

Abstracts for the First Gatherings in Biosemiotics, Copenhagen 2001

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Here is a preliminary [programme](#) for the meeting.

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Three Types of Semiotical Indeterminacy and Their Relevance to Biosemiotics

Phenomena of indeterminacy are of great importance not only to the natural sciences, but also to structural sciences as mathematics and semiotics. Synthesizing important research traditions in information theory, structuralist semiotics and generative linguistics, at least three main types of semiotical indeterminacy must be distinguished: Chaitin's notion of randomness defined as sequential incompressibility; de Saussure's principle of the contingency of the sign function which ensures the possibility of translation between different sign systems; and Chomsky's idea of indefiniteness in the form of empty categories which are required to explain the manifestations of linguistic creativity. These types of semiotical indeterminacy form an abstract system useful for the description of concrete sign processes.

In the natural philosophy of modern biology, Jacques Monod used the conceptual opposition 'chance versus necessity' to analyze several phenomena of indeterminacy. They comprehend not only molecular biological facts as the order of amino acids in proteins or the DNA-representation of amino acids, but also broader philosophical (especially ethical) consequences to be drawn out of modern biology. The biosemiological approach to life permits to apply the suggested system of semiotical indeterminacy on the whole range of these phenomena. Results both on the object and on the metatheoretical level arise, especially concerning the relationship between biological structure and function, and the limits of scientific knowledge.

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A brief history of Semantic Biology

When a new view of life is discovered independently and is developed in two different ways, as in the case of Biosemiotics and Semantic Biology, it is likely that times are ripe for it.

Biosemiotics is the attempt to see the world through the glasses of semiotics. More precisely, it is one of three pairs of glasses, the other two being Anthrosemiotics and Pansemiotics. Semantic Biology is the attempt to build scientific models for specific biological problems, such as the origin of life, the origin of eukaryotes, the Cambrian explosion and so on.

The first model of Semantic Biology appeared in 1981, on the JTB, and described an origin-of-life scenario which led to the conclusion that the cell is a trinity of genotype, ribotype and phenotype. The second model appeared in 1985, in a book which proposed the concept of "evolution by natural conventions". Other models followed, and eventually appeared together in the book "The Organic Codes" (2001). They are the semantic models of the cell, of embryonic development, of mental development, and again of evolution.

Other differences between Biosemiotics and Semantic Biology come from their origins and from their histories. While Biosemiotics can be traced back to Jacob von Uexkull, Semantic Biology's

starting point was the unprecedented discovery of a method for reconstructing structures from incomplete information (1974).

Despite the differences, however, Biosemiotics and Semantic Biology can (and should) converge towards the common goal of building a new paradigm, because such an enterprise transcends the various fields of human enquiry, and ideally embraces them all.

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Does Junk DNA Break the Genetic Code Metaphor?

In this contribution, I propose to examine the Biosemiotic project to consider DNA and/or genes as Peircean signs from the dynamic standpoint of history and philosophy of science. I argue that it is best to look at the trope of "the genetic code" as the key catachresis of a metaphorical network grounded in cybernetics and developed in molecular biology since the early 1950s. I show that such an understanding is not at odds with Peircean semiotics, since Peirce understood metaphor as a specific instance of a hypo-icon, defined as an iconic representamen that represents by virtue of a similarity, whatever its mode of being may be (2.276).

In a first part, I establish the historical links between the founding tropes of the emerging discipline of molecular biology (1950-1970) and the conceptual repertoire of cybernetics, and more precisely, of Shannon and Weaver's "information theory" (1945-1948). Since Erwin Schrödinger's (1944) proposal of a "Morse-like code script" for heredity, molecular biology developed during the 1950s and 1960s on "the central dogma" (Crick, 1958) of a one-way information transfer from DNA to proteins. Much of its understanding of the molecular basis of heredity, however, relied on a metaphorical use of this vocabulary and concepts, rather than on a straightforward application of the theory (Kay, 2000). Information theory provided narrow definitions of the concepts of "code", "message" and "signal" designed for the engineering of telecommunication systems, afar from the semantic concerns of molecular biology. The emerging discipline was chiefly concerned with the "meaning" of the sequences of nucleotides on the DNA brands, understood as a coded message sent from the cell's nucleus and directing the further synthesis of proteins in its cytoplasm. Thus, the "genetic code" was a very fecund but also very common figure of speech borrowing more to the tradition of ciphers than to the information theory transformation of a message into a signal.

In a second part, I start from the standpoint of this particular instance of metaphorical use in molecular biology to reflect back on the long running debate on the use of models and metaphors in science. Following Paul Ricoeur's notion of the metaphor as "a discursive strategy which by preserving and developing the creative power of language, preserves and develop the heuristic power of fiction" (1975, 10), I intend to show that the metaphorical network of molecular biology's "book of life", conveys against the referential illusion a scientific and philosophic truth. To do so, I will again contrast various notions of the metaphor and its role in scientific discourse: from some sort of literary artifice prohibited by the "naked style" conventions of the dawn of experimental science to a crucial resource in the prospective fictions of discovery of a post-modern scientific practice.

I make this theoretical point on the truth value of the metaphor more concrete in the third and final part of my contribution, where I will contrast three different semiotic notions of the metaphor of the "junk" DNA. Following Umberto Eco, Roland Barthes and Charles Sanders Peirce respectively, I will consider the non-coding part of DNA as (1) the false residual part of an analogy that equates DNA with the medium of an S-code, (2) the object of an "effet de réel" and, finally (3) the hypo-iconic dissimilarity that opens new fields of discovery. In this third and final sense, I conclude on the hypothesis that only such a metaphoric notion of "junk DNA" could open the way for a quantum understanding of DNA, away from the limited information theory metaphors that would qualify these 97% of the human DNA sequences as "noise" or "insignificant details"... Therefore inverting the

question of my title: could junk DNA be the key to tomorrow's real understanding of life's ultimate codes?

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Biosemiotics: Is it a tool of theoretical biology or a theory of biology?

The paper will shortly outline the main statements of biosemiotics which is comprehended as the sign study of living organisms, by modelling the behavior of the immune system and the nervous system from a semiotic perspective. These two complex systems represent closed ones for the human observer investigating them from an outsider's view. Our external standpoint helps biologists to objectivate experimental entities like, e.g., tissue components, cell clusters, or biochemical macromolecules. The first part will contribute a micro-scale study testing whether biosemiotics offers a new methodology that is qualified to translate the concept of immunological specificity into neuronal codes, and vice versa. Supposedly, we do not have any problems to deduce syntactic rules of the component's behavior in question, but how will we know the semantics of the whole system without a loan of intelligence, i.e., without naturalizing and/or humanizing it? To answer the crucial issue, at least preliminary, the spell will refer to the biological term of function and the philosophical concept of intentionality (telos). In the second part, the focus will shift to the macroscale as we humans personify it with our relationship to the environment. The new approach dealing with it, is called ecosemiotics that finally aims at to be a human ecology from the semiotic point of view. As ecosemiotics mainly considers the human organism and its behavior whereby we manifest our position as being inside nature, the observer mutates to a player who is responsible for the interpretation and handling of nature's rules, even if the rules were not formulated by himself. Thus, ecosemiotics talks about semantics and, finally, its pragmatic conversion to culture. Instead of a conclusion which I prefer to avoid in general, the audience is asked to decide whether biosemiotics is feasible to be an ontic foundation of biology, or whether it offers a new methodological tool for the biological sciences.

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Does "quorum sensing" imply a new type of biological information?

The debate on the concept of "biological information" has so far proceeded in an inductive manner. Different concepts have been developed autonomously in specific levels and applications. May be, in an attempt to develop an unifying conceptual framework, the only epistemological tool that has been used across the different instances is the Mathematical Theory of Information (Shannon).

Probably, the specific level that has received more attention is the genetic one, originating the long debated concept of genetic information, in which the Mathematical Theory of Information ended up having little application. One problem may be the specification of the emergent levels that proceed from, and simultaneously surround, the genetic one.

In a "scalar" view, the next step is that of regulation, in which different kinds of "information" enter into the scene and interact with the genetic level (and will have to interact with other emergent levels).

When it was thought that the information "problem" was solved and put aside with the cracking of the "genetic code", biologists are talking again about cracking other "codes". In this spontaneous inductive strategy (within the "spontaneous semiotics" in the life sciences described by Emmeche), different types of "information" emerge which may not have a clear conceptual link with previous concepts of biological information.

When dealing with biological communication and information, unifying concepts are necessary because otherwise there will not be proper interfaces to couple the different "codes" that are being inductively "cracked" and defined at the different emergent and "de-emergent" levels.

In this context I intend to compare the type of information implied by genetic information with that implied by the concept of "quorum sensing" which is becoming a new unifying concept at the level of intercellular communication.

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Intrasemiotics

This new concept designates the semiosis of the interpenetration between the biological and psychological autopoietic systems as Luhmann defines them in his theory. Lorenz in ethology worked with the concept of motivation, Uexküll with the concept of tone mostly describing the outgoing effect on perception and the reactions on perception. Lorenz called them instinct movements. Adding a Peircian concept of semiosis in the framework of biosemiotics makes it possible for us to view the interplay of mind and body as a sign play. I have in previous publication suggested this term on exosemiotics processes between animals in the same species stretching Wittgenstein's language concept into the animal world of signs. With intrasemiotics there is an inner

interplay. One could view it as the interplay between Lorenz' biological motivations and Freud's Id understood as the psychological aspect of many of the natural drives. In the last years of development of his theory Lorenz worked with the idea of how emotional feedback introduced just a little learning through pleasurable feelings also into instinctive systems because, as he reasoned, there must be some kind of reward of going through instinctive movements, thus making the appetitive searching behavior for sign stimuli possible.

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Naming Animals in Chinese Writing

Naming, according to Sebeok (1975), constitutes the first stage of zoosemiotics. This special but common use of language actually inaugurates more complicated procedures of human discourse on non-human kingdom, including classification of its members. Because of language's double articulation in sound and sense, as well as the grapheme's pleremic (meaning-full) rather than ceramic (meaning-empty) (Hjelmslev 1959) characteristic, Chinese script is capable of naming and grouping animals randomly but effectively. This paper attempts to describe the said scriptorial 'necessity of naming' (Kripke 1972) in classical Chinese by citing all the creatures, real or fabulous, with a /ma/ (horse) radical. It serves as a furtherance of the author's previous discussion of Chinese writing in *Semiotica* 108.1/2 (1996).

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On the concept of sense: Towards bilateralist biosemiotics

Theoretical biosemiotics has faced the dilemmas which are already well-known to anthroposemioticians and linguists. One of these is the opposition of unilateralism and bilateralism. According to the unilateralist conception of sign, it is sufficient to have a significant with its syntactics and to know that the significant has a meaning. The signified may be of any nature and is not of big interest for unilateralists. In the bilateralist conception of sign, both the significant (plan du expression) and the signified (plan du contenu, sense) are necessary, the sense and the significant being by their nature different, mutually transcendent. Therefore the sign cannot be thought as a means of control, which is possible for unilateralists. In the center of bilateralist understanding of the sign stays the concept of sense as the whole of relations and connections transcendent to the sign body.

Semioticians and linguists are sometimes concerned about the nature of sense. There are many very different views thereon, including extravagant speculations about the spirit, fields, stream of consciousness, etc. Therefore anthroposemioticians prefer either to not discuss the nature of sense or to declare it to be reducible to psychophysiological processes. Biosemioticians, when answering the questions of anthroposemioticians on the nature of sense, cannot do in such a way. So we have a double standard of scientific correctness.

From bilateralist point of view, the semiosis in living beings is discussible when we ask what is the sense as transcendental to the organism's substantial corporality. Then the genotype as idea (sensu A.A. Liubishchev) is the sense referable to the genome as plan of expression. To the sense also belongs the rule of correspondence between adaptor and acceptor in the t-RNA: it is hardly explicable historically nor deducible from or reducible to the substrate properties, this is even transcendental to the polynucleotide chain.

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Habit formation as symmetry breaking in the early universe

Habit formation as symmetry breaking in the early universe: According to the standard "big bang" scenario of cosmic development the initial state of the universe is one of very high temperature and density where matter and radiation are uniformly distributed. elementary particles and their force-laws do not exist in the initial chaos, and gravitation cancels itself out. As the temperature drops various types of order arise spontaneously by symmetry breaking random choices. Thus, the laws of nature are formed like habits, as anticipated by Peirce

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Biosemosis, downward causation, and function in the organism

The paper contributes to investigate the relation between biosemiotics and traditional biology by looking at possible biological accounts for sign action and possible biosemiotic accounts for fundamental phenomena of biology, such as reproduction and autopoiesis. It is argued that it is, to some degree, possible to give evolutionary and molecular explanations of the origin of biosemiosis as the action of signs in organisms. However, these explanations presuppose the existence of organisms and the rich and complex system of causal relations governing the basic processes in living beings. These causal relations include a mereological form of "downward causation", and this kind of causality will be compared with what Peirce termed final causation. There seems to be hidden connections between, on the one hand, tacit presuppositions in the theory structure of theoretical biology and, on the other hand, tacit presuppositions in biosemiotics.

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***Beyond Self and Other:
The Neurosemiotic Emergence of Intersubjectivity***

Empathy, posits Hoffmeyer, is the semiotic antidote to the alienation engendered by the realization of our own biosemiotic as biosemiotic. "Lacan's reflection theory holds the key," writes Hoffmeyer, "the *mutual empathy* between mother and child provided the protection necessary to cope with the unleashing of the awful isolation inherent in the idea of 'not'." Such empathy, continues Hoffmeyer, must be *felt* and not just "reasoned" - "the child must, therefore, be capable of empathizing with 'the other' even before it can talk."

At what point in the organization of a semiotic system, it may reasonably be wondered, does this ability to "empathize" take place? How many orders of biosemiotic interpretation would be necessary for the fundamental relata of "self" and "other" to be robust enough to be "bought into relation" of - of all things - intersubjective identification? Theorists as diverse as Lacan, Bourdieu, Vygotsky and Tomasello all attribute the emergence of this ability (which manifests most commonly at between nine to twelve months of age) as the logical endpoint of an accumulative process of *socialized objectification* - i.e., the epiphanal and irreversible realization that one, too, is an "object" as well as a "subject" of experience.

Social forces (primarily through language use) thus determine the invariant self-splitting and objectification of that "primal unity" that nature (presumably) has endowed - the "subject" or "self."

But does not this picture of the emergence of "objectivity" (by which agents are then supposed to reason syllogistically to "intersubjectivity") leave us bumping up again - even way down here in the primal semiotic - against a fundamental dualism between this dichotic "self" and "other"? Moreover, does not such symbolic and syllogistic reasoning ("x is y to me, therefore I must be y to x") presuppose both *linguaform conceptual reasoning* as well the very *intersubjectivity* it is supposed to engender and explain? What then "grounds" the *mutuality* of intersubjective experience that, in turn, allows for language use, socialization and the ability to negotiate and to co-construct meaning to take place?

A candidate mechanism currently being considered among researchers in the field of the neurobiology of cognition is a class of cells located deep within the Broca's area called *mirror neurons*. These neurons - located in an area of the brain long associated with both motor control and with language use - discharge both during an one's own performance of specific goal-oriented, object-manipulating activities (grasping, tearing, biting) as well during one's motionless observation of those exact same activities whenever they are witnessed being performed by someone else.

This paper presents an overview of the mirror neuron research extant and challenges the prevailing notion in the field that the cognitive transposition between "self" and "other" made possible by the mirror system is the result of "convergence" (agents matching others' external display with their own internal representations and reasoning syllogistically to arrive at a similarity relation), arguing instead for a biosemiotic hypothesis whereby such transposition is the result of "emergence" - i.e., a process whereby neurally primitive motor representations that are mutual to agents' representations of self-action and other-action provide an identity relation upon which later self- and other- representations arise.

The argument is thus made from a biosemiotic standpoint that the most significant contribution of the mirror neuron system to human cognition is *not* the "reasoning," dualistic conceptual orientation that representation is mutual *between* agents - "my representation of x and your representation of x occur similarly in both of us, therefore you and I are similar" - but, rather, the biosemiotic conceptual orientation that "intersubjectivity" - *mutuality* itself - is an *a-priori property* of representational experience *within* agents - "my (primary level) representational experience of x is mutual to both my (higher-order) representational experience of myself and to my (higher-order) representational experience of you."

The *sameness* of "self" and "other" here is quantitative (the same one) rather than just qualitative (the same as). Empathy and self-preservation are thus deeply, inextricably, biologically bound. For at the mirror neuron level of organization, afference and efference do not stand "in relation" to one another, nor are they functionally distinct. Rather, like the reflection that one finds oneself presented with when performing an action in front of a silver nitrate mirror, the distinction between seer and doer, action and reaction, experience and "experience of" is one which *at this level of neuronal and cognitive organization* is impossible to maintain. Witnessing and performing, "self" and "other," are thus not higher-order behaviors which "converge" upon the organizationally primitive and biosemiotically prior mirror system - rather, they are but two of the results, products and "proper significante effects" which ultimately *emerge* from it.

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Is movement the "highest" code?

1. Description of complexity & v.HAYEK's theorem
2. Perception of movement & the binding problem
3. Locomotion, locosensation, proprioception
4. Self (movement) perception & hominisation (optional - time?)
5. The sensorimotor shortcut: mirror neurons
6. AMA; "e-motion" & the communication paradox
7. Change & information

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Where Bonds become Binds: the necessity for Bateson's Inter-subjective Perspective in Biosemiotics.

The paper examines important intellectual discrepancies between major figures in biosemiotics taking its perspective from the work of Gregory Bateson. First, unlike C.S. Peirce and von Uexküll, Bateson begins with a strong notion of inter-subjectivity. He adds depth to his argument through linking communicative inter-subjectivity to social exchange at a second-order level. Bateson was insistent that his 'ecology of mind' was grounded in a) inter-subjectivity b) relations between subject and system, and never in individual subjectivities. Second, though Hoffmeyer and Emmeche rely on Bateson's ideas, their writing is almost entirely concerned with the links between signs in living systems and language. This paper takes a critical look at the relative absence of the social in the new biosemiotics and discusses what re-orientation of concepts might occur if Bateson's writing on social exchange and reciprocity were taken more fully into account. Broadly speaking it contests aspects of Pierce dialogical communication, of von Uexküll's 'functional circles' and umwelt, and Hoffmeyer's discussion of the relation between 'culture' and 'environment.' In the latter case the paper agrees that an empathetic response of humanity to its environmental circumstances is important - but that analysis should be made in respect of a plurality of cultures. In addition it notes that Bateson's focus was reflexive and dynamic; rather than focusing upon the conditions for bonding, he examined situations of blocked communication where bonds become binds.

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Life, Energy and Semiosis

About a reversible world you cannot know a thing, but an irreversible world necessarily opens itself to eventual anticipation. The irreversibility of our universe as expressed by the second law of thermodynamics, the so-called entropy law, is the ultimate source of semiosis, 'nature's tendency to take habits' in the words of C. S. Peirce. The energetic and semiotic aspects of our world became intimately intertwined through the origin of life. Living systems are marvelous tools for semiotically controlled energy flows. The presentation will discuss the biology of semiosis versus the biology of energy.

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Biosemiosis in the context of self-organization

In the perspective of an as yet-to-be-developed unified theory of information as part of an as yet-to-be-developed theory of evolutionary systems semiosis plausibly coincides with self-organization.

A concept of sign processes that is flexible enough to perform two functions as follows is all what is required for this framework. It must relate to the most various manifestations of sign processes, thus enabling a variety of scientific disciplines to use a common concept where it seems appropriate; at the same time, it must be precise enough to fit the unique requirements of any individual branch of science dealing with a concrete manifestation. Different types of sign processes have to be related to, if not derived from, different types of self-organization.

The paper will try to illustrate how the relationship between the *genus proximum* of semiosis in self-organizing systems and the *differentia specifica* of semiosis in self-organizing systems in the biotic sphere may be approached.

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Semiotic structure of living systems: imprints, codes and language games

Life is a self-referential process. Aristotle (De Anima II, 1, 412a) determined life as a body's feeding, growth and decline reasoned in itself (*di'ayton*). Following his approach, we can introduce the definition of life corresponding to a framework of modern science: 'Life is a self-organizing and self-generating activity of open non-equilibrium systems determined by their internal semiotic structure'. In the frames of this definition, living organism resembles rather world as a whole than any finite object of the world, which arises to Bergson's ideas in his *L'Évolution Créatrice* (Bergson 1917). A physical basis of wholeness is the quantum coherence. A sequence of coherent structures determines possibility of information transfer in biological systems (Igamberdiev 1999a).

In living systems, the information based on specific recognitions (imprints) triggering dynamical energy-driven processes is non-digital; the transfer of digital information is realized within hypercycles and corresponds to operation of the genetic code (Igamberdiev 1998). The property of wholeness, which is considered as a background for biological movement and development, is reflected in the hierarchical structure of living organisms where the higher level of organization 'moves' the lower level via signification of its elements. This activity determines semiotic features of biosystems, which are realized in specific recognitions (imprints) and in codes, both in internal structure of organisms and in interactions between organisms.

Specific recognitions are based on quantum non-demolition measurements (Igamberdiev 1993). Biological macromolecules (e.g. enzymes) possess the ability to measure certain low-energy environmental signals, which are transformed into actual work. In accordance to this, every biofunction contains a sort of sense organ, which acts as a trigger for the functional action of the whole system (Barham 1990). This correspondence is realized as being inducible, i.e., the recognizing system induces correspondence of its structure to the structure of an external object and therefore constructs its image (or imprint). Therefore an external object is imprinted via fixation of the characteristic features of its structure. The reaction of a system caused by an external object cannot simply be deduced from its structure. These two components are joined by a relation possessing semiotic character.

The consistent reproduction of this relation is possible via operation of the second semiotic subsystem - the encoding (digital) system. Biological system therefore includes two semiotic subsystems, one based on the structure of imprint, i.e. on recognition of three-dimensional shapes (images), and the other based on the digital linear structure of code.

A well-known biosemiotic structure, the genetic code, has its invariants (triplet structure, complementarity, four elementary letters) that could be derived from the model of reflection. The reflective structure may generate triads of binary compositions forming combinations, which number is multiplied by four (Igamberdiev 1999b), and this can be directly deduced from the triadic reflective action (Lefebvre 1990). The similar generalized structures (square matrices of grouping of pairs of opposites corresponding to the temporal progression of the phenomenal world) are present in Chinese 'I Ching' book and they may represent a general rule for establishing invariants through the unfolding of reflection (Merrell 1992). It can be followed in the genetic code model as finite reflective structure of Gödel numbers. The letter (number) N (e.g., adenine) reflects in its complementary number N^- (e.g., thymine), then duplication of signs leads to the appearance of additional letters N_1 (guanine) and N_1^- (cytosine). The combination of these letters satisfying the principles of consistency, simplicity and optimality generates the observed structure of the genetic code. It is arbitrary in the sense of the Saussurean arbitrariness of sign, but it satisfies optimality principles of construction of Gödel numbers during Wittgensteinian language game. The pattern of genetic code can be explained on the basis of search of the optimal variant of reflective domain structure. Thus we have Peircean trinary structure in living system: a) metabolic network based on specific recognitions (imprints), b) genome as a signifying embedding within metabolic network, and c) superposition of genome rearrangements as an interpretante of the genomic system.

Thus, biological system has its own invariants for unfolding in its space-time, which results in generation of structures more complex than that of non-living forms. There is no algorithm that will take us from primary structure to tertiary structure directly, there is further no algorithm that will take us from tertiary structure to functional activity, or 'active sites' (Rosen 1991). They emerge through a process of morphogenesis. The occurrence of something like positional 'maps' and ordered spatial heterogeneities can be understood as generic self-organized properties in biological systems: thus, morphogenesis includes complementary interaction of digital information (encoding) with non-digital information (imprinting) which reads (decodes) code (i.e. realizes reflective action). Interaction between these two types of information non-recursively forms an interpretante for the semiotic system of living being.

Genome itself is a language, which possesses an internal complementarity between text and its superpositions. The possibility of emergent constructing of 'text in text' is the only reason of self-growing logos, i.e. of the development and evolution. Complementarity means that text and hypertext cannot be viewed at the same moment: they should be separated by time interval. It is an example of uncertainty between the system and its embedding. Overlapping genes, alternatively splicing sequences, RNA and DNA editing, introns, and recombination according to molecular addresses are the features of this hypertext generating potentially infinite number of language games. The genome as a complete language exists as a complementary set of its alternative combinations. This 'existence' can be possible in potentiality, not in actuality, and this is a superposition, which is reduced during evolution. Holding of such a potentiality is some type of unconscious entity. The total 'true' genome is a superposition of contradictory arrangements, which generate one single arrangement in a concrete moment of time. An ambiguity in meaning is analogous to the quantum uncertainty principle in which it is impossible to define strictly the position and impulse of a particle simultaneously, or to fix certain energy in very short period of time necessary for its registration.

The mobility of genome is a semiotic phenomenon. In combinatorial genetic events, selection of a new combination is not written in the genome. The genetic language with distinct finite alphabet of the genetic code participates in potentially infinite language game. Wittgenstein (1953) describes language game as an action in which we do not know the boundaries because none have been drawn. Placing text in text, described as the Gödel enumeration, is a contradictory structure possessing complementary features. Self-reproduction is a creative process of placing text in text with following self-growing of this joint structure. Any evolutionary change also begins from placing text in text. This is possible because the most part of the genome serves for realization of such a non-trivial function. Moreover, even point mutation or deletion may be considered as generative if it is placed in

the repeated (e.g. diploid) structure. This is the main reason that the chromosome number is doubled in cells. The doubling is a premise of metasystem transition, which includes duplication of the original system and the establishment of control over multiple copies (Turchin 1977). Thus, self-reproduction is an interpretation of two interacting texts within the wholeness of the two systems. For development, self-reproduction and overcoming the tendency to self-degradation, the complex system should be a part of a larger system in which it is included and it should generate reflective arrows (Gödel numbers) (Neumann 1966). This means the establishment of a configuration with a description that cannot be given in advance, for the reason that it is being defined just in this process. Thus statements of our metalanguage that reflect the ways configurations change cannot be given independently from the configurations themselves (Kampis 1996). The procedure of attaining these configurations is therefore a language game which rules are established during the process of realization of configurations. Life as a self-organizing and self-generating activity creates its internal language game with rules based on semiotic structure of biological imprints and codes.

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Like a Sheet of Paper. The Interplay Between Sign and Meaning in Nature

Saussure compared the relationship between signifier and signified to a sheet of paper. One can't appear without the other. Saussure dealt with human communication. But if our species realises the same rules as all nature - and seemingly it does -, we must conclude that semiosis in human communication, the interplay from sign to meaning and from meaning to sign, is not only a human phenomenon and the same principles can be shown in all natural processes. Plato and Aristotle

characterised nature as an interplay between form and matter. Their views of both form and matter differed but, the core is, nonetheless, mutual, Aristotle exemplified matter by the word hyle 'wood'; wood is a material and in it the most individual features are missing. Water might have been a more representative example for matter but Aristotle obviously used wood because of its more apparent structure. Plato's term eidos 'image' is a name for the prototype. In the realm of ideas, there are only true entities, the copies of which fill the realm of ours. Images have a proto-face resulting in the single entities with an individual face each. The Aristotelian forms are immanent images (conceptual structures) that organise matter and make it identifiable. There is a certain difference between Platonic ideas and Aristotelian forms. But the process from inner models to individual entities is largely the same.

Aristotle and Plato did not think of in semiotic terms. The interplay between form and matter can be, however, applied to semiotics. It is semiosis. If the Aristotelian hyle represents a faceless void - and more likely - a faceless filled space, then the chaos (Gr 'vast chasm, void') filters into conceptual form-giving at the level of meanings and the organised matter of sounds or letters in the spoken or written discourse. The travel of hyle to get organised encounters in morphemes and allomorphs, which represent meaning from one side and sign from the other. A sentence as a sign is an organised and identifiable body of matter, and the process of meaning has given it its face. Plato and Aristotle emphasised that both generally appear together. But as Aristotle points out, pure form is God. It is a reference to the general rule that meanings are ultimately guided by the Supreme Being. The guidance might be called intentionality. The unorganised hyle will change into the organised one as an effect of form on matter. Semiosis does not have a human copyright. Animals and plants realise it, even the inorganic nature, although our traditional sharp distinction between the two natures - the organic and inorganic ones - makes the idea of general semiosis to us difficult to grasp.

Signs equal the notion of 'matter' in Plato and Aristotle: meanings equal the notion of 'form', respectively. One of the main problems in the history of philosophy has been how to connect the realms of matter and spirit together. Cartesian dualism has seen spirit and matter as opposites. The classical antiquity can lead us to another conclusion. Both are there to complement each other.

Which one is the first: form or matter? The question might be basically wrong. There is no form without matter and no matter without form. Both seem to be complementaries of each other. They are aspects of the one and same basic process. But even if this be the case, we have to come to the same conclusion as did the master and a disciple of his two and a half millenniums ago: no doubt, it is the meaning or the spirit that makes the nature such as it is.

Form and matter might be characterised as structure and process, too. The terms "structure" and "process" are more relevant from the viewpoint of modern science.

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Evolution of the "Window"

It has been argued previously that during the course of evolution complexity increases by meta-system transitions. It has also been argued that in the course of evolution there is a trend towards increasing semiotic interactions.

In this paper we propose a general model that integrates these two perspectives on basis of a metaphor. This metaphor is that of an "evolvable window", which stands for the totality of the semiotic interactions of an organism including the models and meta-models used for anticipation.

According to this metaphor, the evolution of the "window" proceeds via meta-system transitions, during which iteratively new windows are created on the "inner" side of the pre-existing ones. This process generates a cascade of windows, or in other words, a "telescope" growing inwards starting from the "outside".

The tendency of "inwards growth" of the "telescope" can be explained in terms of the following circular causality:

- 1) A well-accepted tendency of nature leads from unity towards individualisation
 - 2) Individual learning provides a basis for more complex semiotic interactions
 - 3) More complex semiotic interactions bring forth sharing of "values"
 - 4) Sharing of "values" brings forth a reunification at a higher (meta-system) level, on which the system evolves according to (1).
- Using the proposed metaphor we hope to provide clarity to the fluctuation between objectivity and subjectivity inherent to the circular causality loop described above.

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Biosemiotics means biology

In this paper, I will argue that semiotic approach is necessary for all major branches of biology.

Morphology - organic structures are results of functional differentiation, which is based on endosemiotic mechanisms. Physiology - biological needs are homological to an intention. Taxonomy - biological species are communicative structures. Ecology - relationships between species are fundamentally communicative. Evolution - organisms' choices influence evolutionary process via Baldwin effect. Consequently, since the biological objects are formed and distinguish themselves on a communicative basis, they differ principally from non-living objects, and the laws which describe the specific features of living systems are non-conservative.

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Human/animal Communications, Language & Evolution

During the sixties, American psychologists have been involved in one of the most interesting scientific adventures of the second part of the 20th century : the teaching of a symbolic language to chimpanzees in order to make them able to communicate with human beings.

- 1) In the first part of the talk, I give a short synthetic presentation of these researches through two pillars: the dichotomie between artificial languages and ASL, on the one hand, and the dichotomie between researchers who decided to establish strong emotional relationships between them and the apes and those who have always seen apes as instrumental devices, on the other hand. I show that the experiments with the most interesting results have been both with artificial languages an ASL but with strong emotional affiliations between researchers and animal involved in the experiments.
- 2) Then, I suggest that unlike what has always been said, these experiments on talking apes are not so much experiments in psycholinguistics (How far can animal learn human language) but wonderful experiments on the communities of communication between human beings and animals. Indeed, for the first time in the history of the world, animals (humans) have tried to built up communities whose only goal is to seriously communicate with another species in order to better know it.
- 3) In the third part of the talk, I analyse that situation in the context of the evolution of communication and I try to

make sense of human language not as a property that puts human being apart of other living creatures, but as a property that makes human being able to better communicate with non human living creatures and to create hybrid communities of sharing interests, meaning and emotions. In conclusion, I analyse the reasons for which this situation is of great importance to think properly the evolution of communication and biosemiotics.

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Understanding Life: Trans-Semiotic Analogies

The paper sketches a network of systematic analogies between classifications in anthroposemiotics, biosemiotics and general semiotics. In this network, for example, the "proportion" between signification and reference is the same as that between functional semiosis and adaptational semiosis.

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An attempt of a hermeneutics of the living

All living beings are able to extract meaning from their world. This is possible because, first, they have inherited digital genetic text - the inscription of the experience of their line. Second, they inherit bodies whose structure presents also an uninterrupted tradition back to the root of life. Due to these two kinds of tradition inherited from their progenitors, living beings feel at home in the world. This, however, often requires a high degree of hermeneutic effort.

The hermeneutic task is undoubtedly very demanding on time, and resources. Living beings, therefore, renounce it whenever they can rely on automatism. Experimental biology, in its quest to become an exact science, has, willingly or unwillingly, developed methods which enable it to study only such machine-like, repetitive, foreseeable behavior and to suppress uniqueness. The equipment as well as the models studied are constructs, prepared in such a way as to minimize variability and self-reference. This approach is of course fully legitimated, it is only the extrapolation of such models to the whole realm of life that lacks legitimacy.

The alternative to mechanistic approach should lie in an understanding the hermeneutic situation of living beings. Hermeneutics should bring our search to a single "principle": *everything is being enacted, negotiated here and now, again and again*. Cell differentiation, ontogeny, the "collapse" of a single phenotype from the field of the reaction norm possibilities, the ecology of proteins, cells, or organisms: all this is an never-ending process of seeking and employing possibilities, potentialities, past experience and projects, and layouts of the future at which the struggle is aimed. Some examples of what may become a playground of the hermeneutic approach are as follows: the role of redundancies, genetic or epigenetic; comparison of phenotypes built on identical or only slightly differing genomes; suppressor mutations; modular biology; analysis of cognate species differing in morphology or life-style; study of chimeras, embryonic stem cells or nuclear transplants; epigenetic inheritance; prokaryotes as the background of the Gaian life.

Living beings are able to "read" their environment and to project their own future in the context of their experience, in other words to behave in a meaningful way. Such interpretation is quite different from common homeostatic regulators without memory and limited degrees of freedom. In living organisms, a different kind of interpretation is at work, which I call hermeneutic.

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The world as semiosis - a semiotic model of reality and evolution.

In the quest of a (bio)semiotic ground of interpreting life one should better deconstruct the model of reality furnished by the trivial entanglement of hard sciences and pop beliefs. Biosemiotics needs a model of its own, more encompassing and more subtle to reconcile in a larger construct the dichotomic realms of *res cogitans* and *res extensa*. The sources of this attempt of a model include an adaptation of Peircean ideas of three-categorical existence, his 12 major kinds of signs, Uexküll's revised theory of *Umwelt*. However, further building elements were necessary regarding the nature of time, information, and causality. The main gist of Peirce this work relies on is the concept of Thirdness viewed as that unexhausted semiotic object which any other law (habit) stands as a sign (Representamen) for. The fundamental statement of Peirce "Law is par excellence the thing that wants a reason" may be pushed a step further into - Law is its own reason. Thus, the ontological realm (the reign of law) and the epistemological realm (the realm of reason) re-enter the circle. But more than that, they open into a triad having Thirdness as an object. Thirdness may be viewed as a continuous, unveiling, transmundane process that act from the enfolded domain of reality (implicit or virtual order) towards the unfolded (explicit, actual) and back. The three categories are viewed as pertaining to a generic interpreter (a larger concept than interpreting system): Firstness (the category of consciousness), Secondness (the category of spatial extension) and Thirdness (the category of process - law and mind). Three semiotic axioms come along with this: 1. There is no existence apart of the three categories altogether; there is nothing less than an interpreter proper. 2. Thirdness and its own signs does not pertain to the same realm of reality. Time separates these two realms (enfolded and unfolded) inside the interpreter. 3. There is no separate interpreter (an interpreter unveils its being by semiotically interacting with others).

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The universality of sign in Charles S. Peirce Semiotics

Biosemiotic appears in our century as a rich conceptual base for new ideas concerning the biological processes. The semiotic tendency in nature attempts a wider approach to the foundations of biology. To biosemioticians the meaning is considered the key to understand life, changing the focus from the organisation of molecules to the sign relation which occurs among them. This proposition is a powerful resource to breaking up the limitation of traditional biology. But although all Semiotics study signs and hold some points in common, there are remarkable differences. They are not all theoretical Semiotics that can recognise general classes of sign in the inner organism and their relation with the environment. This essay presents an investigation about the Semiotic of Charles Sanders Peirce (1839-1914). This science can significantly contribute to Biology researches, for it is not only a taxonomic theory of signs, it is a central column in Peirce's Philosophy. Peircian theory starts from traditional western Philosophy. Peirce belongs to a long tradition that comes from Plato. His theory establishes an important theoretical reference to general conditions of knowledge; he proposed the sign statute in the process of thought and in the determination of conduct. Treated as a logic of conduct, Semiotic and its triadic model of sign will allow to observe an including sphere of signs processes.

Key-Words: Biosemiotic, Peircian Semiotic, Conduct, Sign statute.

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Qualia: From the mind-body dichotomy to the biosemiocybernetic paradigm

Qualia, the mental phenomena like the greenness of the May-woods in our visual experience, or like the sound of high *c* of a tenoral voice in our auditive experience, or like the coldness of the wind on my cheek on a winter day, are the target objects of our consideration. I suggest employing biosemiotic perspectives and biocybernetic models to conceive what qualia are and to explain how qualia emerge and work. This *biosemiocybernetic paradigm of qualia* is furthermore the key to the allegedly intractable *mind-body problem*.

The qualia problem, whether qualia can be explained physically, i.e. in terms of brain state physiology, has been the central issue of the philosophy of mind in the last two and a half decades. Recently, the so-called qualia-scepticism seems to gain the upper hand over the mind-body debate. Allegedly, the intractability of the qualia problem falsifies the physicalism of mind and we are forced to make a confession of "ignoramus et ignorabimus" concerning the mind-body problem.

Against that qualia-scepticism I draw a perspective on conceiving and explaining qualia - I believe the biosemiocybernetic perspective provides us with the best framework to understand qualia.

At the first step I show that the qualia debate has developed upon a pseudo-argumentation which results from an inadequate, even wrong framework of mind-body dichotomy. I try to expose the underlying framework of the contemporary mind-body debate and spell out where and why it is wrong. To mention two grave points: (1) The semantic-biased stand on knowledge evokes confusion of 'physically described world' with 'physical world' and (2) the carelessly taken-for-given reduction of brain science on physics impedes us in conceiving biological processes of mind differentially from the (physically described) mental image of the world. To the first point, we need to introduce the semiotic perspective on knowledge (perceptive knowledge as well as scientific knowledge) as a therapeutic measure against the semantic bias of the current theories of knowledge. To the second point, we need to reintegrate the brain science into the bio-scientific framework because it has its own peculiarity which cannot problem-free be reduced to the physical science. For example, such peculiarity as like the "*Planmäßigkeit*" of living organisms, or the ecological relationship between an organism and its environment cannot be embedded into the framework of physics without certain loss of their essential feature.

At the second step I draw a new framework of the mind-body problem. The conventional mind-body problem complex can profitably be broken up into two distinct components: the problem of the mental-physical dichotomy [MBP-I], and the problem of the mind-brain interrelation [MBP-II]. The MBP-I emerges from the diversity of the syntactic structure of each epistemic system, the perceptual representation system of phenomenal properties on the one hand and the scientific representation system on the other hand. Concerning qualia, the MBP-I is directed at the relation between qualia, the mental-perceptual representation system on the one side, and the physical-scientific representation system on the other. Its task is comparative study of syntactic structure of the both sign systems. MBP-II is concerned with explaining how the mental representation is processed through the cognitive apparatus in organisms. Concerning qualia, the MBP-II is directed at the relation between the neurophysiological apparatus of perceptive systems and qualia as products of those systems. The process of producing qualia is a kind of natural sign-processing, a special kind of biosemiosis. I believe it's worth modelling qualia-process on the basis of the biosemiotic and biocybernetic perspectives.

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Thinking with animals

A central claim in biosemiotics is the ascription of semiotic competence to non-humans. This issue is, for strange historical reasons, very problematic within much of 'standard scientific discourse' where a dualism between humans and the rest of the world, which is probably Cartesian in origin, has

put an almost absolute ban on accepting that other animals do have a semiotic competence. There are, however, many other settings, contemporary as well as historical, where this dichotomy carries a different configuration. An analysis of ethnographical material from Greenland demonstrates that people rather regard animals as 'non-human persons', that is, as sensing and thinking beings. This implies that animals, like other 'persons', are able to build up knowledge about their environment. That people take this semiotic competence as a fact beyond any doubt enables skilled hunters and fishers to rely not only on their own interpretations of the environment, but also, as importantly, on understanding and noticing the interpretations of the animals. The behaviour of fish and seals, mediated by their acknowledged semiotic competence, can thus be interpreted as giving signs about the behaviour of whales, glaciers and winds. This a priori ascription of semiotic competence is, furthermore, seen in discussions on management and regulation of animals. Rather than discussing whether 'the stock' is depleted, much of the internal Greenlandic discourse focuses on how animals may be semiotically disturbed by what people are doing.

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Pragmatics and biosemiotics

The term "pragmatics" was introduced by Charles Morris as one of three parts of semiotics (together with syntax and semantics). According to Morris, pragmatics deals with biological aspects of sign functioning. I interpret pragmatics broader as a theory of usefulness in human life, society, living organisms, and even in non-organic self-reproducing systems. Usefulness and its quantitative measure, value, are central notions of pragmatics. Although signs and languages are natural products of advanced pragmatic systems, not all pragmatic systems communicate with signs. Thus, pragmatics study a broader range of systems than semiotics. But semiotics itself is broader than its pragmatic part because it includes non-pragmatic aspects of sign systems (e.g., structuralism).

Pragmatics is focused on solving the following 3 problems: (1) estimation of values in systems with known behavior; (2) predicting agent behavior using the optimality principle; and (3) reconstructing agent's Umwelt (perceptions, models, and values) based on its behavior and communication. The first problem concerns systems that can not control their behavior, and the latter two problems are considered if the system is an agent (i.e., it has a partial control of its actions). The second problem is addressed if we know agent's perceptions, models, values, and behavioral options. For example, we easily extrapolate our personal sensations and models to other people and then predict their actions (game theory). The third problem arises if we face unknown agents (e.g., other species). I view it as a central problem in biosemiotics. In the evolutionary perspective, agents are self-referencing systems. Thus, reconstruction of agent's perceptions means understanding of its nature, boundaries, and relations. Because agents are organized hierarchically, there have different Umwelts at each level which are linked together via control relations. Umwelt reconstruction can be based on a reversed optimality principle. Instead of finding the best behavior for a given Umwelt, we seek for an Umwelt in which optimal behavior matches with observed agent's actions.

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Some Problems i Neurosemiotics

Brains are the foremost meetingplace for the "bio" and "semiotics" of Biosemiotics. Semiosis may be a more fundamental biological phenomenon, not limited to organisms endowed with a central nervous system (although, as yet, we don't know if that is true), but still brains remain the primary solution to the problem of relating a biological organism to the surrounding world. Certainly, the

advent of brains in biological evolution marks a revolution in semiotic behavior. It is also the case that differences in brain-size, structural organization and complexity lead to differences in types of semiotics behavior: Homonid primates, for instance, are the only known species capable of using full-fledged linguistic sign-phenomena. Being the main biological 'organ' evolved to facilitate semiotic behavior the brain should be of paramount interest to semiotic theory. Until recently this has not been the case, however. With the advances of Biosemiotics and Cognitive Science this situation may be about to change though. The time seems ripe for the introduction of some kind of Neurosemiotics into the field of semiotics. The aim of this paper is to discuss some of the (mainly philosophical) problems which are posed by the such a neurosemiotics -- including, how brains may mediate the realm of biology and the realm of logic.

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Symbols and the evolutionary transition from animal to man

Terrence Deacon's "The Symbolic Species" is a groundbreaking volume, integrating semiotics, neuropsychology, and anthropology in an attempt to understand the semiotic difference between man and animal. The ability of making and using Peircean symbols is taken define this border, in so far symbol usage is only rudimentary in higher animals except for man. This paper discusses this hypothesis and points out the fact that Deacon substantially modifies Peirce's symbol concept in his claim - and it consequently tries to focus more precisely on which types of symbols distinguishes human from animal semiotics. A crucial symbol type is found in Peirce's "hypostatic abstraction" which is taken as a more precise candidate for satisfying Deacon's hypothesis.

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Energy and evolutionary semiosis

This paper explores the ontological and epistemological architecture of an evolutionary semiosis. The analysis in this paper uses a basic definition that energy is the basis of all abiotic and biotic ontology but that it exists only as codified or organized mass. When energy is measured, it is transformed into 'informed matter'. This paper examines the architecture of the semiotic forms of measurement by which energy becomes 'informed matter' within the three basic realms: the physico-chemical, the biological and the socioconceptual. The architecture for these three realms first sets up an ontological cut dividing semiotic measurements into zones of an endo- and exo-semiosis or internal and external codifications. Then, within each of the external and internal zones, a generative semiosis must provide a contradictory dynamics. One process will reduce or contract measurements to enable cohesive global relations and the other process will dissipate or deconstruct measurements to enable local diversity and provide adaptive capacities. Ontologically, the external zone encodes both cohesion and dissipation within classical mechanics while the internal zone encodes within quantum mechanics. It is an axiom of this paper that both the classical and quantum types of measurement are required for a generative ontology and therefore, a mediate process that links classical and quantum mechanics must evolve. The ontological nature of the external and internal zones and their relation, are examined within each of the three realms: the physico-chemical, biological and socioconceptual. It is understood that each realm epistemologically evolves in semiotic complexity, moving from a simple mimetic capacity in the physico-chemical, through a more complex indexical capacity in the biological to the symbolic capacity within the socioconceptual.

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Evolution, semiotics and extraterrestrial life.

Since presence of intelligent life elsewhere in the universe may have dramatic consequences for inhabitants of the earth, investigating tracks of extraterrestrial intelligent life is a legitimate scientific endeavor. However, temporal and spatial separations are epistemological challenges when deciding how to go about to detect extraterrestrial intelligent life. The NASA funded project SETI (Search for Extraterrestrial Intelligence) cut the Gordian knot in an epistemologically accessible but still controversial way when semiotics was chosen as vehicle for contact. SETI dealt with the semiotic problem in two ways. First by sending a message into deep space that would allow any intelligent extraterrestrial to figure out that it was produced by intelligent designers, and second by scanning the night sky for narrow-band radio emissions hoping to detect signs of intelligent life elsewhere in the universe.

The rationale for the SETI project is to be found in certain assumptions derived from evolutionary theory. Evolutionary theory claims that complex structures found anywhere in the universe are/were either alive or that the structures are/were created by something that is/was alive. Although evolutionary theory is opposed to the design argument for explaining biological diversity, the theory is not opposed to deployment of the design argument for explaining artifacts. As such, the design argument is perfectly valid for scientific inference. The SETI engineers search for radio emissions, not because this is an a priori sign of intelligence, but because they know the sorts of mechanisms that are needed to produce radio waves (Sober, forthcoming). According to Peirce's theory, radio waves are sign vehicles (representamen) that stand for intelligent life (object) for inhabitants of the earth (interpretants).

Although the improbability of extraterrestrial life has been heralded by evolutionary biologists (Mayr, 1985), it is widely believed on statistical grounds that intelligent life has arisen independently several places in the universe. Richard Dawkins (1983) claims that Darwinism is the only theory that can adequately account for the phenomena we associate with life, terrestrial or extraterrestrial. If these premises are correct, the SETI project, by focusing on signs of meaning in the universe, may be regarded as a project testing the hypothesis of universal biosemiotics. These investigations will also have bearings on the biosemiotician's claim that life is based entirely on semiosis, on sign operations (Hoffmeyer, 1996). Finally, the SETI project can be looked upon as a test for the claim of universal Darwinian evolution.

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How and why to naturalize semiotic concepts for biosemiotics?

Semiotic concepts have at least three possible roles in biology: 1. They can be merely used as popularizing metaphors. 2. Biosemiotics can be seen as an alternative philosophy of biology, i.e. as

an alternative metaphysical interpretation of biological phenomena, or 3. it can be seen as a preliminary form of a new general ground theory of biology. The second and the third roles are considered (first is too weak to be interesting), and it is argued that in either case a certain kind of naturalization of the semiotic concepts is needed. Instead of the standard physicalistic naturalism (i.e. reduction to non-semiotic), certain kind of semiotic naturalism is in quest. If biosemiotics tries to develop towards a biological ground theory (case 3), the naturalization of its semiotic concepts is a necessary (even if not sufficient) condition for its experimental testability. If biosemiotics is considered as a metaphysics (case 2), and even if it is admitted that its concepts are rather vague, there lays a possible anthropomorphic error in the application of semiotic concepts into natural phenomena. Peircean semiotic concepts are grounded on the study of 'mind in me', i.e. of human self-understanding. Biosemiotics cannot be grounded on 'a thought thinking of itself', but instead, its semiotic concepts must be based on the phenomenology of the other one, in which the 'other' is an object of our external experience, the object-agent. Although Peirce's sem(e)iotic was a theory of logic in general, the normative science of self-controlled thought, his objective logic (logic of things) was a shift from logic to metaphysics. The objective logic, 'mind out there' operative in nature, is the central object of research for biosemiotics. In biosemiotics (and in related research areas) there have already been number of quite successful attempts towards the naturalization of such semiotic concepts as mind (i.e. agency) and purpose (function). The emergence of self-functionality is the basic problem of biosemiotics. However, the hidden anthropomorphic (or rather 'animistic') error lays in Peircean concept of sign, and particularly in the concept of the object of representation. It is argued that if we consider sufficiently 'simple' object-agents, as bacterial agents (e.g. E. coli), there are no objects of representation for the bacterial agent itself (just for us) although its 'interpretive behavior' is certainly purpose-oriented (self-functional). The problem is even worse when vertical semiosis is considered: what is the object of DNA-sign, and to which object-agent there are signs in DNA? It is argued that Peircean concept of sign must be based on more primitive concept of representation (e.g. on Mark Bickhard's model of interactive representation). The causal origins of representations are not important for the object-agent, only their anticipative consequences (meanings).

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***Mimesis and Metaphor. A biosemiotic commentary on the origin of symbolic forms
in the cultural philosophy of Ernst Cassirer***

The work of Ernst Cassirer has been reconsidered in the last decade as an important contribution to cultural semiotics. Cassirer has been influential in theory of art and aesthetics (Langer 1953, 1979, 1967ff, Goodman 1997), in ethnology (Geertz 1997), in cultural philosophy and epistemology (Schwemmer 1997).

Although Cassirer bases his reflections about symbols on the premise that all culture rests on a "primordial emotive ground", he never extensively discusses this background frame. This is a rather Kantish strategy marking the transcendental approach of his cultural philosophy (Knoppe 1992). Cassirer is convinced that we can have conceptions of ourselves only within a symbolic system.

To fill this gap in our self-understanding, Cassirer (1944) in his late work, the "Essay on man", heavily draws upon the biological findings of J. v. Uexküll. He hence adopts the terminology of a cryptosemiotic biologist to complete his cryptosemiotic cultural philosophy. Cassirer particularly extends Uexküll's functional circle by locating the human specificity within a "Symbolnetz" between the Uexküllian "Merknetz" and the "Wirknetz".

But this relation rests rather colloquially and is without any further deepening. I will propose, however, that there is a deep relation between the concept of symbolic forms and a biosemiotic viewpoint. I will forward the view that only by conceiving of the human organism in biosemiotic

terms we can understand the central term in Cassirer's theory, "symbolic pregnancy" ("symbolische Pragnanz"). By this Cassirer tries to explain how symbols are generated viz. imprinted their symbolic values on (Cassirer, PSF III:235). The point where embodied experience turns over into cultural meaning is hence a pivotal point in the Philosophy of symbolic forms. Things themselves in their effects on the living already carry of gloomy or serene traits that later characterize their symbolic import. This process Cassirer also calls an "Urphanomen", in reference to Goethes holist theory of symbols.

I will argue that an understanding of the process of meaning generation proposed by Cassirer has to go back to the creation of meaning by the living itself (Langer 1967, Jonas 1973, Varela 1991, Weber 2000a). Meaning arises in organisms *ex negativo* (Varela 1988): Because of the living's incessant need (Kull 2000) of input to keep up the fragile equilibrium of Autopoiesis (Maturana & Varela 1980), stimuli gain an existential cognitive significance. This is represented to the organism as perspective of existential concern (Jonas 1973). External influences hence act as signs that have a meaning for the organism's survival (for a detailed discussion see Weber 2000a, 2000b).

In a way Suzanne Langer, one of the most eminent scholars of Cassirer, has seen this consequence and has developed her artistic semiotics into a theory of the living (Weber 2000b). I will show however that also Cassirer himself has prepared this view as we can witness by several (though dispersed) descriptions in his work. (Cassirer 1983:106).

The link between a symbolic theory of culture and biosemiotics is a necessary step in the establishment of a unified theory of cognition that tries to overcome the mind-body-problem, as e.g. in the work of Lakoff & Johnson (1980, 1999). Cassirer's quasi-biosemiotic description of symbolic pregnancy parallels Lakoff & Johnsons view of "primary metaphor". It could also serve in a biosemiotic analysis of why nature is such a preeminent symbolic source in both archaic and medieval European societies (Bohme 1988, Schama 1996, Descola 1997). Its discussion hence in general could help modern cultural philosophy to reestablish a serious discourse about the phenomenon of "nature" in its centre.

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Robosemiotics

Much research in AI and cognitive science has recently been devoted to the study of the situated and embodied nature of intelligent behavior in general, and adaptive robots and autonomous agents in particular. Such systems are typically said to `learn', `develop' and `evolve' in interaction with their environments. Hence, it could be argued that these self-organizing properties solve the problem of symbol or representation grounding in AI research, and thus place autonomous agents in a position of semiotic interest. Based on our earlier work (Sharkey & Ziemke, 1998, 2000; Ziemke & Sharkey, 2001; Ziemke, 2001), we discuss the relevance and implications of Jakob von Uexküll's theories, as well as other work in biosemiotics, to the study of adaptive robots and their use of representation and sign processes. Furthermore, we contrast his position with more mechanistic views, and examine the relation to recent theories of embodied cognition and its biological basis, in particular the work of Maturana and Varela.

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*** Contributions marked with an * sign have unfortunately been cancelled.**

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