitter today. My argument contends that messaging gestures on handheld devices convey information primarily about manipulative handwork, in which respect I demonstrate that, biosemiotically, handheld devices in the digital age have evolved from the stone tool industries to transmit messages about work, the survival of organisms and species, and the link between the hand as tool and the tool as end-effector.

## Like seeks like? Dog-owner resemblance as a case of semiotic co-option

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Reports on a striking resemblance between an owner and his dog are more than common. The last decade or so has brought new scientific studies, that, only with a few exceptions, have confirmed this old folk knowledge. In several independent studies, observers were statistically significantly able to match

dog's and owner's photographs. However, evidence of the precise source of this resemblance is missing. Other studies show, for example, resemblances in psychological character traits, but this evidence is weak and such information cannot be read directly from photographs. Using Geometric Morphometrics (GMM), we will precisely measure the similarity between the dog's and owner's most visible semantic organ (i.e. the face) without the necessity of using observers-raters. We can then conclude whether the correctly evaluated similarity can be attributed (at least partly) to the physical resemblance of face structures and the shape of the face as such (the use of GMM will exclude certain simpler traits such as hair colour or general hairiness, which could also be another source of similarity). If a match will be found, this resemblance could be considered as a case of semiotic co-option.

## Dual inheritance theory and the problem of the origins of language

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My presentation considers the general theory of memory and dual inheritance theory. The theoretical and methodological foundations for this study are semiotic, ecological and process approaches. It is stated that there are general principles of the function and reproduction of biological and social systems, namely, these systems determine and are determined by the re-constructive processes of accumulation, maintenance and transmission of inherited information. In this presentation the general principles of the theory of memory and semiotics are applied to explain the origin and evolution of language and communication. It is argued that language origin, maintenance and transmission in biological and social systems presuppose both biological and cultural inheritance and constant correlation of language-related activities with natural or index signs.

## The language of life

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Our paper offers an additional dimension to the rigid view that living beings are only driven and programmed by a hierarchy of hardwired codes. We trace life at different levels of organization to the cohabitation of individuals within and between historically established lineages. Ways of such cohabitation depend on the experience of particular guilds or aggregates; they cannot be easily foretold from any basic level of description, they are distributed across all levels, and across all members of the community. Such phenomena of interactivity constitute a lived world which, we argue, represents a genuine analogy with our domain of human cultures and languages (Markoš 2002; Markoš *et al.* 2009; Markoš, Švorcová 2009; Markoš, Faltýnek 2011).

Examples, on which we would like to demonstrate the historically based concept of meaning, are:

(1) That protein folding is not completely provided by the code but is rather dependent on the historical (evolution, ontogeny) or ad hoc (e.g. temperature, mating season, etc.) contingencies, or on the experience of the given cell/organism.
(2) That chemical diacritics, such as epigenetic modifications like DNA methylation or histone code, can be written and rewritten and how they influence the behaviour within the cell.
(3) That the decisive factor of ontogeny, i.e. of patterning multicellular bodies, is not the mere digital representation of genes but, rather, how the gene is understood in the overall "cultural" context of the species/culture (Švorcová 2012).

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## On the notion of induced semiosis, with emphasis on anthropogenic semiosis

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In this presentation Sharov's (2010) notion of *induced semiosis*, which represents a valuable contribution to biosemiotic vocabulary, will be analysed and further developments of the term suggested. According to Sharov, agents, which are either living organisms or their products, "are defined as systems with goal-directed programmed behaviour" (ibid, 1052), and semiosis "can be inherited or induced by higher-level agents" (ibid, 1050). In Sharov's conception, induced semiosis concerns sign exchange which is induced (initiated) by some higher-level agent for some purpose. The various forms of *anthropogenic* induced semiosis can, in the perspective of human ecology (i.e. ecosemiotics), be considered as constituting a further effectory layer in humankind's control system qua global species. Non-human agents involved in such sign exchange are generally only *vicariously* goal-directed – it is *our* goals they are set to pursue.

But what about the myriad of cases in which biosemiotic sign exchange is *triggered* by our global civilization but not *intended* by any human agent? Is not such semiosis induced (and anthropogenic) as well? We thus have to distinguish between induced semiosis *qua communicative system triggered by some intending agent* and induced semiosis *as triggered by the activity of some communicative system but not intended by its controlling agents.* This latter kind, enveloping a variety of unintended consequences, is arguably an equally informative measure of our ecological impact.

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## Senses of significance and meaning in the models of biosemiotic sign

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If biosemiotics is to make any real difference to standard non-semiotic biology, it has to introduce an irreducible concept of biological meaning or significance. Quite often, such an idea of meaning is left implicit or vague, although the choice of the prototype idea has its effects on the corresponding concept of biosemiotic sign or of semiotic character. A tricky situation appears if the motivation for biosemiotics includes one kind of intuition or intention about biological significance, but the chosen basic semiotic concepts contain implicitly incompatible or inapplicable kinds of concepts of meaning or significance.

I suspect that this is often the case when Peirce's concept of sign or its derivatives are employed at the level of biosemiotic theory. For Peirce, a sign was a logical concept and he kept logic more abstract as a science than any special science, including biosemiotics (='psychical bioscience'). However, it does not follow that the concept of psychological or biological sign would necessarily obey a similar structure and have corresponding components. Peirce's concept of meaning contains the idea of increasing self-awareness, to which semiotic normativity and thus *sign action*, *semiosis* is tightly connected. Moreover, it also includes the idea of the external testability of the content. Neither of them seems to be well applicable in biosemiotics, except perhaps in zoosemiotics of large mammals. Instead, both of them can be seen as valuable at the meta-level, in *making* of the biosemiotic *science* (its concepts, etc.), not at the level of biosemiotic *theory*, although there have been several attempts (mine included) to do so.

I would like to suggest that Peirce's triadic concept of sign as the communion of sign, its object, and its interpretant does not have much use at the level of biosemiotic theory; instead, we need more general concepts of sign, and not necessarily a single concept. For instance, a concept of non-representational but still triadic sign might be handy. In many purpose-oriented actions of humans and other 'higher' mammals, for instance, two different concepts of sign can be seen at work: the representational truth-normative (and Peircean) one, and the other more general, non-representational and action-normative one that has no equivalent to the Peircean object of sign.

## On the semiotics of "interjections"

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There exists a group of words in languages that is often defined (or simply referred to) as "interjections" and which are very different from other linguistic elements on several grounds: [2]

a) phonetically: they sometimes contain sounds which are atypical of their corresponding languages;
b) morphologically: they are often devoid of any morphological structure;
c) syntactically: either they form phrases in themselves or they are syntactically independent of other parts of sentences (which explains their initial designation when this group of words was distinguished for the first time in the history of language sciences, cf. *inter-jection*, in modern English);
d) stylistically: the majority of these words are more commonly found in informal spoken utterances than in literary languages, etc.

On the basis of these criteria (the list of which is far from exhaustive), very heterogeneous words are often grouped under the common label of "interjection", such as exclamations and onomatopoeia, words specific to child speech and language, particular words used to address domestic animals, words of etiquette, the so-called "verbal interjections", etc. The majority of these words are often considered to be at the periphery of the "intellectual language", closer to the "emotional" one (the question why "interjections" are sometimes viewed as elements of human language that have more in common with "animal signs" than other linguistic units needs particular attention). In our paper, which oversteps the limits of a purely linguistic approach, we will dwell on the *semiotics* of these words, offering some *semiotic criteria* and *grounds* for their distinction. More precisely, the following questions will be the main focus of our study:

1) What kind of signs are "interjections"? Should one consider them to be exceptions to the general rule of language signs' arbitrariness, as

[2] Some linguists deny "interjections" the status of "words" and even that of "language elements": in their theories, this problem is linked to the question of the concept of language itself.

F. de Saussure did? Can "interjections" be considered as symbols or indexes?

2) Why does Ch. Peirce's semiotics seem much more appropriate for the study of "interjections" than the Saussurean approach?
3) Is it possible to distinguish one general semiotic function of words referred to as "interjections"?

In the history of language sciences, some attempts have already been undertaken to provide answers to these questions; they go back to various epochs and to the descriptions of the grammars of specific languages. The fact that no due attention seems to have been paid to these answers yet also deserves particular consideration.

## *Umwelt* and *Lebenswelt*: Between subjective significance and intersubjective understanding in human semiotics

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The subject matter of this lecture will be constituted of a discussion of the semiotic properties of human beings who are engaged in communicative interactions as meaning creators and meaning utilizers. Confronting the biological view of *Umwelt* with the anthropological specifications of *Lebenswelt* and *Eigenwelt des Menschen*, the concept of semiotic self, initially referring to an organism which emits to and subsumes signals from its environment as significant, will be counterpoised to the concept of communicating self as an observable person who sends and receives the meaning bearers and as an inferred subject who interprets and understands them appropriately. In consequence, solipsism, usually opposed to collectivism, will be discussed under the label of cognitive semiotics in terms of collective solipsism. Against the background of the European heritage of transcendental, existential and mundane phenomenology, the theories of personal constructs and social construction of reality, with special reference to radical constructivism, will be taken into consideration in order to show that man is a social being whose contacts with external environments are mediated by verbal and nonverbal means of signification and communication, and that it is language which

"objectivates" the shared experiences of communicating individuals, making them available to all members who belong to a given speech community, becoming in such a way both the source and the tool of collective understanding and knowledge. To sum up, language and culture-centred conceptions of sign and meaning will be juxtaposed here with the human-nature-and-culture-centred conceptions of subjective significance, on the one hand, and the intersubjective understanding on the other, which happen to take place in the collective ecosemiotic systems of communicating selves.

## Generalizing von Neumann's theory of self-reproducing automata for biosemiotics

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John von Neumann's *Theory of Self-Reproducing Automata* has emerged as a plausible model for thinking about biosemiotic processes (De Beule 2011; Waters 2011; Barbieri 2009). However, in the form presented by von Neumann (1966) and elaborated by Howard Pattee (2008; 2009), it is focused on the use of symbol strings to guide the physical construction of functional devices.

While this abstraction maps remarkably well to the construction of enzymes by nucleic acid templates in the cell, its mapping to higher-level biosemiotic processes, such as human language, presents a challenge. Human language does not physically construct humans; rather, it constrains and configures humans previously constructed by other means.

Can von Neumann's theory be adapted to incorporate configuration as well as construction? This paper outlines some of the challenges and proposes a more generalized version of von Neumann's model as a preliminary step.

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## There is no outside: A biological corollary for poetic space

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In contemporary biology life is usually understood as a meaning process happening on matter. In this understanding there exist two separated spheres, the material and the symbolical one. The degree to which the notion of meaning is stressed distinguishes the semiotic approach in biology (primacy of meaning) from "mainstream" biology (secondness of meaning, e.g. code/interpretation in some areas of the organism, DNA).

In this paper I want to propose a different understanding of the lived dimension. I want to define the living as a poetic space, which encompasses both material processes and meaning relations, joining them to a lived experience, which is "felt" or subjective from the inside and "sensuous" or "expressive" from the outside. The poetic space is not inside as "spirit" but *inside as body*, which can be best understood as metamorphic material which is always meaningful. This can be related to the idea of "core self" (Panksepp 1997).

I want to argue that the phenomenon of the living starts in this "hybrid" region of being neither inside nor outside. The lived space is rather a continuous communication of felt meaning which at the same time is materially embodied and "ideally" symbolic. The poetic space of the living hence has to be conceived of as really *one* space. This idea breaks with any notion of primacy of either matter or symbolic relationships and hence in a radical way is nondualistic (there is no outside to this poetic space, the poetic space encompasses both organic and anorganic matter).

At the same time it becomes clear that the imaginary scene of this poetic space can be subject to transformation from both sides: through material manipulation but also through imaginative creation. The poetic space is the

only transformable space that there is. The poetic space of the living is open to new interpretations, new framing of utterances of self-expression and can be really transformed in that way.

In this respect the poetic space of the living is also the place of freedom, where in a certain range of existential flexibility no pre-established values of good or bad exist. It is clear that material impacts can be of existential importance, but also signs can be of healing or mortal influence. Both levels, however, are never separable and always joint: because the poetic space is the only space where living occurs, any material impact has "felt" consequences and vice versa (Weber 2001, etc.).

From this point one could argue that any sense-making processes should take place in this lived poetic space. There are, thus, direct implications for our daily dealings with our being alive, the life on this planet and our relationship to the living, which at the moment are treated as rather technical or structural matters. Learning from the idea of poetic space, it should follow that any process of imagining and transforming reality has its greatest potential to be alive if it is a poetic – or artistic – process.

A practice of using the poetic space of the living as transformational and enlivening process can be found in the work of the performance artist Shelley Sacks, who creates poetic or "felt" spaces to generate a process of transforming reality as artistic process. I propose to generalize her idea to a "biology of the artistic process" which can be used to return to a fruitful and creative relationship towards life not only in scientific understanding but also in more general (and urgent) areas of our livelihoods.

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## Augustine and the ape: A biosemiotic investigation into the nature of life

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Everyday ordinary language deeply relies on the exploitation of visual metaphors that, by referring to the phenomenon of light, the faculty of sight and the organ of the eye, draw a striking parallel between, on one side, the functioning of the mind in its meaning generation and understanding processes and, on the other side, visual perception. "I see what you mean", "the eye of the mind" and "an illuminating idea" are a few examples of this rhetorical mechanism.

Nevertheless, this analogy between thinking and perceiving could not be intuitively understood without another implicit assumption, namely a kind of likeness between the external space of visual perception and the internal space of visual cognition. If understanding is somehow akin to seeing, then there must be an inner space of mind where this occurs.

Before a controversial and questionable reason connected to our neurological and psychological nature, there is doubtless a historical ground on which it is more likely to agree: if we speak and think today in terms of an inner mental space where visual-like phenomena happen, this is due to the philosophical-religious synthesis operated in the meditation of St. Augustine between, on one side, Plato's identification between knowledge and vision and, on the other side, Plotinus' inward turn towards the space of mind. In respect to Augustine's philosophy of mind, peculiar significance is then given to the functions of memory and productive imagination, through which human intentionality is able to creatively produce new meanings in the inner mental dimension of consciousness.

Nonetheless, ethological experiments carried out on primates dealing with problem-solving situations seem to suggest that something very similar is happening in the proto-mind of our closest ancestors: when facing circumstances that require an original and innovative rearrangement of elements at their disposal, they behave *as if* something akin to a mental inner representation of the scene before their eyes were created and its structure were somehow abstractly manipulated to find a suitable solution, a solution to be proved by the concrete behaviour subsequent to this reflexive moment.

According to the historical-natural theory of knowledge which goes by the name of Evolutionary Epistemology, the vision-based thinking described by Augustine and hypothesized to be proper to some primates is nothing but an advanced evolutionary step of a far more primitive process by means of which

the primary connection between life and movement is vicariously supported by the creation of a complex apparatus of perceptive and proprioceptive systems, of which vision is one of the most prominent. What is basically missing in such a perspective are both some corrective conceptual tools within evolutionary biology itself, in order to avoid strictly adaptationist interpretations of how the creation of biological novelties actually occurs, and a biosemiotic approach able to properly account for this "long-distance relationship" between living beings and their surrounding environments, a relationship whose mediating and mediated character cannot be explained otherwise than by its semiotic nature.

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## Merleau-Ponty's ontological bridge between biosemiotics and culture

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Scholars such as Jesper Hoffmeyer (2008) and Wendy Wheeler (2006) have acknowledged the relevance of Merleau-Ponty's philosophy for biosemiotics. This paper will demonstrate how his chiasmic ontology, with its understanding of the world itself as the only *Logos* and animality as its incorporated meaning, explains the emergence of human communication and cultural behaviour within the semiosphere in synergy with other organisms. "Their landscapes interweave, their actions and their passions fit together exactly," he says in *The Visible and the Invisible* (Merleau-Ponty 1968: 144). His *Nature* lectures at the Collège de France explored research in embryology, ethology, and evolutionary biology to demonstrate the complementarity between philosophy and science, and the philosopher's ability to "see behind the scientist" broader meanings

and consequences of experimental findings. Discussing Jakob von Uexküll and Niko Tinbergen, for example, he explains how their work demonstrates the beginnings of culture in other animals, such as the crab: "The architecture of symbols that the animal brings from its side thus defines within Nature a species of preculture" (Merleau-Ponty 2003: 176). Merleau-Ponty's linguistic theories – developed in dialogue with cognitive psychology and studies of infant language acquisition – help him to explore how literature and the other arts function as human modes of redoubling and inscribing the wild Being we share with the rest of life. His philosophy thus provides a foundation for new interdisciplinary approaches in environmental humanities that are poised for collaboration with biosemiotics.

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## Genetic information, mechanical interpreters and thermodynamics: The physico-informatic basis of biosemiosis

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The sequence of nucleotide bases occurring in an organism's DNA is often regarded as a codescript for its construction. However, information in a DNA sequence can only be regarded as a codescript relative to a biochemical machine which the information constrains in such a way as to direct the process of construction (Wills 2009). In reality, any biochemical machine for which a DNA codescript is efficacious is itself produced through the mechanical interpretation of an identical or very similar codescript. In these terms the origin of life can be described as a bootstrap process involving the simultaneous accumulation

of genetic information and the generation of a machine that interprets it as instructions for its own construction. This problem will be discussed within the theoretical frameworks of thermodynamics, informatics and self-reproducing automata, paying special attention to the physico-chemical origin of genetic coding and the conditions, both thermodynamic and informatic, that a system must fulfil in order for it to sustain semiosis. The conclusion reached is that biological systems are necessarily semiotic and vice-versa.

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## Affect, attention, and organic selection

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In the life of an animal, the functional cycles of its past resonate into those of the future. Results of past perception-action sequences influence which potential perceptual cues of the world enter into the umwelt. One mechanism by which potential perceptual cues are marked and weighed for their salience to the organism's needs is through the influence of affect on attention.

Affective impulses stem from an endosemiosic chain that represents the organism's needs (which the functional cycles of the animal are constructed to meet), drives, motivations, appetites, and other dispositions in the body and life history of the animal. The semiosic processes that underlie the dispositions resonate outward, as it were, towards the object in the umwelt, and yet resonate inward, affecting the innenwelt without the presence of perceptual or operational cues to anchor them. Additionally, this resonance, when anchored to perceptual or operational cue-carriers, is experienced not only as properties of the external object alone but also the attraction or repulsion of the self in connection to that object. Thus, as a complement to the concept of functional tone, the concept of affective resonance is introduced.

The role of affective resonance in biasing the choices the animal makes in its lifetime suggests a larger role for it in phylogenetic change. Sensitivity to affective resonance is here suggested as a type of phenotypic plasticity and is hypothesized to be a site of organic selection.

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## Code semiosis, interpretative semiosis and translation modelling

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The burgeoning literature on translation as interpretative semiosis is intriguing. Translation as interpretative semiosis implies the construction of an inter-dependent relation between texts in translational process. The interpretative semiosis of translation manifests itself through constructing unlimited textual and intertextual relationships between the translated and translatant texts. Viewing translation as interpretative semiosis means seeing translation from the angle of text modelling, since the interpretative relation arises not from individual signs in both texts, but from both of them being treated as unitary texts. In this case, the interpretative semiosis of translation is not limited to the genesis of one particular text, but mirrors the different textual modelling processes that Juri M. Lotman suggests. However, both the Peircean and Lotmanian viewpoints suggest 'translation' as understanding or comprehension in communication, which is broader than the Jakobsonian trichotomy of interlingual, intralingual and intersemiotic translation (henceforth: Translation). The difference between the two is that in Translation, in addition to building an intersemiosic relation, the agent is also implicated, as translators undergird the whole process related to code selection/realization. Hence, I propose to include Marcello Barbieri's notion of code semiosis for demonstrating the nature of Translation modelling. Code semiosis may shed light on Translation modelling when we accommodate coding rules, sign, meaning and translator into Jakobson's communication model. In this project, my adaptation of code semiosis and Jakobson's model will be used to explain how Translation modelling functions as meta-text modelling achieved by the complimentary relation between code and interpretative semiosis.

## Tactile scores: How tactile perception leads to convergence semiosis

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The word 'score' indicates a handwritten or printed form of musical notation, and the medium of scores is typically paper. On the one hand, the notion of 'score' is based on the categorization of the score's musical symbols (visual input) and, on the other hand, it is related to the production of a vocal/instrumental performance (auditory output/input). The musical performance is something perceived through the auditory channel, which is apparently incompatible with hearing impairments. However, deaf people too are able to perceive the musical input by using hearing aids or through tactile perception. 'Tactile score' is a term for indicating dynamical sequences of relief signs organized from the left to the right side of a limited paper space. The performance of a 'tactile score' does not implicate the use of instruments and it can be realized by people with or without perception impairments. Using 'tactile scores' (tactile plates) I explore the relief signs categorization process in hearing and deaf subjects. Data show that tactile sensation enriches the visual input and leads to the creation of convergent communication in both groups (the performance result). I discover the semiosic process in hearing and deaf subjects by analysing the relations between different sign systems and observing the 'tactile scores' performances.

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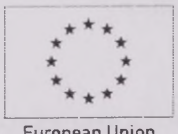

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