

GATHERINGS IN BIOSEMIOTICS 2



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*Abstracts of the meeting in Estonia (Tartu – Puhtu –Tallinn, June 14–17,
2002)*

Edited by

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Tartu — University of Tartu

2002

Introduction

"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).

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.

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Neoteny and its role in taming and domestication

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A notion once applied, descriptively, to the retention of embryological characters from an antecedent form of an organism, into a subsequent, more mature period in the ontogeny of a phylogenetic descendent form — neoteny is now appreciated as a fundamental systems process concomitant with hierarchization. Specifically, neoteny connects to constituent simplification, codependence, flexibility, and exogenous dissipative structures, while hierarchization connects with the overarching, maturing coevolutionary system with its absorption of noise, tolerances permitting resilience, and endogenous dissipative structures. Consequently, the domain of neoteny crosscuts, and even articulates, biology, culture, and behavior.

An understanding of the dynamics of neoteny in systemic evolution and in interspecific relations leads to fresh insight with respect to domestication, or, more properly, codomestication. Rather than reduce domestication to human activity through artificial selection (selection-in), with or without intention, the topic must enlarge to acknowledge the shape of ontogenetic trajectories and the serendipity in the integration of enabling (largely informational, in ontogenesis) and limiting (largely energetic, in ‘natural’ selection-out) constraints.

Codomesticates exhibit many neotenous traits and processes, some pre-dating the domestication process, some consequent to it, and most intensified by it. Humans, as codomesticates, are further neotenized and domesticated by culture. Such an approach to codomestication sheds light on other interspecific relations, including protection, predation, and parasitism. The analytically distinctive properties of codomestication involve a complex of cooperation and competition, consisting largely in loops of information throughput in patently open, disequilibrium systems, while intentional protection within or without a domestication framework involves an asymmetric investment of energy in more closed, equilibrium systems.

Predation involves a competitive tradeoff of predominately energy accruing to successful predator and of predominately information accruing to the surviving prey. The ultimate potential in reciprocal cooperation lies in host-parasite relations. The codomestication process, often emerges from predation and/or protection scenarios, as outlined here, and not infrequently merges with a category of host-parasite relations best glossed as coparasitic. These dynamics of the recursive process of neoteny underlie the prehistory and history of codomestication, as well as provide some algorithm for contemporary trends, with or without deliberate human intervention.

Four principles of Jacobian biopragmatics

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The French molecular biologist François Jacob has outlined a theory of biologic evolution as tinkering. From a methodologic point of view, his approach can be seen as a biologically specified version of the abstract relation between laws, describing the dynamics of a system, and boundary conditions on this dynamics. Evolutionary theory, then, would finally be a theory of consistent biologic histories, i.e., of coherent transformations of contingent boundary conditions due to reduplication, recombination, mutation, and hierarchization of a limited set of given structures, so that the same or very similar structures fulfil several functions in different contexts. Because every proposal of some evolutionary causality has to fit in with this general scheme, Jacob's theory of tinkering is a meta-theory sketching a framework for analysing the form of evolution. In semiotic perspective, tinkering is a pragmatic concept well-known from the information-theoretic anthropology of Claude Lévi-Strauss. In idealized contrast to an engineer, the tinkerer has to accept the concrete contingent restrictions of his material resources as only gradually changeable constraints on his well-thought-out projects. Jacobian biopragmatics examines evolution as a biologic analogue to this human tinkering but obviously devoid of any projecting subjectivity. To validate this analogy, four basic principles of Jacobian biopragmatics concerning its main aspects are proposed. Firstly, the fundamental notion of biopragmatics is context-dependency: every biologic information can act as information only in relation to a context. Secondly, the main interest of biopragmatics is to explore the potentials the evolutionary process possesses (especially in respect to genetic engineering as a scientifically refined form of tinkering). Thirdly, the research strategy of the biopragmatician is characterized by the non-existence of an essential methodic difference between object- and meta-level: he has to follow in his research the same logic of tinkering as his object in its evolutionary generation. Fourthly, biopragmatics is connected to semantics by the theory of narrative programs, and to syntax by the notion of logical depth.

Organic codes: Metaphors or realities?

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Coding characteristics have been discovered not only in protein synthesis but in various other natural processes, thus showing that the *genetic code* is not an isolated case in the organic world. Other examples are the *sequence codes*, the *adhesion code*, the *signal transduction codes*, the *splicing codes*, the *sugar code*, the *histone code*, and probably more. These discoveries however have not had a significant impact because of the widespread belief that organic codes are not real but metaphorical entities. They are supposed to lack arbitrariness and codemakers, the two qualifying features of real codes. Here it is shown that the arbitrariness

issue can be solved on an experimental basis, while the codemaker issue is dependent on our theoretical description of the cell and can only be solved by a new concept. In order to appreciate the reality of the organic codes, in short, it is necessary to have not only a more critical evaluation of the experimental data but also a new theory of the living system.

The evolution of empathy in social systems

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The social play behavior of animals is poorly understood in terms of traditional biological explanations. There are no exact definitions of these types of behavior, and there is no ethological method that applies to the behavioral category of play. By focusing on the intersubjective field between the playing individuals — instead of on the individual as an entity — I try to create space for a new approach to ethology. This approach involves a biosemiotic view on the “socio-empathic field”. When animals play they learn to negotiate and define themselves clearly in the social group, this demands empathic understanding. Since play is found throughout the animal world, there must be evolutionary capacities underlying this type of construction in the social system.

Biosemiotics and the Third Culture

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In 1995, John Brockman wrote a book called *The Third Culture*. The book was based on interviews with prominent scientists like Stephen Jay Gould, Lynn Margulis, Marvin Minsky, Murrau-Gell-Mann, and Francisco Varela. The title was inspired by Snow's book from 1959: *The Two Cultures: the culture of science and technology and the culture of the humanities (the intellectual scholars)*. In an addition to the second edition of his book (1963) Snow talks about the necessity of a third culture to bridge the gap between the other two and make a new synergy. Brockman points out that the third culture he describes is not exactly that of Snow's. What is happening is that a handful of researchers within science and technology have started writing books for the broader public about the philosophical consequences of the new evolutionary worldview of complexity and self-organization. This is based on new discoveries in science and technology, especially computing. The discoveries seem to affect the understanding of the deeper meaning of life in the universe. The new sciences of complexity within mathematics, physics, and chemistry are through the concept of information making contact with biology and the ideas of self-organization, agency and autopoiesis developed there. An informational-evolutionary self-organizing worldview for both the universe and the living systems in a complex mutual interdependency is the result.

Although researchers, scholars and popularisators, like Allan Guth, Paul Davis, Lee Smolin, David Dennett, Stuart Kauffman, have all contributed to this new view of the world as a self-organising complexity with no clearly determined lawful foundation, they have not yet dared to address the concepts of meaning and signification. These are concepts usually attached to continental philosophy such as structuralism, semiology, phenomenology and hermeneutics.

Peircian semiotics, and especially its biosemiotic version, is unusual in its integration of qualia, signification and semiosis across "dead" and living nature, culture and machines. Connecting to ethology through Uexküll's Umwelt concept, biosemiotics regards the sphere of signification, created by every living system as the primary living space. Thus the habitat in the ecological niche becomes a meaningful sphere.

Through embodied cognitive semantics as for instance that of Lakoff and Johnson's, the influence of embodiment on the construction of cultural meaning through language is revealed. Through endosemiotics the production of meaning is carried inside the organisms to the communication between the cells, and in microsemiotics even within the cells. In the development of physiosemiotics (J. Deely), the production of meaning is taken into "dead" nature and the development of the universe, in accordance with Peirce's philosophy of hylozoism, synechism and agapism. Biosemiotics is introducing the concept of meaning to science, thus paving the way for a true Third Culture. Recent work by Andreas Weber develops further aspects of such an understanding.

The global phenotype

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In the extensive reconceptualization of the nature and organisation of genome architectures that has taken place at the turning of the XX century, the communication potential between genomes has become of the highest importance. The entire set of genomes of all living organisms has been defined elsewhere as the “genome space”. Just as we are bound to bear in mind that all live manifestations are historical entities we have to keep in mind also that all living entities are alive at the same moment. So the “global genome space” is a dynamic space that contains (and continuously renovates) the potentiality of the “global phenotype”. But unless we want to remain stuck to a geno-centric view, we have to consider the mutual semiotic constitutivity of the global genome and its phenotypical counterpart. Genomes do not walk around by themselves.

The potentiality for “change” and for the production of novelty implicit in the genome space may be regulated by the actual manifestation of such potentiality in relation to the actual environmental conditions. It is suggested that the constant digital-analogical-digital translation, from global genome to global phenotype and vice versa can be considered as a homeostatic system of mutual determination (and change). This process is mediated by codes which are formed at different hierarchical levels out of an indeterminate number of dyadic causal relations, specific “lock and key” interactions, that by their simultaneous occurrence create a context that gives rise to emergent and “de-emergent” triadic relations.

Is it ever possible to separate the hen from the egg?

Bilateral biosemiotics: A problem of sense on a super-triplet level

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In my previous work in which I proved the necessities of creation of bilateralist biosemiotics, I focused my attention on the nature of biological sense. The arising problems are most evident in an example of semantics triplets, in particular, in discussing the mechanisms of correspondence between the adapter and acceptor in t-RNA.

Certainly, any component connected with the t-RNA is present at any biological semantics. However, to reduce all biological semantics to semantics t-RNA would be reductionism, but further, from the practical point of view, such an arrangement lacks perspective.

At the present time there are at least two another ways of introducing biological semantics.

The first of which - consideration of sequences nucleotides DNA/RNA and sequences amino-acids in peptides from the perspective of their functional synonym/homonym. Thus, three moments are of most importance:

- The transformation from sense to meaning.
- Opens up the way to restriction by unilateralistic concepts of semiotic means or simply cybernetics.
- Appears the opportunity of using philological-linguistic data about graphic poetry features (palindromes, heterograms, acrostics), which at present time do not appear as marginal phenomenons of language.

Second - reference to sense in ethological semiotics. The main problem thus is overcoming anthropomorphism.

In this context two interconnected areas are especially interesting:

- Reconstructing taxon-specific *umwelten* in a J. von Uexküll's sense. However, this *umwelt* is not a semiotic environment, but special material of the *plan du contenu* for generation taxon-specific semiotic means.
- Revealing taxo-specific invariants of receptions (in the Pribram-Galanter-Glaser sense), which, on the one hand, exist as components of morpho-functional organization of a body of a living being, and as another — as “building material” of this *umwelt*.

Information expression requires cohesive levels

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Information carrying capacity is the consequence of a system having certain causal (dynamical) properties. These properties can be defined at a single scalar level, allowing but not implying arbitrarily high degrees of specifiability. The expression of information, however, requires at least a second dynamically defined level. This is sufficient for at least a form of protoreference, but, I will argue, not a real pragmatics, and hence not a real semantics.

In search of a reconciliation between semiotics, thermodynamics and metasystem transition theory

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Characterised by positive feedback, metasystem transitions appear to play a fundamental role as the quanta of evolution in natural history. In addition to that, semiotic processes are of prime importance for the realisation of those metasystem transitions. From a thermodynamic point of view, the emergence of more complex, self-producing agents that tend to become “greedier” consumers of energy gradients, depends on the emergence of more advanced forms of semiosis. The possible efficiency improvement in the energy consumption achieved through semiotic means can shift the balance between the advantages (such as the increased access to energy resources) and the disadvantages (such as the increased amount of the so-called “tax” paid in the form of entropy production) of greediness in the positive direction. As an evolutionary consequence, more symbolic forms of semiosis that allow higher competence for abstraction, anticipation and efficiency emerge. In this semiotic and thermodynamic context, the relevance of the concept of senescence will also be discussed.

Biosemiotics and experiential biology

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The evolutionary emergence of biosystems with inner, qualitative states have not been explained in any sufficient way within the traditional neo-Darwinian paradigm. Here, natural selection would appear to work just as well on insentient zombies with the right behavioral input-output relations as their fellow beings, the real sentient animals. In consciousness studies, one talks about the ‘hard’ problem of qualia. Is it possible to describe a set of principles about sign action, causality and emergent evolution, drawn from biosemiotics and complex systems research, that will allow us to sketch a theory of the emergence of conscious experiences in evolution? An attempt is made to give such a list of principles, and “the hard problem” will be reformulated as the problem of relating experimental biology to experiential biology.

**Collapsing the wave function of meaning:
The contextualizing resources of talk-in-interaction**

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In a radical departure from both the formal and the materialist reductionism so often prevalent in the disciplines of linguistics, sociology, anthropology and neuroscience, a growing number of researchers at the interdisciplinary interface known as ethnography of Communication have, over the course of the last three decades, compiled compelling evidence demonstrating that “language” as it is actually realized in naturally occurring, everyday talk-in-interaction, derives its semiotic efficacy more from the active co-participation of situated speakers in creating contexts of relevancy, constraint and possibility for each other’s actions than from the mental, computational recombination of referential tokens within the bounds of some predetermined, category-structuring syntax.

Rigorously empirical and devoted to an explication of how language-using agents themselves display to each other their understandings of what they are doing as they are collaboratively making meaning (as opposed to how theoreticians of such meaning-making may interpret those displays analytically), the nascent disciplines of ethnography of communication and conversation analysis are, in much the same fashion as the nascent discipline of biosemiotics, studying “meaning” as an ongoing interactional achievement among linked and living agents — a caused and causative *event* in the world, rather than a determined and determining referent or *thing*.

Understanding the world of conversational interaction to be one wherein the actions of its participants mutually and reciprocally co-create the conditions for each other to realize singular actualities out of the realm of possibilities created by those actions (and wherein those actualities subsequently constitute the conditions for further possibility), conversation analysis and ethnography of communication studies share with the semiotic philosophy of Charles Sanders Peirce (1839–1914) the notion of a perpetually built environment of meaning that is irreducibly relational and interactionally accomplished and sustained.

The focus of this talk will be an introduction to some of the basic principles, methodologies and research data of conversation analysis, and an attempt to situate such research and its findings within the broader study of meaning-making among living agents that is the goal of biosemiotics. I will argue that the former can well illuminate and assist the latter in its continuing effort to understand the principles whereby not only our social worlds, but our very biological world itself comes into being not as a “given” in the furniture of the universe, but as a fundamentally interactional, locally organized, massively co-constructed, context-sensitive and context-creating, ongoing semiotic achievement in that universe instead.

Teleology and the ‘natural history of signification’: The implications of Hans Jonas’ bioontology for biosemiotics.

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Biosemiotics claims the sign to be the fundamental biological unit. The ontological status of the sign, however, is ambiguous. Are signs simply ‘there’ or are they only existing for the interpreter? If a sign is defined ‘a difference that makes a difference’, it is still unsettled if a sign is an agent itself or the tool of an agent. Or if the receiver — through an interpretational ‘act’ — is the true origin of any signification.

Biosemiotics seems to claim, that all meaning is the result of signification, of a sign-*making*. The reason for this is probably, that it makes the sign a good match to the efficient ‘cause’ of physics, thus saving the explanatory force of traditional science. On the other hand biosemiotics tacitly assumes, that signs not only ‘make’ sense in a quasi-causal way, but also ‘have’ a meaning in the good old-fashioned way. If not, the carefree mixture of traditional naturalism and antropomorfism (a stylistic free riding-trait of biosemiotics) will collapse.

One could say, that biosemiotics has taken a stand between Kant and Schelling. The kantian approach (also seen in Jakob von Uexküll) traces all signification back to a (quasi-human) subject, thus only allowing its ‘as-if’-status in external nature. The schellingian approach (Schellings *Naturphilosophie* after year 1801) insists on seeing humans, subjectivity, consciousness and meaning as natural, thus having to extend the concepts of nature and matter in order to avoid semiotic irrationalism.

In Hans Jonas’ philosophy of life the influence from Schelling is indisputable. Jonas attempts to rehabilitate natural teleology and he develops a ‘cosmogonical’ or even “speculative” concept of matter in order to save both the dynamic unity of nature and the reality of meaning.

In its basic features the Naturphilosophie and cosmology of Hans Jonas is not unlike the philosophy of another Schelling-successor, Charles Sanders Peirce. To me it seems indispensable for biosemiotics to elaborate more consequently into its fundamentals to get a less ambiguous concept of sign and information. Even at the cost of traditional physicalism and scientivism. My paper will contribute to this aim through the philosophy of Hans Jonas.

***Scitoi mesoib* — or why the genome is so small**
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The finding, reported in the newspapers all over the world at February 11, 2001, that the human genome, previously believed to contain approximately 100,000 genes, did in fact only contain some thirty thousands genes has seriously challenged the received understanding of phenotypic determination. Perhaps as little as 300 genes separate the human species from that of the mouse. Thus, contrary to what we were often told, at least there cannot be a mutated gene for every item on the list of human sins. An analysis of gene action in *Caenorhabditis elegans* and in the virtual species *Scitoi mesoib* shows us how this can be.

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

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The paper will deal with the *differentia specifica* of information and sign processes in biotic systems in the framework of a Unified Theory of Information.

Starting point will be the co-extension of semiosis and self-organization. On the one hand, semiosis and self-organization in biotic systems has to be distinguished from semiosis and self-organization in physical and chemical systems. On the other, it has to be distinguished from that in human systems. The paper will discuss some approaches to giving the essence of life and will focus on semiotic implications. It will conclude that the characteristics of the living in the perspective of a theory of evolutionary systems will serve as a novel function that has emerged in the course of the evolution of self-organizing systems and that the semiotic features of biotic systems in cognitive, communicative and co-operative respects derive from this very function.

Molecular semiotics of the cell

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Most, if not all, contemporary molecular and cell biologists seem to be working under the tacit assumption that the principles of physics and chemistry are necessary and sufficient to account for the observable properties of the living cell. Although this so-called ‘PC paradigm’ (P = physics; C = chemistry) has been enormously successful in the past century in unraveling the material details of the living cell, a growing number of biomedical scientists, since toward the end of the last century, has expressed the alternative view that physics and chemistry are necessary but may not be sufficient to account for life on the molecular and cellular levels. One such emerging perspective is the ‘PCL paradigm’ (L = linguistics) that began to be formulated in the late 1960’s (e.g., Pattee 1968; Marcus 1974), according to which, in addition to the laws and principles of physics and chemistry, those of linguistics are absolutely needed to completely account for life on the cellular and molecular levels (for a review, see Ji 2001). The conceptualization of the PCL paradigm was spurred by the surprising finding that the molecular language used by cells has design principles that are very similar to, or isomorphic with, those of human language (Ji 1997). Since linguistics is a major subdiscipline of semiotics, the PCL paradigm can be alternatively referred to as the ‘molecular semiotics’ or ‘microsemiotics’ paradigm (Ji 1999).

Theoretical and experimental evidences that have accumulated during the past three decades indicate that the living cell is a complementary union of two irreconcilably opposite aspects – the energy/matter aspect and the information aspect (Ji 2002). The conformon (i.e., sequence-specific conformational strains of biopolymers driving molecular work processes in the cell) theory embodies primarily the energy/matter aspect of the cell (Ji 2000; also in Ji 1991), while the cell language theory reflects the information aspect (Ji 1997). It has been found that the combination of the conformon and cell language theories provides more complete and coherent explanations, than any existing biological theories, for various molecular structures and processes in the cell, including the actions of molecular motors and pumps, oxidative phosphorylation, signal transduction, and the phenomenon of genome-wide coordinated gene expression revealed by the DNA microarray technique.

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Biosemitotic perspectives in gasflux models

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During the last decade interest in both carbon and nitrogen dynamics has increased because of the predicted anthropogenically induced global changes in them, and the global climate change that may follow. Today, the understanding of carbon and nitrogen dynamics are mainly based on mechanical models that describe physico-chemical interactions related to these processes.

As a contribution towards our understanding of carbon and nitrogen dynamics I present my study on the exchange of methane and nitrous oxide fluxes with the atmosphere from a constructed wetland. In these studies I suggest that it is important to include biosemiotic perspectives in the gas flux models.

Thus, the aim of this study is to develop new paths for gas flux investigations in research fields related to constructed wetlands.

Biosemiosis: A search for other

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(1) The phenomenon of biosemiosis, as well as semiosis in general, includes features that may be inaccessible via a methodology of a standard physical science; this requires an approach of semiotic science.

(2) There exists a semiosic force — the force that appears as a result of communication or a dialogue, an individual connectedness via a signification or a dialogue *sensu lato*.

(3) A principal feature of the semiosic force is anticipation. As related to the concept of need, it distinguishes semiosis from non-semiosis.

(4) A search for *other*, as a general and universal feature or tendency of all active behaviour of organisms, provides a principle that bridges many problems of biosemiotics and ecosemiotics. One can see in the search for other (or in a ‘need for impression’, according to a zoosemiotic formulation by A. Turovski) a characteristics (or working principle) that is responsible simultaneously both for the fixation and for the evolving of codes.

(5) Biological evolution is a semiosic search.

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On the expression of negation among animals

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Gregory Bateson thought that the great difference between human language and animal communications was in the fact that these latter were unable to express negation. Even if we don't agree about the rapidity of such a statement and its generality, it is nevertheless true that it leads to a very interesting question about the expression of negation among animals: are they able to do it, and how? In that paper, I wish to discuss Bateson's statement from the point of view of contemporary researches in ethology and comparative psychology — in particular in play, sharing and regulation of power. I wish to show that if it is not possible to say that animals are not able to express negation, it does not mean that they are able to express it as humans do. I will also show that interactions with humans lead animals to acquire new means to express negation. Finally, I shall discuss that question in the more general framework of a phylogenesis of meaning.

The role of relations in semiotics

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A distinction will be introduced between relations (*Verhältnisse*) und relationships (*Beziehungen*). The related are in relations, whereas relationships are made by the related.

Signs are connecting links between relations and relationships.

A new perspective on sign types will be suggested on the basis of a distinction between relations (*Verhältnisse*) and relationships (*Beziehungen*).

If opposites are entirely independent from each other and entirely separated then they coincide. In this case they are in a relation. They are formed by this relation, i.e, they are possible due to this relation.

If opposites depend on each other by their interaction and immediate contact then they exclude each other. In this case they are entering a relationship. This relationship is made by them, i.e., it is actual due to them.

Signs are connecting links between relations and relationships. Human reality (the reality as accessible to human beings) has a sign character which in our experience is broken into being formed by something objective and being made by someone subjective. We are in an objective relation, and we are entering a subjective relationship. Signs have been made by and from non-signs along with the human, and signs are forming the entire world into signs.

Our life is experienced as communication between object and subject. It seems that, on the basis of a model of the object as the sender and the subject as the addressee, Peirce reduces the object to the "object" and the subject to the "interpretant". In my interpretation of the Peircian terms, actually, the object is what is forming and what is formed, whereas the interpretant is what is made and what is making.

The object is a relation, whereas the interpretant is a relationship. The sign is a relationship being in a relation with an object, and a relation entering a relationship with an interpretant. The sign is a connection between the object and the interpretant, between the relation and the relationship. It combines both the relation character and the relationship character.

The way a sign mediates between the relation and the relationship (the object and the interpretant) may be different. To denote these different ways I shall use the terms of Sebeok's sign typology in a reinterpreted manner:

	left	right
third level	5. <i>symbol</i>	6. <i>name</i>
second level	3. <i>icon</i>	4. <i>index</i>
first level	1. <i>signal</i>	2. <i>symptom</i>

In the left column, we deal with objects (relations), whereas in the right column, we deal with interpretants

(relationships). An object-sign is formed by an interpretant, whereas an interpretant-sign makes an interpretant.

Now I will expound the sign types in the context of Peirce's metaphysic and biosemiotics. In the terms of our table, the first level, the second level and the third level correspond to Peirce's Firstness, Secondness and Thirdness. Peirce concentrates on our right column, i.e., on how the interpretant gets made.

On the first level, the object-sign is a "signal", whereas the interpretant-sign is a "symptom". A signal is an object in itself, revealing itself only symptomatically. A symptom is a symptom (a sensuous appearance) of a signal. In Peirce's terms, chance-spontaneity is signal, and feeling is symptom.

Signal is sign without system: it does not depend on any sign system. It determines itself by itself, being an interpretant forming itself and relation identical to its related. Symptom is context without text. It determines itself by itself, being a sign making itself and a related identical to its relationship.

The second level is the properly semiotic level and the properly biosemiotic level. "Icons" are signs in a sign system and "indices" are texts on the background of a context. The signs are formed by the sign system and the texts are made by the context. An icon is like a sign in Uexküll's terms (in anthroposemiotics - like a language sign in Saussure's terms) and an index is like an adaptation sign or adaptation text (which has not yet been elaborated in biosemiotics) or, in anthroposemiotics, a speech text (a message).

To understand an icon, let us regard Saussure's language sign. Saussure distinguishes between the signifier, the signified and the sign. In my interpretation, the sign is the interpretant, the signified is the object and the signifier is the sign (representamen). The interpretant is the relation forming the object (signified) and the sign (signifier). The interpretant is formed by the sign system. The relation (sign) is a relation of a relation (signified) and a relationship (signifier). Here, the sign is the same as the signified. The same relation is both the interpretant (sign) and the object (signified). So an icon is a relation being a relation of itself and a relationship. In biosemiotics, for instance, to each function of an organism there corresponds an icon, and to its system of functions there corresponds a sign system. (In icons, the sign and the object are similar to each other by being each others "reverse sides".) In Peirce's metaphysic, the "icons" are habits or laws.

The counterparts of the "indices" in Peirce's metaphysic are the reaction senses. The subject is free in its resistance to the object. The interpretant is the subject such as it changes into in the context of the object's presence. The sign (text) is the subject such as it "reacts" to the object's presence. The sign and the interpretant are states of the same substance (the subject). The object just is the object's presence. In biosemiotics, the subject

of adaptation is changing from the sign into the interpretant. This process of change is its adaptation in the context of the object. The index (text) is the relationship between itself (the relationship) and the relation (the object). As the sign, the text is what the object is in the relationship with, and as the interpretant, the text is the very relationship. (The "indices" are texts gathering information about the object in the course of their self-interpretation.)

On the third level, we deal with "symbols" and "names". A symbol is a system without signs. A name is a text without context. The symbol is what forms the possibility of signs. The name is what makes the actuality of text. The symbol is the initial (true) object. The name is the final (true) interpretant.

The symbol is the relation (interpretant) of the relation (interpretant) with itself (sign). In the symbol, all relationships have been "turned" into relations. Signs (and especially, symbols in Peirce's sense) are finite projections of the initial symbol. The symbol is the source of all possible signs. In the symbol in itself, everything means everything. In Peirce's metaphysic, the "symbol's" counterpart seems to be God.

The name is a relationship being in a relation with the relation (the symbol). The name does not mean anything beyond itself, it is the end of interpretation. Nevertheless, the Named is embodied in the Name. The name is the sign, the unreachable end of the name is the interpretant, and what is embodied in the name is the object. In Peirce's metaphysic, the counterpart of the name is the endless thought, the endless evolution.

Mimicry and mimesis in the bio-semiosphere

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Mimicry-like phenomena has been described both in the evolutionary and individual level of (bio)semiotic systems. Mimicry and crypsis occurring in evolutionary time-scale are usually described as biological phenomena by the terms of Batesian, Müllerian, aggressive mimicry and others. Whereas deceptive behaviour arising from activity of the individuals is often regarded belonging to the sphere of human culture. In this paper attempt is made to consider both mimicry (evolutionary level) and mimesis (individual level) as two possible semiotic deceptive systems or as the two different ways of functioning these systems. Comparing mimicry and mimesis schematically shows characteristic features of both.

Through the actual cases it is shown, that both mimicry and mimesis cross the culture-nature borderline although the first is definitely more common in biological sphere whereas the other is more concentrated in cultural sphere. Common to the both systems, mimicry and mimeses increase complexity of the semiosphere via cyclical communication and selective feedback — the trait that may consider as the common feature to the all mimicry-like systems.

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Who is the addressee of the genetic text?

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The prevailing contemporary view of organic life, coined largely by the classics of molecular biology and the new evolutionary synthesis, is based on the assumption that structural and functional features of organisms are fully encoded in their DNA genomes. Development is therefore understood as execution of the genetic program for construction of a given species of organism (Davidson 2001). Such a metaphor leads to questions regarding the nature of the hardware, operation system and programming language responsible for execution of the program. We can safely ignore such questions only under assumption that the non-program components remain constant throughout evolution and ontogeny. However, there is abundant evidence that this “wetware” is species-specific or context-dependent. The same DNA sequence (“genetic text”) can, however, be interpreted in a context-dependent manner, as documented, e.g., by:

- “misinterpretations” of cloned genes in different organisms (leading to improper spatial folding of encoded protein or even to improper delimitation of protein-coding message);
- epigenetic memory — heritable conditions encoded by media other than the sequence of DNA;
- the “reaction norm” phenomena, where an established wetware explores the phenotype phase space, including rarely visited or hidden areas;
- occurrence of novel phenotypes in interspecies hybrids, revealing the potential of alternative interpretations of existing genetic programs;
- the action exerted by the expression of homologous (often even identical) genes in ontogeny (homeotic genes etc.).

Many of such phenomena may become easier to grasp when we abandon the computer metaphor with its software–hardware (or program–wetware) controversy. Instead, we suggest a natural-language-based (hermeneutic) framework in which such phenomena become expected rather than anomalous. A string of digital symbols cannot contain the rules for its translation into shapes (bodies). The “being-a-program” is *not* the property of the string — it must be imposed (negotiated) from outside, i.e. by the body itself. The metaphor of hard-wired epigenetic rules that decode messages into bodies can survive only in a creationist (or, at least, deist) framework. Moreover, even the most engaged proponents of such worldviews are not entirely consistent in this respect (see, e.g., the concept of *gratuity*, Monod 1979).

We propose that the decision what strings will serve as programs, and how they will be executed, is made in a process analogous to reading and understanding in a natural language (Markoš 2002). From such an angle, individuals, species, and consortia of organisms (bacterial films, symbioses, host-parasite

relationships, etc.) become analogies of culture, with their “wetware” rules molded by contingencies of their evolutionary history.

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Proteomics as a tool for studying complex systems and the abductive induction of C. S. Peirce
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The draft of the human genome announced in February 2001 marked an epoch in the history of molecular biosciences and will influence the emphasis and direction of biomedical research in the future. With a known genome an entirely new approach is possible for the understanding of life in molecular terms. For example, with the genome information and the data created from the proteins displayed on a two-dimensional gel followed by mass spectrometry, it is now possible to identify the proteins of interest without any presumptions about their identity. Such technique is often called a proteomics approach. A proteomic investigation begins with the discovery of unidentified proteins of interest under well-defined physiological conditions. The operation involves (1) protein display by two-dimensional gel electrophoresis or other separation technique, (2) determination of protein entities, (3) peptide mass fingerprinting, and (4) genome/proteome database search. We show that the methodology of the proteomics approach is characterized neither by deduction nor by induction in the traditional sense, but is a clear example of what C. S. Peirce described as abductive inference almost a century ago. The investigation of complex signaling pathways is intractable to deductive and inductive methods due to its extreme complexity. We show two cases of the proteomics approach as applied to the visual systems of the fruit fly *Drosophila melanogaster*, and rodents. These examples illustrate the role of abductive inference in proteomics, a discipline at the forefront of current studies in molecular biology.

From biosemiotics to semiotics

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Abstract. Biosemiotics and Semiotics have similarities and differences. Both deal with signal and meaning. One difference is that Biosemiotics covers a domain (life) that is less complex than the one addressed by Semiotics (human). We believe that this difference can be used to have Biosemiotics bringing added value to Semiotics. This belief is based on the fact that a theory of meaning is easier to build up for living elements than for human, and that the results obtained for life can make available some tools usable for a higher level of complexity.

Semiotics has been encountering some difficulties to deliver a scientific theory of meaning that can be efficient at the level of human mind. The obstacles making difficult such theory of meaning can be understood as resulting of our ignorance on the nature of human. As it is true that we do not understand the nature of human mind on a scientific basis.

On the other hand, the nature and properties of life are better understood. And we can propose a modelization for a generation of meaningful information in the field of elementary life. Once such modelization established, it is possible to look at how it could be extended to the domain of human life.

Such an approach on a theory of meaning, beginning in Biosemiotics and aiming at Semiotics, is what we present in this paper. Taking an elementary living element as reference, we introduce the bases of a systemic theory of meaning. Using a simple living system submitted to a constraint, we define a meaningful information, a meaning generator system and some elements related to meaningful information transmission. We then try to identify the hypothesis that need to be taken into account in order to look at extending to human the results obtained for living elements.

Semiotics and biosemiotics. Information and meaning

Semiotics and Biosemiotics entertain multiple and complex relations. Several definitions are available for these two words [1; 2], but there is a characteristic we would like to underline. It is about the domains covered. Semiotics address information and meaning for human. Biosemiotics address information and meaning for non human living elements.

In terms of evolution, the Biosemiotics domain appeared on earth billions of years before the Semiotics domain. On an evolutionary stand point, Semiotics is rooted in Biosemiotics. So Semiotics can be looked at as a branch of Biosemiotics, as human is a branch of animal life. And this parallel is interesting because of the difficulties encountered in the understanding of the nature of human. Indeed, the nature of human is today out of reach of scientific knowledge. Despite the efforts of philosophy, psychology, anthropology and neurosciences, the nature of human mind is currently unknown (the "hard problem").

On the contrary, the nature of life is rather well understood on a scientific basis. And, as Semiotics is a result of Biosemiotics evolution, we want to believe that modelizing some functions in the field of Biosemiotics will provide models that could find interesting application in the field of Semiotics. In other words, evolution from Biosemiotics to Semiotics can be an interesting window on the transition from animal to man.

Biosemiotics and Semiotics cover many parameters. And we need to make a choice in order to work on a practical example. The concept of meaning is a good choice, as it is of some interest for both fields [3].

We are going to build up a modelization of meaningful information generation for Biosemiotics. More precisely, we will analyze meaningful information generation for simple living elements in order to make available a model that could shed some light on the understanding of meaningful information generation for human (Semiotics).

A theory of meaning for biosemiotics

Looking for a simple living element that is well known, we can choose the *Paramecium*.

Many behaviors of paramecia have been studied, and some can be looked as displaying the existence of meaningful information generation.

Take for instance a paramecium living in water, and assume that the water becomes acid in the vicinity of the little animal. The paramecium will rapidly move away towards a less acid area. It seems quite obvious that the presence of acid has participated to the build up of some meaningful information in the paramecium. Meaningful information sounding like: "the environment is becoming incompatible with survival". And the paramecium to react correspondingly by moving away from the acid location.

Basically, three elements have participated to the creation of this meaningful information within the paramecium:

- the constraint of staying alive;
- the acid water becoming close;
- the incompatibility between the satisfaction of the constraint and the acid water.

This example of a paramecium building up "meaning" from the presence of acid water can be represented as a system (Fig 1), the meaningful information being the connection existing between the constraint of the system (to stay alive) and the received information (acid in water).

The meaningful information (acid non compatible with staying alive) will be used by the system to participate to the determination of an action aimed at the satisfaction of the constraints (move away from acid area).

Such a modelization brings up the definition on a meaningful information, with corresponding properties:

"A meaning is a meaningful information that is created by a system submitted to a constraint when it receives an external information that has a connection with the constraint. The meaning is formed of the connection existing between the incident information and the constraint of the system. The function of the meaningful information is to participate to the determination of an action that will be implemented in order to satisfy the constraint of the system".

(Properties of a meaningful information are detailed at I.1 in [4].)



Towards a theory of meaning for semiotics

The generation of a meaning in a simple living element as introduced here above can be generalized into a Meaning Generator System (MGS) built up with the following elements:

- a system submitted to a constraint and able to receive an incident information;
- an information incident on the system;
- an information processing element, internal to the system and capable of identifying a connection between the received information and the constraint.

An MGS is represented in Fig 2 where a system submitted to a constraint S generates a meaningful (S) information that will be used to satisfy the constraint of the system.

It is to be noted that the meaningful (S) information created by a system S can exist for some usage internal to S, but can also be transmitted for usage by other systems.

Let's assume that the system (S) generates and sends out a meaningful (S) information, and that this information is received by another system (S') submitted to the constraint (S'). What will be the effect of the meaningful (S) information in the system (S') ?

In order to address this question, we need to define the "domain of efficiency (S) of a meaning" as being the domain where the meaningful (S) information is capable to participate to the determination of an action aimed at satisfying the constraint S.

We state that the meaningful (S) information is efficient (S) in the domain of efficiency (S).

These elements bring us to define and analyse different cases where an information can be meaningful (S) and efficient (S) or not, depending upon the location of the signal carrying the information vs the constraints S.

(These cases are analysed at I.3 in [4].)



Meaningful information processing in a living element (Biosemiotics) has allowed us to build an MGS. Next step is to see how this MGS can be used to shed some light in meaningful information processing in human

(Semiotics).

This subject being currently under analysis. We will only present here some first directions of investigation.

First, our hypothesis that the MGS is a general system and that the proposed modelization can remain valid for complex systems, assuming we locate the complexity within the elements that constitute the system, and assuming that several systems can work together (we keep in mind that this hypothesis has to be validated).

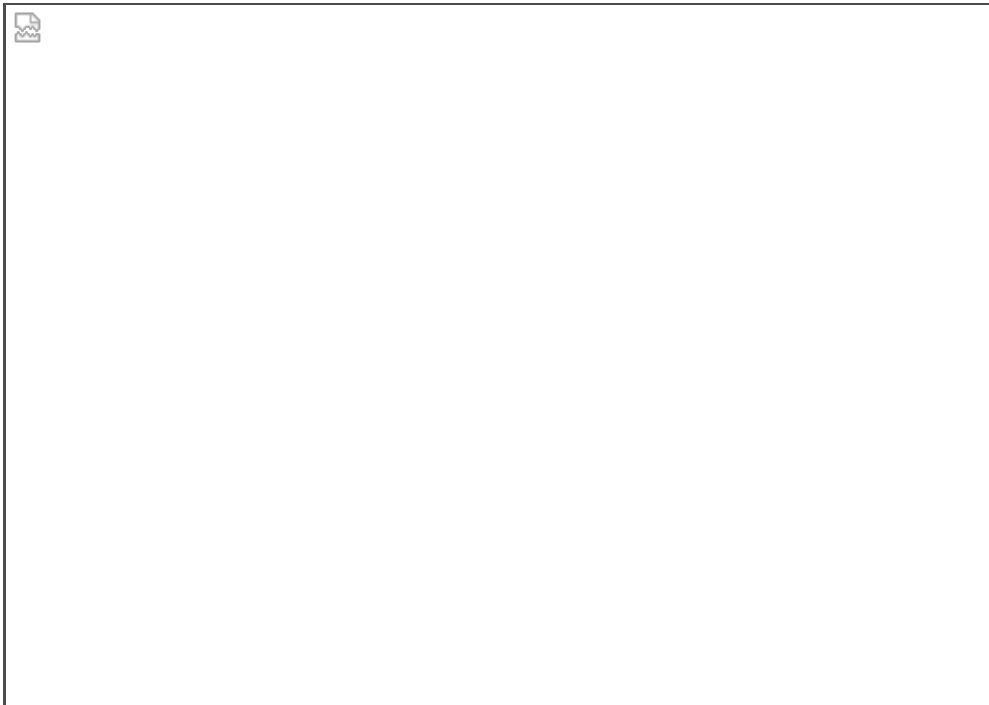
Then, regarding the case of human, we consider that at least two interacting MGSs have to be taken into account.

— The MGS applied to the living aspect of human where the constraints will be the ones existing for all living elements (vital constraints: survival and reproduction).

— The MGS applied to the psychic aspect of human where the constraints are the ones made available by psychology and psychoanalytic theory (combine pleasure and reality, valorization of the ego, combine impulses of life and death, limitation of anxiety...).

Much work is to be done in this last field, looking at the new constraint as they could have appeared during evolution from animal to human.

Even if the understanding of these new constraints deserves significant effort, it is possible to propose today a simplified draft of MGS for human (taking into account the two intricate MGSs with the set of corresponding constraints). Fig 3 illustrates this very preliminary version.



Conclusion

We have tried in this short paper to show how a modelization in the field of Biosemiotics could provide a tool having possible usage for studies in Semiotics.

With an example of meaningful information generation in a simple living element, we have built up a model of a Meaning Generator System (MGS) that can find some application in the field of meaningful information generation in human. Work is still to be done in this last area, but the proposed MGS is an example of Biosemiotics added value to Semiotics.

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The semiotic substance of homeopathy

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The term semiotic is instrumentally understood here as an approach opposed to mechanicism in the field of medicine and medical anthropology. We identify three semiotically relevant matters in the homeopathic setting.

First, homeopathy never deals with common pathophysiological reasoning but only with symptomatology. The aim is not to decipher and subsequently recover an altered mechanism but to reconstitute a typology by its constellation of signs. Furthermore homeopathy treats the disease by handling the relation between the signs and the governor principle of their dynamic, i.e. the similar remedy. This commitment is reflected by the homeopathic main principle: *Similia similibus currentur*.

Secondly, in the homeopathic respect, disease is not a material phenomenon occurring at the level of physical body and having emotional and mental consequences. It is rather a subtle phenomenon which reflects itself physically, mentally and emotionally when disturbed. Even that these three modes of being are hierarchically assembled from the standpoint of their causal power the real ground of disease stands beyond them. The acting principle which grounds the three-tiered realm of manifestation was historically called the vital force. However, the semiotic heritage allows us to treat it in the terms of Thirdness and to set a deeper interpretation of vitalism.

Finally, the relation among the individual being (a patient), the remedy and the vital force while beautifully depicting a triad enlarges the frame of understanding beyond the biological, psychological and chemical realms. Science cannot explain satisfactorily how a substance while loosing its materiality through the process of dilution and potentation gains tremendous powers upon the being. According to us, the answer should be sought in the semiotic nature of reality: what is manifested represents only a sign of the non-manifested object. Homeopathy is a royal way in understanding the depth of semiotic approach this respect because it enlightens semiosis not only in the horizontal relations among the levels of manifestation but also explores the vertical relations between them and their governing principle.

Construction of umwelt to control probabilities of events in living systems

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Biological adaptation to the environment involves continual maintenance of a particular set of relationships with the environment at relatively higher probabilities than expected in abiotic processes. Molecules involved in living systems, cells, and organisms discriminate between environmental configurations, and act selectively to establish a particular relation with the environment. Probabilities of events occurring to actors are determined by the degree of discriminability and selectivity in action or cognition, where the probability of an event is defined as the degree of certainty at which it occurs among events possibly occurring to a focal actor. In other words, they can control the probabilities of events occurring to themselves through discriminative and selective actions. What is discriminated by an actor constitutes its umwelt. In this sense, the construction of umwelt and the ability of controlling probabilities of events are closely interrelated. The problem addressed in this paper is to formalize this interrelation. Interactions between a focal biological actor (e.g. molecule, cell, organism) and the environment can be represented as sign processing between the actor and the environment. An actor in a general sense, called cognizer, acts against a given environmental state, while the environment acts against the cognizer's state, where action implies shifting from one state to another against a given configuration of others, a generalized concept of motion, called cognition. This description of a focal cognizer and its environment is framed by a meta-observer, located outside the world including both of them. Conceptual distinction between the environment for the meta-observer and the umwelt for a focal cognizer is important. The umwelt is constituted by what is discriminated by the cognizer, smaller than the environment described by the meta-observer. Unlike the meta-observer, organisms, molecules and cells as well, are not omnipotent in discriminating between all the differences in the environment under the meta-observer view. They instead construct their own umwelt, smaller than the environment, within which differences are discriminated to raise probabilities of preferable events and reduce the less preferable for maintaining organization or survival.

Introduction to biorhetorics: Applied rhetoric in the life sciences

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In this paper I shall set out my conception and theory of rhetoric, beginning with a historical overview of rhetoric, and shortly follow this with a discussion of contemporary usage of rhetoric, particularly rhetoric/s of biology. I intend to distinguish the deconstruction of rhetoric from my own approach. I will discuss the definition of "life" and rhetoric and proceed with a formalisation of rhetoric, setting out the key components of rhetoric, the nature of argument and probability, enthymetic reasoning, rhetorical agency (rhetor and

audience), rhetorical situation, rhetorical competency and epistemic determinancy. I will also discuss symbolic rhetoric, the development of constructive species specific rhetoric in connection with Uexküll's theory of significance, and round up by summarising the possible applications with a series of case studies.

**A biosemiotical approach to music cognition:
Event perception between auditory listening and cognitive economy**

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This paper is programmatic in its claims. It questions the biological bases of musical epistemology and stresses the role of ecological constraints in knowledge construction as applied to music. It takes as a starting point the biosemiotical approach to perception, which encompasses the whole domain from lower sensory functioning to higher levels of cognitive processing. Central in this approach is the possibility to interact with the sonic environment and to modify the semantic relations with the world. As such the listener can be conceived as an 'adaptive device' which can expand its perceptual, motor and conceptual tools in an attempt to make sense out of the outer world. In order to make these claims operational we propose to lean upon the concepts of circularity of stimulus and reaction (Uexküll, Piaget), the experiential or enactive approach to cognition (Varela, Johnson, Lakoff) and the concepts of semantic closure and epistemic autonomy. Listening, then, is a kind of 'coping behaviour' which fits the solicitations of the sonic environment. For doing so, the listener can rely on his wired-in machinery, but it is possible to transcend this stimulus-bound reactivity as well. This involves a shift from conservative to anticipatory behaviour, which goes beyond the closed-loop character of sensorimotor integration. The brain, then, acts not merely as a controller, but as a simulator, which performs internal computations on the observables. A major problem, however, is the delimitation of the elements on which to do the computations. Our proposal is to start from 'event perception', which implies both a 'bottom-up' and 'top-down' approach to knowledge acquisition. It allows, further, a transition from ecological to symbolic knowledge and offers interesting cognitive tools for doing the conceptualization which calls forth principles of cognitive economy. An attempt is made, finally, to translate this to the realm of music.

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**A project to establish the Jakob-von-Uexküll-Archiv
at the University of Hamburg**

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The “Institut für Umweltforschung” was founded by Jakob von Uexküll 1925 at Hamburg university. After the war this institute was situated in a private house in Hamburg until the sixties. At the dissolving of the institute parts of the library and the files reached the zoological institute of the University of Hamburg and the Federal Archives. The Uexküll family provided the collection of private offprints of Jakob von Uexküll to the Senckenberg library in Frankfurt. These approx. 4200 Separata and 120 monographs were submitted to the zoological institute and museum of the University of Hamburg in 1983. On request of Gösta and Thure von Uexküll a “Jakob von Uexküll-Archiv” should arise there. To this day, the construction of the archive was not perfected. For this reason different representatives of the University of Hamburg were against lending inventory of the “Nachlass” to Tartu University and the Uexküll Center in 1997. The question of the Uexküll-Archive hasn't been followed up since. I now make plans for a project in cooperation with Professor Hünemörder of the Institute for history of science, mathematics and technology of the University of Hamburg, which has good chances to include the partnership between the Universities of Tartu and Hamburg as well as several foundations. A stipend was granted to me by the “Marga and Kurt Möllgaard-Stiftung” in order to go to Tartu and for the Gathering in Biosemiotics. I hope for good cooperation with the Jakob von Uexküll-Centre and the society of the Biosemiotics.

I want to make the restoration of the Jakob von Uexküll-Archive the basis for writing a history of *Umweltforschung* and biosemiotics. For this greater project I seek suggestions, ideas and hints to interesting questions and subjects.

My own background is a Diploma in Biology (Neurophysiology) and PhD in History of Science. I was graduated with a Dissertation on the development and influence of Ivan Pavlov's research project in Russia and the Soviet Union.

Sustainability during development depends on the types of part-whole interactions: Logical comparisons of biological systems of various structural levels

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Using various examples, i.e. main problems in different branches and levels of modern biology, the concepts of classificational, structural, and functional multilevel clusters and hierarchies are discussed and summarized. Some general system sophistications for all these cases of different levels, that are useful for empirical research, are proposed. So, here are analyzed main cluster approaches in classification, logical variability for bases in structural clusterisation, and variability in semantical values of similar functional elements of different biosystems. The meta-concept 'heterological transpositions' that embraces various levels of human-caused biological phenomena, is proposed and summarized in the three-level table. It permits to analyze these phenomena using the strict analogies in comparisons of different levels. The main ideas seem to have high predictive potential for many cases of modern biology, and, moreover, for various social and technical phenomena.

The pedagogical aspects of these approaches for high education, and even for school education, is discussed all along the paper.

The semiotics of sexuality

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Pragmatism is the idea that we learn about our worlds through our bodies. *Ipso facto*, it follows that different bodies will be predisposed to learning different kinds of logics. How might we apprehend the essence of these logics?

I apply Peirce's "law of association of habits", in conjunction with a more general interpretation of Heidegger's "Dasein". Peirce regarded habit and association as fundamental aspects of consciousness. Thus, he proclaimed his "law of association of ideas": "There is a law in this association of ideas. We may roughly say it is the law of habit. It is the great 'Law of association of ideas' - the one law of all psychical action".

I want to be more specific with the relationship between association and habit, and that is why I would prefer to refer to his Great Law as the "Law of association of habits".

In summary, I apply Peirce's law of association of habits and Heidegger's Dasein to infer three crucial points about gender roles: (1) Gender roles are habits. Thus, we can infer that: (2) Gender roles are chosen. And from a more general interpretation of Heidegger's Dasein (I call it the desire to be) we know that: (3) Men and women "like" the roles to which they have been assigned. What is even more exciting about the application of semiotics to understanding gender roles is the treasure of interpretations we might derive not only for how men and women relate to each other, but also for how we might infer the cognitive realms of non-human animals and inter-galactic aliens.

What Heidegger refers to as "being-in-the-world" (*Dasein*) is actually closer to my own definition that I call "the desire to be". The key point here is that choice molds desire, and that desires are as infinitely moldable as there are an infinitude of choices that might be made. To put it more simply, we become what we choose. The choices we make shape what we become. The reason we humans don't eat dirt is that we do not have the bodies of earthworms. So, while dirt might be particularly alluring to some critters, to others, it will arouse considerably less excitement.

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The core hypothesis of biosemiotics

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After some decades of biosemiotic research and discussions, the time seems right for establishing and scrutinising the basic hypotheses supported by that research.

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**Epigenetic biology: The relation of context
dependent dynamic system management of genetic information**
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Modern biology and its codependent biotechnology are undergoing a dual revolution. The *first* is illusory and represented by a triumphant molecular genetics symbolized by the Human Genome Project and the acknowledged *genetic determinist paradigm* of 20th century biology. Relying on another metaphor, *genetic programs*, it promises to reconstruct the living world from "the genome up". The *second*, real, revolution is all about the denial of the first. As the reductionist program continues to reveal finer details of life's complex organization it also reveals "anomalies" or failure of experimental results to confirm the genetic paradigm driving the experiments. The genetic paradigm cannot assimilate these anomalies and so one may conclude that something vital is missing from it: and this problem deepens with each week of new reports in *Nature* and *Science*. Still, the hype for genetic determinism continues and the technology, ignoring all warnings issuing from anomaly, presses on ... apparently on the basis of a flawed scientific paradigm ...to transform the intellectual products of the laboratory into the material products of the medical and pharmaceutical marketplace. It is at the nexus of these two revolutions that one may identify first, a powerful source of conflict of interest between technology and science, and second, a more fundamental conflict defined by the differences between a *world of made and a world of born* and the ethical problems inherent in the conflation of these two worlds.

It is in this context that I would like to have a conversation concerning (a) what is missing from genetics, (b) concerning the complementation of genetics with dynamical systems thinking and (c) concerning the relationship between the genotype and phenotype. Biology today finds itself suspended, not only over the abyss of the genotype-phenotype relationship but over the epistemological abyss of a deterministic-dynamic systems model of life itself. In both of these is the irreducibility of phenotype to genotype, and the possibility, best defined by Howard Pattee and Walter Elsasser, of a new paradigm in which genetics is complemented by biological systems and their dynamical laws. Pattee has discussed this in terms of the complementation of semiotics with dynamics. I will bring to the conference a stunning ignorance of semiotics but also an up-to-date report on the emergence of dynamical processes as a major new feature in experimental biology. These processes include self-organizing metabolic pathways governed by the known laws of chemistry (kinetics & thermodynamics), and by epigenetic genome-marking systems that pose a new question: "What is the context-dependent phenotype of the genotype?" Laws governing the construction and function of epigenetic self-organizing systems remain completely unknown. These epigenetic systems interpret the world *without* for the world *within* and, in that activity, define (give meaning to?) the sequences in DNA. I agree with E. F. Keller: in eukaryotic organisms there are no genes until they emerge as the products of dynamic systems operations refined by natural selection *on the basis of their functional usefulness*.

Mythology and evolutionary psychology: On the relevance of prehistoric fire usage for the evolution of human culture, consciousness, and language

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When trying to explain the enigmatic beginning of mankind many authors interested in the evolution of human culture investigated the correlations between factors such as encephalization, toolmaking capabilities, dieting habits, communicative skills etc. Alas, despite the relevance of the usage of fire — being the *differentia specifica* (Blumenberg, 1979) — only in passing did they refer to the competence in methods of fire usage in this respect. Arguments relating to this question have, on one hand, addressed the change of diet and other multifarious advantages of the use of fire; on the other hand, it seemed self-evident that Early homo developed the competence of using fire because their intelligence was improved by the successful experience of tool-using techniques, predesigned by the evolution of hand-brain-interaction, and supported by early communicative skills.

Applying the question of how the early *Homo* developed the capacity to deal with fire to the question of whether mythology offers some hints in this respect one can find two complexes of creative fantasy within Greek mythology — Dionysos and Prometheus (and numerous other stories from different cultures). Philosophy has dealt with these protagonists extensively (e.g. Nietzsche, Blumenberg); however, so far, nobody has related their thoughts to a hypothesis of Evolutionary Psychology (cf. Buss 1999) where many critics identify a lack of inspiration.

In order to offer new incentives for research undertaken by Evolutionary Psychology this paper connects modular hypotheses about the origin of fluid/hybrid intelligence (cf. Mithen 1996; Donald 2001) to semiotic hypotheses (cf. Deacon 1997). It analyzes in detail the necessary steps, which had to occur in order to eventually not only maintain but also create fire — steps which, of course, correspond with successive stages in the human evolution proposed by evolutionary theorists. However, inherent in these stages were transitions which led from a status of early homo living in a world represented by iconic and indexical reference processes to a status where first-person contents of thought should not only imply the concept “I” but also be free for both iconic as well as symbolic thought and communication. These transitions can be best explained by considering the necessary cognitive as well as emotional and communicative steps which had to occur in order for fire to eventually be used in the way our species uses it.

The myth of Prometheus indicates the beginning and the step-by-step improvement of ritualistic group behavior regulating fire use, which on one hand led to the recognition of the interplay of fire with other “elements” (in this way developing cognitive abilities), on the other hand helped them to cope with contradictions between instincts and emotions (e. g., horror vs. desire). The myth of Dionysos, however, indicates changes of sexuality regarding social as well as physical conditions. Both myths, nevertheless,

relate to experiences of sacrilege and punishment — experiences which can be exploited to some advantage: The hypothetical steps of mastering fire implicate achievements of mimetical coordination as well as affective disciplination the struggles of which can best be described by using these myths as starting-points of evolutionary research.

A pansemiotic architecture

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This paper examines our cosmos as an ongoing thermodynamics of both conservation of mass/information and conservation of energy. This is a pansemiotic rather than a biosemiotic architecture and endeavours to explore abiotic and biotic mass as semiotic transformations of 'uninformed to informed mass' within different realms of semiotic organization.

To explain this perspective, the paper investigates the semiotic process within a dynamic model. First, it differentiates this model from the "primitive model". The primitive model operates within a framework where its parts and wholes function within one mode of reality, that of "rest-mass" in current time. This is the domain of our familiar experiences. The framework is ontologically dyadic and examines information and knowledge as formal descriptions of these objective or external entities of "rest-mass". The model establishes a mechanical descriptive action, operating in absolute time, where one side of the dyad "represents" the material other side by a particular and/or aggregate descriptive classification, which is held by a mediator agent, the interpreter. The dynamic model functions within three modes of reality. It adds to the external rest-mass a rich internal process, with three internal processes that set up mass as an ongoing dynamics of relations. These internal motions obscure the rest-mass membranes of the external entities as well as the formal representational descriptions. The resultant entanglement of the internal with the external moves mass/information from its isolation as an inert rest-mass to the transformative dissipative and ampliative openness of "relational mass". To maintain this dynamic state of a "constrained evolving exploration" of ongoing intransitive relations; that is, a world of infinite inexhaustible transformations of mass to information, we postulate, in the second part of the paper, the existence in this triadic architecture of a complex hierarchy of temporal modes, involving five levels of entangled time processes. The paper examines the role of time in the generation of knowledge and information and presents a model of mass/energy as a dynamic force involved in a constant transformative exploration of its own nature. Third, the paper examines these transformative explorations as operations that take place in three separate codal realms, the abiotic, biotic and conceptual realms, and examines the nature of semiotic codification within each realm.

Umwelt ethics

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Has the Umwelt theory got any ethical implications, or affinities? Can a study of Uexküll's principles contribute to ethics? In search for an *Umwelt ethics*, I will start by analysing Uexküll's biologism, which is obvious, e. g., in his *Staatsbiologie*, and his justification of pain by reference to the "Plan des Organismus" (Uexküll 1928: 131). While Jesper Hoffmeyer (1993) argues that a biosemiotic approach favours one particular ethical system, I will argue that the Umwelt theory could be regarded as consistent with several ethical systems, gradualistic and egalitarian alike. In this connection, topics such as biodiversity, cultural diversity and animal welfare will be addressed. Finally, I will suggest that the Umwelt theory can provide environmental ethics with a fruitful re-definition of what it means to be a sensing being: Namely, an Umwelt-owner, that is, a subject of the phenomenal world.

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The signs of bizarre characteristics in the semiometabolism of animal associations

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An outline of basic semiotic concepts for bio- and robosemiotics and the emergence of Umwelt

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I will continue on what I ended in the first Gatherings and give a proposal for what could be the result of the naturalization of semiotic concepts in a sense of semiotic naturalism (cf. Vehkavaara 2002). The approach is restricted to agential semiosis, but the concept of agent is considered as general concept as I can see possible.

I will propose that the concept of representation should be ‘overgeneralized’ beyond genuine semiotic processes. The prototype of the most primitive concept of representation can be found in any goal-directed control system like thermostats. This corresponds to representation at level 4 in Mark Bickhard’s theory of interactive representation (Bickhard 1998). The interaction of the subsystem (measuring device) of a thermostat with its environment indicates different activities (heating or not heating) depending on the quality of the environment (the temperature). A thermostat makes the environmental representation and uses it when it is functioning to fulfill its goal (to keep steady temperature etc.). At this level, there is not yet any object of representation for the system. When a system starts to maintain a set of ‘default-settings’ for its activities (at levels 6 and 7 in Bickhard’s theory), it becomes capable to ‘observe objects’ and to create its *Umwelt*. At this level most Peircean and Uexküllian semiotic concepts become applicable.

The goal-relative validity of the primitive representation is independent on the origin of the system. The historicity of a representative system is nevertheless needed in order to understand the nature of the goals. Thermostats and other machines are mere quasi-agents, because their goals are not ‘their own’ but human ones — they are made to fulfill human purposes. Any goal of any control system is either ‘other-organized’, i.e. set by some other quasi-agent when it is trying to achieve its goals (e.g. parasite-host relation), or self-organized. Self-organization of goals is possible at least in systems that are far from thermodynamical equilibrium. The most primitive goal is a self-maintenance of a far-from-equilibrium system. This goal is significant for the system itself, because it is its existential condition — if a system fails to achieve this goal, the system dies. It is hypothesized that any apparent real goal, intention, purpose, etc. of a system is embodied as some subsystem that is maintaining itself far-from-equilibrium. The minimal criterion for the concept of semiotic agent could then be that an agent must be a representative system (control system) with at least one goal of its own. Consequently, a genuine agent is ‘potentially immortal’ self-maintaining far-from-equilibrium system that is potentially capable changing its goals in interaction with its environment.

One benefit of separating the concept of representation and its validity from the evolution and nature of goals is that these rather formal concepts are applicable in biosemiotics as well as in robosemiotics.

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

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The current species extinction event is generally understood as being caused by human behaviors that continue to undermine the functioning of ecosystems (Wilson 1992; Hilton-Taylor 2000). While ecosystem function has traditionally been described in terms of the structure and flux of organisms, materials and energy, the ecosemiotic viewpoint understands these ecosystem structures and fluxes as largely mediated by fluxes of meaning, and interprets the rapid ecosystem degradation (and concomitant species extinctions) as the result of the inadequate coupling of human and non-human semiotic systems (Zucker *et al.* 2001, in press). This paper explores several strategies to create a coupling that will terminate the functional cycles (Uexküll 1932) of unsustainable human behaviors.

The first section of the paper presents an ecosemiotic analysis of the development of the notion of “biotic integrity” in the United States. I employ Latour’s (1999) idea of “circulating reference” to describe the sequence of articulations in the evolution of “biotic integrity”: from a concept inherent in a legalistic semiotic (Clean Water Act 1977), to a term of scientific discourse (Karr 1981), which attempts to embody the zoosemiotic of freshwater fish communities, as a surrogate indicator of a broader ecosemiotic of “ecosystem health”, brought back into the legalistic discourse to effect regulatory actions, ultimately to coerce changes in public behavior and terminate a variety of (dysfunctional) functional cycles. The notion of using, in this strategy, “reference conditions” that exhibit characteristics “comparable to the best situations without the influence of man” (Karr 1981) is discussed as both a technical and philosophical problematic.

The second section of the paper speculates on a complementary strategy for coupling human and non-human semiotics to produce feedback mechanisms that reduce environmentally damaging human behavior. This experimental strategy is characterized by methods that, rather than simply articulating more elements of environmental semiosis into the human Umwelt, alter the perceived boundary between Self and Other within the Umwelt.

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The ‘surplus of meaning’: Biosemiotic aspects in Francisco J. Varela’s philosophy of cognition

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The late Chile born biologist Francisco J. Varela has been influential in theoretical biology throughout the last three decades of the 20. century. His thinking shows a marked development from a biologically founded constructivism (developed together with his fellow citizen, Humberto Maturana, with the main key word being “autopoiesis theory”) to a more phenomenological oriented standpoint, which Varela called himself the philosophy of embodiment, or “enactivism”. In this paper I want to show that major arguments in this latter position can be made fruitful for a biosemiotic approach to organism. Varela himself already applies concepts as e.g. “signification”, “relevance”, “meaning” which are *de facto* biosemiotic. He derives these concepts from a compact theory of organism which he understands as the process of self-realization of a materially embodied subject. This theory is developed, though modified, from Autopoiesis theory and so attempts a quasi-empirical description of the living in terms of self-organization. Varela’s thinking hence might count as an exemplary model for a foundation of a biosemiotic approach in a theory of organism. It can be said with some justification, that Francisco Varela’s thinking offers genuine clues for the broader project of a semiotic biology. Especially Varela’s association with down-to-earth biological research offers tools to link biosemiotics into the ongoing debate about the status of a biological system within genetics and proteomics research.

Affordance vs. functional tone:
A comparison of Gibson's and von Uexküll's theories
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Gibson's affordance concept and von Uexküll's concept of functional tone (as well as Merkwelt/Umwelt) agree in viewing perception as ecologically embedded and arising from the interaction between agents and their environments. They do, however, disagree in the sense that, roughly speaking, Gibson viewed affordances as part of the external environment whereas von Uexküll described functional tones, and their dynamical variation, as part of the subject's inner world. This talk discusses the similarities and differences between the concepts and the underlying theoretical frameworks, and presents simple robotic models of functional tone through varying sensorimotor mappings realized in so-called recurrent neural networks.

Gatherings in Biosemiotics 2

Program

June 14–17 2002, Tartu–Puhtu–Tallinn, Estonia

Tartu

June 14

University History Museum (Toome Hill)

11.00 Registration desk opened

12.00 Opening, forewords

M.Anderson, M.Lotman, C.Emmeche, K.Kull

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

13.10 Coffee break

13.30 Marcello **Barbieri** – Organic codes: metaphors or realities?

14.15 Anton **Markoš** & **Fatima Cvrčková** – Who is the addressee of the genetic text

15.00 Lunch

16.00 Stefan **Artmann** – Four principles of Jacobian biopragmatic

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

17.00 Coffee break

17.15 Frederik **Stjernfelt** – The core hypotheses of biosemiotics

17.45 Kalevi **Kull** – Biosemiosis: A search for other

18.15 Discussion: Organic codes and first principles of biosemiotics

20.30 Garden party: Karl Ernst von Baer House (Veski Str. 4)

June 15

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

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

10.00 John **Collier** – Information expression requires cohesive levels

10.30 Coffee break

11.00 Claus **Emmeche** – Biosemiotics and experiential biology

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

12.00 Coffee break

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

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

13.45 Lunch

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

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

16.00 Coffee break

16.15 Andres **Luure** – The role of relations in semiotics

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

17.15 Coffee break

17.30 Elisabeth **Johansson** – Biosemiotic perspectives in gasflux models

18.00 Christophe **Menant** – From biosemiotics to semiotics

18.30 Discussion: Formalisation in biosemiotics

20.30 Evening snacks and drinks (Tammekuru Str. 5)

June 16

9.00 Edwina **Taborsky** – A pansemiotic architecture

9.30 Soren **Brier** – Biosemiotics and the Third Culture

10.00 Coffee break

10.15 Luis **Bruni** – The global phenotype

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

11.15 Coffee break

11.30 Myrdene **Anderson** – Neoteny and its role in taming and domestication

12.00 Mette **Böll** – The evolution of empathy in social systems

12.30 Coffee break

12.45 Domonique **Lestel** – On the expression of negation among animals

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

14.00 Lunch

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

15.30 Timo **Maran** – Mimicry and mimesis in the bio-semiosphere

16.00 Coffee break

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

16.45 Morten **Tønnessen** – Umwelt ethics

17.15 Coffee break

17.30 Tiberiu G. **Mustata** – The semiotic substance of homeopathy

18.00 General discussion: Experimental use of biosemiotics

20.30 Evening tea (Tammekuru Str. 5)

June 17

Puhtu–Tallinn

7.30 Departure to Puhtu

11.00 Arrival to Puhtu, coffee

11.40 K. Kull – *Genius loci*

12.00 Sune **Frølund** – Teleology and the ‘natural history of signification’: the implications of Hans Jonas’
bioontology for biosemiotics

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

13.00 Ester **Võsu** – How to stage nature

14.00 Lunch in Puhtu

15.00 Laelatu walk

16.00 Departure to Tallinn

18.00 Arrival to Hotel Mihkli in Tallinn

19.30 Dinner in Tallinn Zoo

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

22.30 Closing event

24.00 Finish

June 18

Departure from Tallinn
