ABSTRACTS

10th Gathering in Biosemiotics – Braga, Portugal 2010

Biological and social levels complementarity in human communication

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All living organisms are dynamic systems, humans are different in the way that they are extremely complex dynamic systems of biological origin. Evolution reveals the stable tendency to dynamic complexity, and being what we are now we need to pay our tribute to procaryotes prehistory. The problem of the human language emergence is directly linked to biological forms of communication. The notorious dichotomy of the body and mind was forced by the religious and philosophical tradition, and nowadays biosemiotics has all chances to resolve this opposition. This paper thesis is that human semiotic competence comprises most levels of biological forms of communication that serve as a foundation for human social forms of intercourse, including verbal communication. It is only at first sight impossible to compare the communicative potential of a single cell and a human. But does not a human consist of cells? Do not those cells function within the body? Are not they united in complex physiological subsystems that have to communicate *successfully* to ensure the whole organism's survival? Etc. By admitting that we can conclude that humans as organisms have preserved in themselves all stages of biological evolution – from the cellular level to the highest mammals.

The main danger in comparing human language to other species' forms of communication is that « we look for the analogues of words and phrases in animal cells» (Deacon 1997). As the pragmatic behaviour of different components of the body is different, the form of the signs and the interpretation processes must be different. We need to understand that each level of biological communication uses its code system for exchanging messages, each code being perfect in itself as it successfully services the information needs of the given living organism, either a cell or a monkey.

The semiotic competence of humans being so diversified, the question is what unifies and controlls the integral functioning of the organism. In my opinion semantics is the driving force of life and evolutionary development. It is knowledge acquired during a life-cycle that is to be preserved (memory function) and transmitted. The acquired knowledge is to be passed to other individuals and generation. This is the main principle of evolution, a sort of relay-race with handing on the baton. One and the same concept of DANGER is equally relevant for every system of the organism, but this concept is differently coded and is transmitted through different channels of communication. Thus when a man shouts in words «It hurts!», he generalizes what other parts of his organism have already informed him about in a set of other codes that have passed through a number translations (Hoffmeyer 1997, 2008), the language phrase being the final here. The epistemic cut (Pattee 1994), separating the known and the knower, is an important notion not only at the initial stage evolution. With every other stage the cut becomes wider and wider, reaching the maximum degree in humans.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Alpha and Omega: the oldest and newest example of interphylogenetic semiotics: the orchid

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The Family of orchids, orchidaceae, is one of the oldest examples science has of communication between Phyla and Kingdoms, since it depends on semiotic relationships between plants and fungi for its existence through the protocorm stage to adulthood. Moreover, its reproductive cycle depends upon semiosis with the animal Kingdom for pollination. The key to understanding these relationships is the nature of orchid seed and its self-coded intentionality. Orchids also provide the newest information about speciation in evolutionary terms through the "bar-coding" of living organisms and cladograms, thus becoming the poster-child for Biosemiotics.

Key words: phylogenic semiosis, orchidaceae, clade, speciation.

10th Gathering in Biosemiotics – Braga, Portugal 2010

On the Origin of Language

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There is a large consensus, today, on two general conclusions about language. One is that language is a biological phenomenon. The other is that language has been a product of evolution. As soon as we move beyond these generalities, however, the consensus immediately breaks down, and what we have is a bewildering variety of hypotheses, models and scenarios on virtually every issue concerning language. The origin of language, in particular, continues to be the object of free-ranging speculations, many of which do not even bother to take into account the experimental facts that we do have. Here it is shown that the very considerable evidence that has been gathered on the evolution of human *anatomy*, leads inevitably to a specific theoretical framework for the origin of language. This does not solve all problems, of course, because in such a frameworks there is ample room for different mechanisms, but it does put severe limits on our speculations. It is no longer true, in short, that "*anything goes*" in the origin of language. The clear neotenic features of our anatomy and the details of our foetal development make it very likely that the preconditions for language were created by a fetalization process. More precisely, by a process that produced an extra-uterine phase of foetal development, and gradually extended it to the point that it became longer than the intrauterine one. The first thesis of this paper is that the two phases of foetal development led to two different types of brain wiring, and created a condition that can be referred to as *cerebra bifida*, in some ways analogous to the condition of *cardia bifida* that is well known from laboratory experiments. The second thesis is that the brain wiring processes that take place in all phases of our ontogenesis (embryonic, foetal, infant and child development) are controlled by specific sets of rules, i.e., by the rules of organic codes, and it is therefore the step-by-step appearance of these brain-wiring codes, in a condition of *cerebra bifida*, that holds the key to the origin and the evolution of language.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Identity, species, order

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That semiosis is specific to the living world is the cornerstone of biosemiotics. An information-theoretic interpretation of this statement was proposed at the 2009 Biosemiotics Gathering in Prague. For checking this interpretation, it is attempted to answer the question asked by Kupiec and Sonigo in Ni Dieu ni g`ene (Seuil/Science ouverte, 2000): '[...] why a biological process, which produces looking alike organisms referred to as humans, rabbits, or oaks, would endow these reassemblies with a greater reality than a geophysical process, natural as well, endows looking alike objects referred to as stones, mountains, or rivers?' It is argued here that the inanimate world only contains aggregates while the living world is made of organisms, i.e., self-maintaining and self-reproducing informed assemblies (the word 'informed' being understood in its Aristotelian meaning). A biological process thus keeps order through the use of information, while a geophysical process does not. For defining the concept of order, it is proposed that an ordered object can be produced by a construction (e.g., the copy of a template) using available data within some given context. In other words, an ordered object does not bring innovation into its context. Order in this meaning appears as specific to the living world, at variance with the inanimate world which is basically disordered. A better understanding of what separates the living world from the inanimate world results: the use of information is the distinguishing feature which defines their border. Any living thing contains a symbolic information, referred to as genome, inscribed into DNA molecules. This genome can indeed be copied but, its support being embedded in the physical world, it incurs disturbances interpreted according to information theory as channel errors. Keeping its order thus needs endowing any genome with error correction ability: it must belong to a redundant code, i.e., a set of sequences separated by some minimum distance. The larger its minimum distance, the better a code protects its elements against errors. Then genomes become as distinct as to ensure order. Identity and specificity result. Although conservative according to the above definition of order, the living world actually exhibits an extreme diversity which even tends to increase as evolution proceeds. In sharp contrast, homogeneity and monotony are observed in the inanimate world, assumed however non-conservative. In order to solve this paradox and justify the proposed definition, it is argued that the error-correcting means which ensure the conservation of genomes can not always succeed. They fail with some low, but non-zero, probability. Although very infrequent, regeneration errors have important and lasting consequences: in case of such an error a genome largely different from the initial one results; and the correction mechanisms conserve the mutated genomes just as the original ones. These genomes and the phenotypes they specify become targets of Darwinian selection. The good conservation of old parts of genomes moreover demands that the genomic error-correcting codes assume a nested structure. Then mutations occur in steps with changes the bigger, the more infrequent and long-lasting they are, and a hierarchical taxonomy results.

10th Gathering in Biosemiotics – Braga, Portugal 2010

To Life on Earth: Messages from the Moon

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Endosymbiotic cells evolved and grew up on Earth during the last 3.5 billion years, and they did so always in the presence of both Sun and Moon. Throughout that time, it is likely that cells were susceptible to the orbital positions of these two cosmic bodies relative to the Earth. Then, by the time that multicellular organisms developed, these susceptibilities already had become an inherent feature of their single-cell predecessors and so would be present in these new Life-forms. Cosmic susceptibility had now become integral and constituted a sign within the organisms. But how? What types of geophysical signals could pass from the Moon, say, to Life on Earth? Moonlight and the lunisolar gravitational variation, δg, are the two most obvious. The former has been shown, in plants, to interfere with rhythmic phenomena instigated by solar illumination – one example of a general conflict between lunar and solar susceptibilities. Effects of δg, however, are less easily studied because nothing can shield organisms from its omnipresent force. Lunisolar gravity is registered everywhere – on the Earth's surface and its interior. It causes continual elastic deformations of the planet which give rise to the marine tides.

Two plant movement phenomena were investigated which seem promising for uncovering fundamentals of the relationship between δg and plant life: 1) the rhythmic movements of leaves, δL, and 2) daily variations in tree-stem diameter, δD. Biological variables δL and δD were recorded continuously over periods of hours or days; time-courses of δg were computed for the same dates and locations as the records for δL (Germany, Netherlands) and δD (Italy). Because plants can never be free from the influence of δg (though they can be removed from the influence of solar illumination), study of interactions between biological and cosmic geophysical variables needs resorted to graphical evaluations and statistical procedures such as cosinor analysis and cross-correlation.

Positive relationships between the time-courses of the two types of plant movement δL and δD and the pattern of δg were found in nearly every case. The characteristically swift variations of δL were triggered by a single event (after 20min delay), the rapid fall of δg from a maximum. Variations of δD consistently tracked the values of δg with delays of 2h.

The biosphere is incorporated within a geophysical matrix which includes δg. The surfaces and interiors of present-day organisms include structures – signs – which capture every transient variation within the matrix and, after summation to a threshold value which enables organisms to make use of these variations, to modulate, via the organisms' semiosphere, their corresponding metabolic processes and thereby adjust their development or behaviour.

The entire cell-protoplast induced by an every-varying δg may comprise the biosemiotic sign. According to a quantum gravitational hypothesis of G. Dorda (ref. 1), lunar gravity affects the molecular cohesiveness of cellular water; δg is able to draw water into and out of the protoplast affecting the variables δL and δD. In terms of volume, the critical molecular-cohesiveness volume corresponds to that of a cell (approx 8-10μm^3). Hence, it is possible that lunisolar δg has brought about the evolution of plant and animal cellular dimensions. The signal permeating the geophysical matrix of Earth from the Moon (the contribution of Moon to δg being 54% more than that of Sun) has transmuted into an ineluctable remote control, by the Moon, over plant behaviour.

Ref.1 – Dorda G. 2004. Sudetendeutsche Akad Wiss Künste. Naturwiss Kl 25.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Heterarchical semantic congruence

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In a previous contribution I outlined an account that considers the heterarchical embeddedness of many instances of categorical sensing and perception (Bruni, 2008). In this presentation I will take another step towards the delineation of a "heterarchical model of cognition".
While I will try to improve some of the basic definitions of the model (e.g.: the notion of "heterarchy" itself and the notion of "cognitive tautology"), this time I will concentrate on another phenomenon closely related to categorical sensing and perception, i.e.: the phenomenon of "semantic congruence", which has recently experimented a timid revival in empirical research on multimodal sensorial integration and perception.
In the perceptual realm, semantic congruence has come to refer to how the cognitive system goes to great lengths to bind multisensory cues presented in close spatial and temporal proximity so as to form a coherent perceptual gestalt. This gives places to a diversity of empirical strategies to study the effects of semantically congruent or incongruent stimuli on performance.
Inspired by the work of Hermann Lotze (1817-1881), I will claim that "differences" mapped by aggregates of sensors are "meaningfully" organized by latent representational matrices (in the form of concepts or intuitions) that have been incorporated into the "cognitive tautology" of the individual throughout a learning or developmental process. This may occur at lower levels in the heterarchy, as in single features of unimodal stimuli (i.e. shape or colors in visual stimuli), as well as in higher levels of integration in multimodal stimuli (as in audiovisual semantic congruency), up to higher logical levels involving increasing semantic richness along the scale of semiotic freedom.
Congruence will be related here to the degree in which the representation constructed by the senses accurately maps physical reality, whereas the semantic component will be related to the non-innateness of the (conscious or unconscious) evaluation that the cognitive tautology of an organism does of such an "expected" congruency when assimilating a given percept.
In order to assess the plausibility of this claim I will consider the three customary Percian modalities of how signs represent its object (symbol, icon and index) to explore whether all instances of semantic congruency in cognitive processes are of a symbolic nature (i.e. linked to a learning or developmental process), or whether such cognitive processes find some instances in the iconic or indexical modality (and if so, whether this could provide an argument for the innateness of some instances of semantic congruence. This exploration could help address some general questions such as: are all instances of semantic congruency based on symbolic relations? If so, is memory symbolic by nature? How does "semantic congruence" as a cognitive phenomenon stand in the historical (and still open) debate on the trade-offs between "empirism" and "nativism", i.e. learned and innate categories?

10th Gathering in Biosemiotics – Braga, Portugal 2010

The Biological Foundation of Roland Barthes's 'Writing Degree Zero'

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In his first published book, *Le degré zéro de l'écriture* (*Writing Degree Zero*) (1953), the French semiologist Roland Barthes throws out a phrase which has become the book's intriguing title. A relatively overlooked book by the profound thinker and voluminous writer, who was to dominate the French literary and cultural scene from the mid 1960s to the early1980s, the expression 'writing degree zero', though never adequately explicated, has become the banner of a new critical movement in the human sciences (*les sciences humaines*)..

The book was followed, among other things, by Barthes' better known pamphlet, originally a long journal article, *Éléments de sémiologie* (*Elements of Semiology*) (1964), which remains arguably the most ambitious and successful expansion of Saussure's linguistics-based semiology and its application to various facets of modern life style, such as fashion (*le vêtement*), cuisine (*la nourriture*), automobile (*l'automobile*), and furniture (*le mobilier*).

It is in the latter book that Barthes exposes the shortcomings of the Saussurian distinction between *langue* and *parole* and the Jakobsonian distinction between sociolect and idiolect, and that he tries to displace such dichotomies by alluding to, though in passing, his 'writing degree zero'. Critics' subsequent interpretations of the concept have been, more often than not, ideological, and they have failed to do justice to the author's assertion that writing is a "biological or biographical, not historical" phenomenon. This negligence has been aggravated by another critical commonplace, namely, that the early 1970s saw Barthes' post-structuralist turn from classical semiology to deconstruction. Thus Barthes' concept of writing (and language use in general) has, if ever, rarely been studied from a biological point of view. By identifying writing's biological and biographical nature, Barthes has virtually touched upon the processes of phylogenesis and ontogenesis of *langage*, the third element but the overall framework in Saussure's conceptualization of language.

This paper discusses the biological foundation of Barthes' concept of writing (*écriture*) and attempts to relate it to the current debate on the origin and evolution of language.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Immediate and final interpretants in the immune system

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The immune system contains two parts, an older innate immune system and a learned immune system. Although the innate immune system is arguably not symbolic in its operation in any way that need s the resources of semiotics, the learning aspect as well as certain features of the learned immune system strongly suggest that semiotic analysis of its functioning will be useful. I will look at some aspects of this part of the immune system and try to identify the immediate elements of its semiosis, especially with respect to the interpretants. I will argue that there is a chain of interpretants leading to a final interpretant within the immune system itself, based on the distinction between self and non-self. Further, I will argue that there is another final interpretant external to the immune system that explains its functioning: biological autonomy and survival.

The line of argument is an extension and application of the argument that I developed two years ago to the effect that semiosis in biology must be understood in terms of function, and that the appropriate form of function is autonomy. Autonomy in biology is the capacity for interactive self-maintenance and perpetuation, which can be applied to various kinds and levels. I argued that there is a chain of interpretants of any biosemiotic element going back to autonomy. In this case the immune system has a certain degree of autonomy, but it also works within the overall functioning of the organism. Its relative autonomy implies that immune system elements must adapt by integrating into the immune system as a whole, and cannot adapt independently (this is not necessarily true of the innate immune system).

10th Gathering in Biosemiotics – Braga, Portugal 2010

Mind beyond the brain? The 'extended mind' debate

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Since the publication of "The extended mind" (1998) a paper by David Chalmers and Andy Clark in which the authors claim that the concept of mind must refer to a reality that is not limited to the brain but goes well beyond it and includes relations with the environment, a debate has begun that continues even today. There have been two main answers to the question whether the mind in inside the brain. An internalist position claims that the mind is indeed inside the brain. An externalist position argues that extends beyond the brain towards the environment. The authors put forward a third view which they call active externalism: the environment has an active, not a merely passive, role in generating cognitive processes. They claim that their view is based upon research in the area of the cognitive sciences. After more than a decade of debate, it is justified to assess its relevance today.

Keywords: mind, brain, active externalism, cognition, environment, extended mind, extended self

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10th Gathering in Biosemiotics – Braga, Portugal 2010

On Signs and Codes

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The relation between the concepts of *sign* and *code* has been much disputed among members of our society and a persistent disagreement has concerned whether — briefly stated — codes or signs should be considered the 'primary' category. Fortunately, given the need to develop these notions further, there is no clear consensus as to what signs and codes really are. Different scientific disciplines and different time periods have put these concepts to use for very different purposes. Even in semiotics proper two rather different conceptions of signs and codes have been at work, one following the lead of the Swiss linguist Ferdinand de Saussure, the other leaning on insights from American scientist and philosopher Charles S. Peirce. The present paper is an attempt to clarify the main positions as they pertain to the analysis of biological systems (including humans), and to overcome apparent conflicts. Based on this analysis, we argue for the idea that coding should not be seen as a basic and separate kind of semiosis, distinct from semiosis as involving interpretation. Sign action is shown to be fundamental to semiosis, and codes can on one level be seen as either tools for semiosis or pure mechanisms, and on another level as the law-like or habitual aspect of semiosis understood as the action of complex relations between representama, objects and interpretants. 'Interpretation' – widely misunderstood to refer to only the acting of a self-consciously thinking agent to the signs of 'mental representation' – refers instead to any activity performed by an agent (eg, a cell, a tissue, an organ, or an organism) when it engages itself in semiosis, i.e. the sign-induced formation of an interpretant (in Peirce's sense: a *reaction* whose 'appropriateness' *as* a 'sign' *to* a system derives exclusively from its bringing objects and their representama *into* relations with one another *for* that system – an action which often results in the creation of an even more highly developed sign).

10th Gathering in Biosemiotics – Braga, Portugal 2010

Common Cues in Endothelial and Axon Guidance or Patterning Codes in Nervous and Vascular Systems

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The structural similarity between nerves and blood vessels is present in many levels i.e. expression of molecular markers, transition between cell states and, most remarkably, development of stereotyped patterns. Here we will discuss the genesis of nerve fibers and blood vessels to highlight the presence of common cellular codes operating with similar rules in both cases. We shall discuss axon and endothelial cells guidance in the light of semiosis or meaning making, stressing the polysemic nature of guidance signs; the degenated nature of guidance codes and the selective nature of cell patterning.
We will briefly describe how discrete dynamics between different agents can act as patterning codes for these sytems: the balance between attractive and repulsive molecules as Semaphorins, Slits and Netrins; their interplay with cell membrane receptors as VEGFR Robo4 and UNC5; the paracrine and autocrine loops orchestrated by hypoxic gradients. Our approach will not come as an alternative to the tradiotional biology conceptualization initially presented but as a complementary view to examine the process of meaning making in these combinatorial and multileveled systems. Beyond the syntactic level – here illustrated as specific recognition of discrete ligands by distinct receptors – we shall reach the semantic and pragmatic levels by bringing into light the dynamics of some "word games", *i.e.* Lewis Carroll's doublets; and magic squares. In such poetic games the synthetic transformations subjected by the words have to deal with semantic rules, but are ultimately dictated by meaning, as concrete pragmatic constrains. We shall claim that the same is true in the case of vascular and nervous patterning.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Opening Address

Celebrating a Milestone in Biosemiotics – but Certainly Not Standing Still

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In 1984, Thomas A. Sebeok co-authored a programmatic manifesto for what would eventually become the contemporary interdiscipline of *biosemiotics*, calling for "a semiotics which provides the human sciences with a context for reconceptualizing foundations and for moving along a path which, demonstrably, avoids crashing into the philosophical roadblock thrown up by forced choices between realism and idealism, as though this exclusive dichotomy were also exhaustive of the possibilities for interpreting experience.

Avoiding this particular roadblock is no mere empty claim, still less a maneuver or tactic. It is, rather, the rationale that will enable semiotics to reintegrate the natural and human sciences" (Anderson, Deely, Krampen, Ransdell, Sebeok and von Uexküll 1984: 7).

Today, over a quarter of a century later, the biosemiotic project envisioned by Tom Sebeok and his colleagues seems to be finally coming into its own. Sebeok's Glottertal conferences of the early 1990s, aimed at bringing together researchers from the life sciences with researchers from the sign sciences, have now taken institutional form as the Annual International Gatherings in Biosemiotics, which today begins its 10^{th} iteration.

Conceived in June 2000 by biosemioticians Claus Emmeche, Jesper Hoffmeyer and Kalevi Kull, and convened for the first time at the Institute for Molecular Biology at the University of Copenhagen (in the very room, it was noted, that Wilhelm Johannsen first introduced the word "gene" into science in 1909) eleven months later, the Annual International Gatherings in Biosemiotics has more become exponentially more interdisciplinary and more internationally constituted and recognized every year.

Milestones along the way have included the founding of the International Society for Biosemiotic Studies (2005), the inauguration of a Book Series in Biosemiotics published by Springer Science (2007), the launching the world's first internationally peer-reviewed journal in biosemiotics (2008), and the awarding of the first doctorates in Biosemiotics at the University of Tartu, Estonia (2009) – as well as the sad passing of Tom Sebeok in2001.

This year marks yet another milestone in biosemiotics, in addition to the ten year anniversary of the founding of the Gatherings, and that is the near-simultaneous publication of both the first historical anthology of biosemiotics, Springer Science's *Essential Readings in Biosemiotics*, as well as the Faculty of Philosophy of Braga's *Signifying Bodies*, which is first the full-length volume of papers attempting to incorporate biosemiotics into the study of medical and health interaction, and to push the field even further away from residual conceptions of semiotic autonomy and towards a more explicitly distributed understanding of the processes of interaction, life and mind.

Both volumes will make their public debuts at this conference. One examines biosemiotics' past and the other proposes ways of moving biosemiotics into one of its many possible futures. I will examine some of the implications of this well-timed confluence in my talk.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Living is Surviving: Causation, Reproduction and Semiosis

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Since Darwin's appropriation of Spencer's phrase "survival of the fittest," differential survival has become the basis of explanatory accounts of biological evolution through natural selection. Beyond extrinsic survival (finding food, avoiding dangers, etc.), intrinsic survival demands continual internal repair and reconstruction to offset the effects of unrelenting internal decay and depletion. The organism must constantly *re-produce* the conditions of its own existence. The survival of the individual is nevertheless subordinate to that of the species. The survival of the species is achieved through biological *reproduction* in the ordinary sense, i.e. assemblage of a working copy of the organism itself, capable of surviving and reproducing in turn.

In this contribution I attempt to explain how these two types of reproduction (for the survival of the individual and of the species) are related to other kinds of replication, such as the reproduction of a picture, of a melody, of a movement, etc. I believe all of these forms of reproduction are based on a fundamental one, which is the condition of possibility of all forms of replication. This fundamental kind of reproduction resides in the *spontaneous reproduction of events under physical causation.*

Since its inception in the 17th century, modern natural philosophy appeals to a scheme of causal explanation in which a physical system causally isolated from its surroundings is characterized by a quantitative description of its *state* during an arbitrarily short time interval. When this set of particular, contingent determinations (*initial conditions*) are injected as inputs into mathematical functions known as *laws of nature* any future state of the system can be computed in principle. Every time we are able to *reproduce* sufficiently similar initial conditions nature spontaneously and automatically *reproduces* sufficiently similar future states. This modern conception of physical causation replaced the medieval Aristotelian view based on the idea of powers or capacities, inherent in things of a common nature, ready to be enacted upon the occurrence of well-defined triggering conditions. I show that these different causality conceptions are not incompatible but, on the contrary, Peirce's conception of *habit* represents their synthesis into a more general notion well suited to the needs of biosemiotics and biology in general.

In the second part of my contribution I draw contrasts between forms of semiotic and physical causality in terms of differences and similarities between representation and reproduction. I then explore the connections between causal reproduction and the global symmetries of space and time which act as constraints on the laws of nature themselves. Analysis of the phenomenon of repetition as state reproduction in the periodic transitions of artifactual and natural clocks leads to new insights on the nature of temporality and its role in physical and semiotic causation.

Finally I briefly asses the possible bearing of the ideas here advanced on the tasks of defining a notion of information capable of closing the conceptual divide between physics and biology and of promoting their integration into a unified natural philosophy.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Interactive bodies
The semiosis of architectural forms - a case study

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In this paper architectural forms are presented as symbolic forms issued from the complex semiosis that characterises human cognition (Ferreira, 2007, 2010).
Being semiotic objects, these symbolic forms are, consequently, context-dependent_ they emerge and have meaning, i.e., they are assigned a functional and/or aesthetic value in particular physical, social and cultural frameworks. As it happens with all semiotic objects, architectural forms, whatever their nature, are not static but highly interactive. In fact, they act as agents of specific semiotic processes, engaged in a permanent dialectic relationship with the environment they are embedded in. From this dialectics important physical, social, cultural and economic changes frequently arise, redefining this way the original framework for decades to come. As Pallasmaa (2005) points out: "Architecture is existentially rooted, and it expresses fundamental existential experiences, the complex condensation of how it feels to be human being in this world. Architecture grounds and frames existence and creates specific horizons of perception, understanding and identity."
Architecture happens in the context of particular landscapes both natural and man-made, individuating spaces, assigning them an identity, turning the frequently undifferentiated physical environment into "locus" "place", "site", "ort" definitely contributing to the definition of the mental map that individual minds are able to share collectively.
The fundamental role played by architectural forms in the definition of "place" and identity and in the shaping or reshaping of a physical, social and cultural environment is analysed in this paper through a case study that observes the consequences of this dynamics in the development of the social and cultural tissue of a particular city.

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10th Gathering in Biosemiotics – Braga, Portugal 2010

Are olfactory receptors really olfactive?

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The question whether olfactory receptors are really olfactive may sound rather prosaic, as odor discrimination may apparently be considered their sole activity. However, the observation that they are also expressed in such diverse tissues as testis and renal distal nephrons, besides the olfactory epithelium, raises the question how their structural communality can actually generate such an astonishing functional diversity. Olfactory receptors constitute the largest gene family amongst the mammalian G-protein-coupled receptors. They exhibit such prominent features as high intraspecific variability, remarkable discriminative repertoires of environmental molecules and large numbers of pseudogenes. It is through the realization of these features that animals can actually search for food, accomplish mating and care for their offspring, and occasionally flee to avoid danger. In these circumstances, the animal behaves in such a way as to properly identify any encountered signal, in spite of an ever changing odor combination in the environment. In the end, this recurrent olfactive interaction allows the animal to establish a comprehensive image of the environment – its Umwelt – and to gain access to already acquired or newly learned olfactive patterns.

To account for this highly discriminative power of the olfactory receptors, along with their ectopically differentiated distribution, several explanations are possible. In this presentation, we will first show how odor discriminations could be accounted for by a number of molecular mechanism(s) whereby odorants are allowed to interact with the activated state of their respective olfactory receptors, above a certain binding threshold. However, even though this mechanistic causal explanation may ultimately aim at justifying the receptor discriminative power in terms of cell and molecular specificities, it does not explain how and why olfactory receptors have evolved in such a variety of roles and cell types. As a second attempt, we will be arguing that olfactory receptors could be explained in functional terms, i.e., justified for the function they guarantee, whenever expressed in competent organisms. However, this type of approach is inevitably teleological and bound to subsume their usefulness to the temporal asymmetry of the causal-effect relationship. Consequently, it would leave unanswered the question how targeted activities could have been selected prior to their final realization.

The causal and functional approaches so far described are both reductionistic attempts explaining diadically receptor-ligand interactions as single-cause to single-effect relationships. However, biological relations are always context-dependent, for it may prove unwarranted to account for their usefulness without considering the semiotic context in which they are ultimately expressed. What could be judged as simply useful, it may turn out to be genuinely meaningful if recognized as a sign by the bearing organism. But this would require the organism and/or the tissue expressing certain receptor specificities to behave as an evolved system capable of interacting qua agent with the sign-objects of a triadic world. Accordingly, to explain the ligand specificity and the ectopic diversity of the olfactory receptors would imply considering the organism as an emerging interpretant capable of rearranging heterarchically its internal dynamics in response to any meaningful combination of environmental odors.

Biology entails heterarchical organizations that have evolved through multilevel selective processes. The approaches discussed above are to be intended as complementary and not as mutually exclusive descriptions, and their explanatory power is therefore critically evaluated in relation to progressively enlarging referential contexts.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Swarm Intelligence: Biodiversity and Biosemiotics

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This year is the International Year of Biodiversity. Biodiversity has not yet been a primary perspective for the discussion of communication, perception and meaning in Biosemiotics, Currently the starting points have been either originary conditions of life or perceptions of organism probing its *umwelt.* A key question flowing from my recent paper on honeybees and the collapse of ecosystems is what can we conclude about semiosis from their behaviour of flying out to die in conditions of extreme adversity. The paper suggests the following: 1) the type of information/semiosis in ecosystems is "reactant" that is response -to- response communication in a broadly grounded information system where living sensory capacities are already tuned to myriad forms of "readiness to receive" at varying ecosystem levels. Semiosis holds ecosystems together by enabling connectivities, pragmatic action, continue to be robust and resilient 2) A primary ordering is through "timing" of response in a circularity or spirality of rhythms i.e. seasonal cycles and life cycles, with differences between the fast cycling and slow cycling which trumps the "force" of energy and mechanism in primary reactant response. 3) different "meaning" derives from multi-level relational connection and/or breaks in connection. Each connection is a qualitative jump between two co-existent conditions, the differences between differences of context. 4) an ecosystem with its variety of intercommunicative connectivity is polycontextual, at any given moment, both in respect of its horizontal and its vertical ordering. Polycontextural meaning is derived recursively through a triad of dynamic activities cell, cybernetic and learning-in- adaptation - the Bateson triad. 5) decision taking in communication is situational, which, in turn, yields heterarchical decision taking, a "standpoint perspective" rather than derived from network (horizontal-mutual causal) or hierarchical (top-down injunctive) forms. 6) The myriad response- to- response characteristic of reactant systems of communication, especially ecosystem communication ensures flexibility in connective interrelations. Relationships between species become less flexible with die-offs and other forms of severe stress and as peripheral relations begin to break, so too the more loosely coupled relations begin to disappear, altering activity and opportunities for communicative interaction, putting stress on "keystone" co-relations and coordination of activity in the niches within which species live and evolve. Domain change is then a possibility; and an ecosystem can then flip to a different interactive domain. Many of the six points above, especially points (5,6), is already embedded in resilience theory (C.S. Holling). Resilience was one of the dominant perspectives on climate change at Copenhagen 2010. Origins of resilience theory lie in C.H. Waddington and in the catastrophe theory of Renée Thom (3, 6); the notion of polycontextuality is drawn from Bateson (2, 4) as is the idea that meaning is drawn recursively in 'creatural' systems of information. The notion of heterarchy (5) is drawn originally from Warren McCulloch's neural nets, however its outcome for ecology was never fully appreciated until recently. Currently, the domain of reactant communication systems (1) is most prominently analyzed at cell level and is best approached through Irun Cohen's discussion of "cognition" and "subjectivity" in the immune system; Yair Neuman has developed some "languaging" aspects of this approach and Gunther Witzany its pragmatic dimensions. Finally, the timing component of heterarchical order is best modeled through a topological display of toruses. However McCulloch proposed a torus with dillels, i.e. a dialectical torus, or doubly recursive torus, and this topological mapping has been only partly resolved .

10th Gathering in Biosemiotics – Braga, Portugal 2010

A Biosemiotic Formulation of Survival Strategies For Robots

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Robots are the perfect testbeds for the study of both artificial life and nature. They are inherently semiotic systems since their basic laws of control implemented in them are derived from the canonical triad of "sign, meaning and code". How and what a robot perceives is necessarily imposed (explicitly or not) by those who build them. In this paper we shall focus on how robots make sense of their environment (Umwelt) and evaluate costs and benefits (saliency detection). We have to this end firstly modeled an environment in terms of conventional mathematical values (i.e. probability within a defined space) and used this primary saliency map as the platform for integrating looser or more plastic and top-end saliency detection based on animal behaviour. We will argue that the incorporation of programmed ethograms into a robot's sensory system will improve its efficiency in saliency detection and confer greater advantages in its overall survival and maintenance. We also analyze the semiotic relations between saliency and the attention structure. Experiments will be produced to illustrate the originality of our approach.

Keywords: robot, biosemiotics, Umwelt, saliency, ethology, ethogram, signaling, attention.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Coat Patterns Among Felids – Function Or Sign?

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The pattern on an animal's coat is usually explained in terms of (neo)Darwinian evolutionary theory. Kleisner (2008) shows that this explanation is unsatisfactory in the case of so-called non-addressed phenomena as described in Portmann's biology. Non-addressed phenomena, typically of some visual quality, are characterized as the features which do not have any known observer. As the result, it is very problematic to imagine the particular process of natural selection that gave origin to that kind of phenomena. According to Portmann (1960), astonishing coat patterns among felids do not necessarily carry any adaptive function (eg. crypsis). Nevertheless, once a visually valuable phenomenon has arisen, it takes on a semantic function in the *umwelt* (perceptual world) of its bearer. It announces the bearer's physical existence to observers orientated by sight. We need to abandon a static view of function: fitness is not dependent solely on physical attributes of the environment, but also on the *umwelt* of receivers. In the case of felids, the originally neutral function of coat patterns regarding selective pressures changed to the meaning comparable to a heraldic sign (Neubauer's idea, see Markoš et al. 2009). Two results follow: a characteristic pattern facilitates the identification of a stalking cat and gives the prey time to get away. It is well documented that macaques recognize hunting leopards due to their spotted coat, drawing into question the theory of crypsis (Stankowich and Coss 2007). On the other hand, the distinctive coat pattern warns any potential competitor of the strength of its wearer, so that the latter is protected via the mere visual meaning of the sign. To sum it up, there is a need to rethink the traditional Darwinian concept of purposeful organs, because its role changes depending on the varied *umwelt* of other living beings.

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10th Gathering in Biosemiotics – Braga, Portugal 2010

Eye color and facial shape form one semantic ornament: On the semiotic co-option of iris color

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Eyes need not necessarily be regarded only as physiological devices of sight, as organs that receive information from outside the organism. Eyes certainly represent structures that offer information about both past and present behavior, as well as the inner attitude of the bearer. Compared to the eyes of our phylogetically closest relatives, human eyes are somewhat unusual in both shape and color. Our eyes have very apparent white sclera, the iris may potentially gain different colors spanning from dark brown to light blue, the overall shape is horizontally prolonged etc. (Kobayashi & Kohshima, 1997; 2001). Interestingly, the blue eye color phenotype most likely originated in the northwest part of the Black Sea region, wherefrom it spread to the northern part of Europe in the time of the great agricultural migrations of the Neolithic periods about 6000 – 10,000 years ago (Cavalli-Sforza et al. 1994; Frost, 2006). So-called blue eyes thus represent an evolutionary novelty that evolved relatively recently. We presuppose that these differences in shape and color of the eyes of different human populations imply an evolutionary role that may be culturally and geographically specific. Our contribution focuses on the relationship between eye color, gender, and psychological characteristics perceived from the human face. We have studied the differences of perceived attractiveness and dominance using photographs of 40 males and 40 females that were rated by Estonian and Czech volunteers, mostly students. The comparison shows that there is a difference in perception of dominance of blue-eyed/brown-eyed males and females between Czech and Estonian raters. Moreover, previous results from Czech Republic show that the relationship between eye color and the perception of dominance is not caused by iris color itself but by other morphological characteristic of a face. *Preliminarily, we hypothesize that thanks to its linkage to a specific features in facial morphology, eye color has acquired particular meanings in different populations.* This is also reflected in folk literature and the rhetoric of different nations wherein a particular eye color is often connected either with increased attractiveness or danger. Comparing data collected in different parts of Europe will help us answer some of the questions erected upon eye color diversity in this region.

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10th Gathering in Biosemiotics – Braga, Portugal 2010

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

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Sign relations are based on experience. Organisms' experiences that are embedded in sign relations are also modelling relations. In this concrete sense, we can generalise the notion of 'knowing' over any experience, covering all sign relations in which organisms are involved. In this context, we shall analyse the phenomenon of adaptation (adaptational relation) from the biosemiotic viewpoint.

Insofar as the correspondences of organisms' features to the features of their surrounding are not universal but a result of (ontogenetic or phylogenetic) experience, the *adaptations* as such correspondences turn out to be a kind of knowledge, a model that is acquired or worked out via certain mechanisms (either developmental or evolutionary). Possessing an adaptation or habit would mean that one has some experience through which the adaptation has formed. Thus via a study of organic functions that characterize adaptations, biology has described the information the organisms have, including the (ontogenetic and phylogenetic) memory and the behavioural purpose. Adaptations which are always relations, bonds of life, qualitative phenomena, can be seen as iconic relations (or in more complex situations also as indexical or symbolic relations), that is, sign relations. Since the sign relations are modelling relations, so are adaptations certain kind of models. The description and explanation of adaptations has turned the attention of biology towards the concepts of history and meaning, and this has always made biology the "humanities" of the natural sciences. Stating this, one should notice that much of the work in (particularly the neo-Darwinian) biology has digressed from this path. Once the adaptation is defined quantitatively via (so-called) fitness — via the number of copies one makes — its fundamental feature of qualitative *fit* is lost from the description. In other words, the meaning is lost; this is like description of sign without paying attention to its reference.

Structuralism and formalism in biology have been strongly opposed to functionalism on the bases of different role attributed to adaptations in biological explanation (for instance, S. J. Gould has devoted much of his *magnum opus* on this opposition). Semiotic biology seems to be capable of including both structuralism and functionalism.

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10th Gathering in Biosemiotics – Braga, Portugal 2010

From Signal to Sign... The Facts

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It is my conviction that students of child development have still a word to say when considering the important question of «self» construction and its relevance when reflecting on disturbances in human social intercourse and in society in general.
The problem to be addressed has found renewed hearing based on the novel discipline of biosemiotics, as discussed by Jesper Hoffmeyer's book: "Signs of meaning in the universe" (1996). Among many other things, he proposes "to discover how nature could come to mean something to someone", and summarizes the question in the following words: “How could a biological self become a semiotic self? and how, finally, do we unite these two different selves 'nature' and 'mind' which we all carry in us and all too often are at war with each other?”
I shall first make an effort to delineate my theoretical propositions, and subsequently I shall present in empirical terms the slow construction of the «Self» as a basic whole human body-mind experience, through which human infants place themselves from the beginning in a global encounter face to face with their socio-emotional environments (Jarvilehto, 1998) thus contributing to create personal meanings - even before acquiring language.

10th Gathering in Biosemiotics – Braga, Portugal 2010

On needs

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The concept of biological need should not be a mere metaphor nor isolated from the full-blown human concept of need. Therefore we propose a classification of needs involving both concepts. In particular, we distinguish 'inner needs' due to functional roles and 'outer needs' due to the complementary role of the environment. Needs constitute a hierarchy corresponding to the hierarchy of purposes of action.
They express an aspect of meaning. In general, biological agents need more than they get. This is why cultivating plants or keeping animals makes sense.
Do cars need petrol? We should be cautious in answering...

10th Gathering in Biosemiotics – Braga, Portugal 2010

From Biosemiotics to Health

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By replacing the traditional chemical approach to the understanding of body function by a sign-theoretic or semiotic approach, biosemiotics suggests a way to bridge the gap between the biological and the social dimension of the human life.

It is the relational paradigm what we want to invoke: sign processes are not forces or things, but pure relations whereby certain activities are organized; the sign is a process, the sign does not exist apart from the process through which it exerts its effect. In this way, semiosis it is the key to understand/differentiate life from non-life and understand the kind of semiosis we engage in: the world of language — what frees us from a merely chemical approach, unable to reach the world of (human) meanings.

Even though cells, brains, bodies and minds are but levels of the same one endlessly interacting system, they can be *tuned out*. In other words, in spite of the semiotic logic of the living, we can pull ourselves out of that, with profound repercussions to health. But, a strong intersubjective conception, in a distributed sense, a semiotic or relational paradigm, can set us in the right path to understand man and the ways he get sick or strengthens himself.

So, it is time to rethink health care in terms of their logic, not their mechanics, and give back to the mind (or cognition) its biological character: the adaptative capacity to compensate perturbations, the very skill of living and surviving.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Is zoosemiotics a biosemiotic area of inquiry, after all?

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The goal of the present paper is to discuss the relationship between zoosemiotics and biosemiotics, in terms of theoretical program and research ethics. A discussion of this kind is called for, for at least the following reasons:

1) The on-going debate (perhaps a crisis), within biosemiotics, between different schools (the code-based and the sign-based, to mention the main ones) has raised a number of issues that – partly – involve the specific zoosemiotic field. How does zoosemiotics, in the light of its history (which remains older than the biosemiotic one) and its recent developments, relate to this discussion?;
2) Zoosemiotics has to cope with a critical equilibrium between its double identity as human/philosophical discipline on one hand and biological science on the other. Biosemiotics, particularly nowadays, has engaged into a similar ambiguity. Are these the same kinds of ambiguity? And if yes, are they of the same relevance?;
3) Zoosemiotics still seems to occupy a marginal position, within the biosemiotic environment. What are the reasons behind this occurrence? Are they related with the current historical context, or are there, after all, less "elective affinities" than previously expected?;
4) Quite simply, do biosemiotics and zoosemiotics approach their key-topics (life, semiosis, relation with other fields of inquiry…) in the same way and with the same spirit?

Without the pretension to "answer" these questions, the present paper aims at least to formulate them in such a way that they would "pertinently" be located within the above-mentioned debate/crisis.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Suffering, Education and Health (Biosemiosis and Health)

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The global concern of this paper is to study the impact of (auto) education that suffering can bring, making of an observationally harmful disturbance one opportunity to better biopsychosocial and spiritual development and equilibrium of individuals and communities. In this sense, we will emphasize concepts (eg: pain, suffering, pathogenesis, salutogenesis), justifying them epistemologically, and explaining (dis) continuities between pain, total pain and suffering.
We will mention the formal training of health professionals with regard to suffering and stress the importance of training of non-formal health educators in relation to suffering. We will address some of the meanings that human suffering has, and as regards the salutogenic perpective, we will discuss in particular the concepts of Aaron Antonovsky

10th Gathering in Biosemiotics – Braga, Portugal 2010

From Imprint to Representation

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Because the mountain grass
Cannot but keep the form
Where the mountain hare has lain.

("Memory", by William Butler Yeats)

The notion of "representation" implicitly assumes a process of replacement: a former relation between an object Y and a subject S is replaced by a relation between the "representation" of the object and the subject. Although here we formally refer to a subject – i.e. a system that "owns" and uses such a representation- we do not necessarily imply a subject with a conscious mind. It is merely a "subject system" that initially has some functional relation R(S⇨Y) to some object (which can be another system or process), i.e. the system S is involved in a process with a specific pattern of interaction with Y. If -as a result of an evolutionary process- some other object X takes over the role of Y without necessitating much alteration in the pattern of interaction of the "subject system" then one can designate X as a representation of Y for S. Such replacements can take place as a chain reaction, as we have already discussed in a former publication. One of the problems associated with such a description in terms of a chain of replacements –thus a chain of representations- is the necessity for a grounding relation, for which we have proposed an original state of unity containing the future subject and object as a potential.
In this contribution we are going to investigate in further detail the evolution of the relation R(S⇨Y) on basis of various biological phenomena considered in our previous publications such as the functioning of the eukaryotic endomembrane system or the bacterial magnetotaxis. We suggest that the archaic form of this relation can be described as a kind of "imprint" of Y on S. The notion of imprint seems to provide an adequate link to the original state of unity via the notion of complementarity.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Cast in Plastic:
Semiotic plasticity and the Pragmatic reading of Darwin

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As Darwin portended but failed to develop, and of which Gould made much, the forensic evidence of evolution points toward a model closer to one of Punctuated Equilibrium than of Phyletic Gradualism; however Gould's empirical postulation has long suffered from its lack of a testable theoretical basis. This lack is being rectified by the work of Jaroslav Flegr and the Theory of Frozen Plasticity, a hypothesis with striking consequences within and for semiotic theory.

By contrast, much Darwinian and most Neo-Darwinian thought have presumed that the quality of plasticity is necessarily present within populations undergoing the interactive processes of living, and that all populations thus slowly evolve. This has resulted in a devaluing of the point of interplay of such processes, which is the instigation of a specific instance of relating as a phenomenon of signage both delineated by and delineating its own unique heritage. The presumption that these moments of transaction are all of a singular type which necessarily functions in an automated fashion following 'laws' that science reveals, has resulted in a resurgence of the metaphors of early modernity with its particular emphasis on strict mechanic causation. It has also generated certain failures in extrapolating from evolutionary theory to understanding the experience of life.

However, the portents of Darwin were read quite differently by others, especially Darwin's philosophical champion and Peirce's "boxing master" Chauncey Wright. Using the historical encounter of the early Pragmatists with *Origin*, as well as the hypothesis that both Pragmatism and Peirce's Semiotics originated within a study of the ontological principles implicit within Darwin's long argument, this essay approaches Frozen Plasticity as a theoretical semiosis, so as to clarify the functioning of signage in evolution and its various morphologies, cognition and its various metaphysics, and life itself with all its various meanings.

10th Gathering in Biosemiotics – Braga, Portugal 2010

The Question of the Self

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According to Marcello Barbieri "code" is something that relates two independent worlds, and besides the genetic code he has identified a host of other codes. An organism is the result of these various codings. Here we could make a distinction between the empirical "I" of the organism and the transcendental "self" which corresponds to this "I" and makes it possible. The "I" is what is synthesized on the basis of codes and the "self" is the inner mechanism of this synthesis. I shall explain this mechanism from two aspects, "temporal" and "spatial".

(1) The problem is that from the point of view of the empirical "I" the code seems to be eternal; but on the other hand we notice that the codes have changed over time and that new ones have been invented. Barbieri's theory is in harmony with Gould's evolutionary theory of punctuated equilibrium, where sudden periods of quick change alternate with long periods of stasis. The question is, *when* are new codes and new forms invented? What is the temporality of this kind of "invention"? I shall call it the Moment or the "Blink" (with reference to Kierkegaard's *Øieblikket* and Heidegger's *Augenblick*). It is neither the eternity of the code nor the continuous duration of the empirical "I" – it is the pure form of time (G. Deleuze), the "form" of change itself.

(2) Another question is, how does the code relate the two worlds. It seems that the axis of "ideality", represented by the code, needs another counterpart. A code is a structure of ideal elements which assure the correspondence of two "worlds": for example, genetic code for the world of nucleotides and the world of aminoacids, signal transduction code for extracellular signals and intercellular "second-order" messengers, and several others. The problem is that if the ideally differentiated elements of a code would be isolated from each other, then what guarantees their cohesion? If two worlds are *mediated* by the code, then what mediates the code itself, or the code and any one of the worlds? There's an infinite regress here. Therefore it seems necessary to posit a counterpart of the code, which would be the code "in negative", the *difference in itself* articulating a code, pure difference which *immediately* relates independent worlds and generates the elements of a code – a "dark precursor" or differentiator (G. Deleuze).

In summary, the transcendental "self" is nothing other but the form of change itself and the pure difference or differentiation. Barbieri has made the bold statement ("Organic Codes", p. 159) that in the strict sense life is neither genotype nor phenotype, neither genes nor proteins, or – according to his metaphor of the city – neither houses nor blueprints of the houses, but life rather resides in the ribotype, in the "inhabitants". Along the same lines I would say that in a still stricter sense even the code is not life, but life is in the pure change and difference which has generated codes, as well as correspondences between the otherwise independent worlds.

Cells use external signals to interpret the world, not to yield to it ("Organic Codes", p. 109) – that is, the "self" of a living organism is an agent of forming problems and asking questions, and the creation of new codes can be seen as new axiomatics for certain problems, a certain way of posing questions to the environment, and finding answers to these questions. So, in a more profound way, the title "Question of the Self" should be understood both in the sense of objective and subjective genitive.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Semiotic Appraisal in Invertebrates

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How an invertebrate makes sense and evaluates (saliency detection) its environment as part of its Umwelt has evolved from simpler biological systems, providing a useful model for artificial intelligence modelling (i.e., robotics), and for an understanding of how humans in first or secondary cognitive processing stages make sense of their environment. This paper will explore the relations between awareness, saliency, response systems and affective neuroscience, drawing on a range of studies from several disciplines – the aim will be to develop a working hypothesis regarding multi-modal semiotic appraisal within saliency and attention systems in animals (primarily invertebrates). The model animals used in this paper will be crustaceans as they are robust and have obvious neural and motor pathways. The paper will also develop an architecture of semiotic processing in non-linguistic organisms.

Key words: invertebrate, semiotics, saliency, affective neuroscience, semiotic architecture.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Towards a sign-theoretic model of perception

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Many of the concepts in nowadays mainstream perception theories are based on a reductionist approach to cognitive processes. Among those concepts are for example the sensation-perception-cognition trichotomy, the modularity of mind thesis, the impenetrability thesis of perception and the bottom-up nature of perceptual processes. However, in the last decades we have seen an increasing amount of evidence that these concepts, and the mainstream perception theories in general, are proposing a wrong view of perceptual and cognitive processes. Research on multimodal integration has for example proven that perception is multimodal, questioning the viability of the impenetrability thesis of perception. Brain imaging research, by giving empirical proofs of the importance of top-down connections in the cognitive system, has equally contributed in shaking the foundations of what some have called the *"perception dogma"*. The abandon of a system divided into sensation-perception-cognition has also been proposed for the creation of a new dominant theory of perception, with for example the argument that the concept sensation is originally a philosophical concept created to make the distinction between the immediate objects of awareness and the perceptions that are then inferred from it.
By looking at the history of perceptual sciences, it is possible to trace some interesting theories that could be used as a ground for the rise of new perception theories. In particular, the writings of Hermann von Helmholtz (1821 – 1894) and Adelbert Ames (1880 – 1955) give us a view of perception as a "problem solving" deductive process, based on knowledge collected through experience in an inductive way. In other words, according to this view, perception would be a *"guess work"* driven by the past experience accumulated by individuals. Of particular interest in the context of biosemiotics is von Helmholtz's "sign theory of perception" developed in his early career. Current developments in the field of biosemiotics could refresh our quest for theoretical frameworks and contribute to the redefinition of "perception". For example, the concept of heterarchical cognitive systems, giving rise to different levels of semiotic freedom through second-order emergence (Bruni, 2008), could be the basis of an alternative theory to reductionist views that advocate for bottom-up driven cognitive processes. This presentation will present these concepts, confront them to the dominant reductionist views and attempt to prove their values as a ground for new theories of perception.

L.E.Bruni, (2008) "Hierarchical categorical perception in sensing and cognitive processes", *Biosemiotics*, 1(1), p.113-130

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"My Dog Uses Intensional Logic"

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My dog uses intensional logic. How do I know? I watch him as he considers a decision or tries to solve a problem. Then he always lets me know the final outcome. I watch him as he considers first one possibility, then another and the outcome that will result from each. All outcomes except the one actually chosen involve only possible worlds and the equivalence between possible worlds theory and intensional logic is the theme of this essay.

It is the intensional (connotative) level of semiosis that allows us to create or imagine possible worlds, as my dog and I both do. This, however, must operate in conjunction with protensional (pronotative) meaning. From the immediate ground of the sign, we can combine any imaginable properties to obtain a possibility so long as the combination of properties is logically possible. The properties are creatively available from the immediate ground because they are not blocked by the immediate cognitive mentellect, but the immediate cognitive mentellect does determine the logical consistency of the combination of properties.

Thus the logic of possible worlds has the same logical structure and the same generative structure as intensional logic, as brought out by both Peirce's quantification of intensional logic and his gamma system of existential graphs.

From this, we can derive several conclusions that I want to discuss in this paper. First, as in the case of my dog, possible worlds are not unique to human semiosis. The laboratory ape considers several different possible worlds in solving the experimental problem of reaching the hidden banana. And any dog or cat lover can tell you exactly when his or her own beloved pet is considering other possible worlds.

A second conclusion stemming from the equivalence between possible worlds logic and intensional logic, that I want to discuss in this paper, involves an understanding of the semiotics of perception. As the mentating element cogitates all possible worlds, the perceptual system causes the dynamic cognitive mentellect to pull the dynamic object and the dynamic ground together, fusing them together into a judgment. The dynamic ground forces a selection of properties from among all possible properties, thus rejecting all possible worlds that are not consistent with the currently perceived properties. Again, it is the cognitive mentellect that determines logical consistency. Thus, it is the intensional element of the perceptual judgment, the percipuum, which is responsible for all of the properties of the judgment.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Traps in routine diagnostics of sleep, walk and heartbeat

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In aim to perform desired functions necessary to sustain life, the biosystems are built of multiple oscillators of different structure, generating diverse frequencies of certain amplitude. These more or less stable parameters are used for diagnostics. However, experience shows that sometimes important factors are neglected and processing of vague data may lead to unreliable conclusions.

Sleep dysfunctions apparently affect our cognitive capabilities <www.sciam.com/article.cfm?id =how-snoozing-makes-you-smarter> and often lead to numerous diseases since poor sleep is linked to disturbances of tissue natural regeneration necessary for continuous reconditioning of our health. In most sleep laboratories routine testing consists of EEG, ECG, eye movement and jaw/throat EMG, inhalation/exhalation detection by nasal pressure cannula, oxygen saturation, trunk position sensor, breast and diaphragm sensory belts. Patient is anchored to the monitoring equipment through set of multiple electrodes and sensors attached by pressing contact or adhesive to the skin of head, face, trunk, sometimes also legs. Uneasy is to sleep with mouth restrained and nostrils airflow reduced, sometimes in addition with exposure to noise, poor ventilation, also incomplete darkness. Hence awareness is growing that diagnostics shouldn't be single-night-based nor performed in so invasive set-up. If even in our bed at home we sleep in different manner each night, what is the diagnostic significance of any parameter of sleep physiology measured with the highest accuracy, when unfortunately equipments and environment disturb the sleep significantly?

Gait is basic means to change our placement in space and is also considered as the healthiest form of physical exercise, contributing to natural physiological electro-stimulation of all body parts, hence improving bioflows and whole body harmonization. Therefore rehabilitation is vital in states of walking deficiency. In most gait labs bipedal walk is evaluated by multi-infrared-camera body motion capture systems and analysis of reactions generated during support phase when patient's weight is loaded on the strain-gauge platform. But gait assessment based on a single-step recording has limited meaning because each step in series is not homogeneous - even in norm - specially if patient is requested to step accurately on force-plate while walking. Surprisingly, gait in norm and after severe trauma feature particular similarity despite dramatic differences in physical states, patterns of gait, and its lab records too: in an able-bodied and a paraplegic equally better is gait signal's relative repeatability in domain of time compared to amplitude uniformity. What that means? Bipedal gait is always a resonance phenomenon.

Cardiac arrhythmia often spells danger, however experienced clinicians do know that appropriate heartbeat rate drifts might be positive physiological signs signaling the functional ability to adapt cardio-pulmonary system to alternate conditions. As 2010 is the Year of Fryderyk Chopin (1810-1849) worth to look at relations between human physiology and music. In musical compositions '*tempo rubato*' is characteristic by slight drifts of basic rhythm accelerating and decelerating in the course as the piece is being played. Chopin, a major innovator in the piano ballade, sonata, waltz, mazurka, nocturne, etude, polonaise, impromptu and prelude, has marked many of his piano compositions with '*rubato*' but abandoned these codes in later career. However, experts in Chopin's heritage are convinced the composer did so because he believed all of his fine pieces should be played '*rubato*'. Compliance to natural, healthy frequency drift of the heartbeat may be a factor contributing to attractiveness of Chopin's music.

In times of great progress in sophistication of equipment being used, data should be analyzed with biosemiotic caution to avoid misrepresentation causing erroneous diagnostics and treatments.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Notes on the semiotics of biological mimicry

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Biological mimicry is a widespread semiotic phenomenon. It has been carefully described and various approaches have established different classification structures and typologies. It is generally defined as a functional and evolutionary multimodal (visual, auditory, chemical, tactile) adaptive behavior between biosemiotic systems – systems causally affected by signs qualities, events, and laws. Which kinds of signs are involved in mimicry interactions? What is the general logic of the process? What are the simplest known examples? From a biosemiotic point of view, these are interesting research questions, and a possible avenue to address them is provided by Peirce's mature theory of signs, as we will explore in this work. In his later works, Peirce pragmatically defined a sign as a medium for the communication of a form or habit embodied in the object to the interpretant, so as to determine the interpretant as a sign or (in biosemiotic systems) the interpreter's behavior. The notion of semiosis as the communication of form from the object to the interpreter through the mediation of the sign allows us to conceive meaning in a processual (non-substantive) way, as a constraining factor of possible patterns of interpretative behavior through habit and change of habit. In mimicry systems, a consistent relationship between variations in the form of the model (superficial or structural features) and the corresponding effects on the receiver (interpretant) results from the mediation of a mimic. It is our primary aim here to describe the triadic structure of mimicry as a strongly iconic-dependent process.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Exaptation as re-signification

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Meaning always occurs at a 'meta' level: i.e. it is determined in negotial, situated and contextual modalities by the system that makes use of it. Besides the diversity in connotation which characterizes human semiosis, this theme recurs at all levels of organization of the living. The 'meaning' of a protein can be readily found at the level of the single cell (of course, and above all if we have to do with monocellular organisms) within the biocenosis, but frequently meaning occurs at the level of the organ made up by the cell in question, or at the level of the system the organ belongs to, or of the body in its entirety, up to the social group. This idea is crucial in the *multilevel selection* concept of D.S. Wilson and E.O. Wilson (2007). In a biological and evolutionary perspective the attribution of new meanings, as an outcome of either changes in context or of a re-negotiation, results in an *exaptation*, i.e. is the outcome of a *re-signification* process, in Saussurean words.
Some remarks made by Barbieri on the codes seem to be of primary importance: " the true codes we are familiar with, have two qualifying properties: (1) they are arbitrary rules, and (2) they are created by a codemaker. Here are their peculiarities: arbitrariness and codemaking. […] a code is a set of rules establishing a correspondence between two independent worlds […] In short, the enforcement of the rules of a code is deterministic in all codes, even in cultural ones. Arbitrariness comes into play only when a code is created – or modified – not when it is enforced.[…] what does an arbitrary code mean? It means that there is no necessary link between the objects for which the code establishes a correspondence, […] an organic code calls necessarily for the existence of organic molecules carrying out two recognition processes that must be independent." Between the two 'worlds' a system of bijective correspondence is established. (Barbieri 2003, p. 101- 103). This paper questions both the constraints this author establishes for the term *meaning*, "the meaning is an object associated to another object by a code" (ibidem p. 105), as well as his proposal to replace the Peircean *interpretant* with the *codemaker*.
Barbieri makes reference to a *semiotic threshold* whose code and codemaker impose bijective correspondences between two 'worlds' which relate to each other (in this manner a protein becomes the meaning of DNA); as well as to a *hermeneutical threshold*, where, together with codes, other than the genetic one, and most likely in a multicellular context, possibilities of interpretation (thus hermeneutical) do emerge. According to this author context, memory and learning are necessary for interpretation, that, hence, goes further back in time than the origin of life (cfr. Barbieri, 2008). From the perspective of this study, the hermeneutical threshold is crossed when the correspondences between forms and referents are no longer exclusively bijective and systematically become one-to-many and many-to-one. Hence, if a protein corresponds to one given gene, more and potentially numerous functions correspond to a protein; and this is true even in the context of monocellular organisms. Wikipedia defines 'Exaptation' (a term introduced by S. J. Gould and E.S. Vrba) along with "cooption, and preadaptation" as "related terms referring to shifts in the function of a trait during evolution". Reference will be made to much earlier authors, including E. D. Cope and his "Law of the Unspecialized"; F. A. Dohrn with his "Law or principle of change of function"; H. Milne-Edwards and his "Principle of physiological borrowing".

10th Gathering in Biosemiotics – Braga, Portugal 2010

Grounding biosemiotics: how Peirce's semeiotic explains Uexküll's concepts of Umwelt and self-world

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The purpose of this paper is to build a stronger foundation for biosemiotics by exploring possible relations between Charles S. Peirce's mature semeiotic – based on a detailed distinction of several aspects of sign and their trichotomization – and J. von Uexküll's concepts of Umwelt and self-world. Both Peirce and Uexküll were influenced in their early years by Kant's transcendental philosophy. Kant considered space and time *a priori* forms of intuition, where space is the form of our outer sense, and time is the form of our inner sense. Both Peirce and Uexküll departed from Kant by proposing a semiotic structure for perception and cognition, where the concepts of time and space are functions of our perceptive apparel. Here we argue that is possible to describe and explain Uexküll's concepts of Umwelt and self-word in terms of Peirce's aspects of signs, uniting both theories on a fundamental level. Our first step is to show that any class of sign has eleven and not ten aspects, as Peirce considered when he tried to find out the 66 possible classes of signs. We achieve this by a logical analysis of the Phaneron. Our second step is to propose a logical order of determination among the eleven aspects. Our third step is showing that two of Peirce's aspects, the Immediate Object (IO) and the Immediate Interpretant (II), link directly to the emergence and development of the concepts of space and time, respectively. The next step is to show how these two sign aspects participate in the process of perception. We argue that the immediate object is the percept whenever the class of sign is not habitual, that is, when it has only the categories of Firstness and Secondness. Perception is then turned into a particular case of signification, and the concepts of space and time are explained as degenerated forms of symbols that emerge in the process of perception. In fact, this should not be surprising for any concept is a symbol. Umwelt and self-world can be explained precisely as degenerated forms of symbols produced by perception. Different perceptive apparels produce different degenerated forms of symbols – and so have different time-space perceptions. That is, different Umwelten. We end our paper presenting a formal structure for semeiosis, the action of sign – which we have named "the solenoid of semeiosis" – in which the concepts of time and space, in the aspects of immediate interpretant and immediate object, appear as the grounding for presentation, representation and communication.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Functional information: towards synthesis of biosemiotics and cybernetics

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Biosemiotics and cybernetics are closely related, yet they are separated by the boundary between life and non-life. Biosemiotics is focused on living organisms, whereas cybernetics is focused on non-living artificial programmed agents. To facilitate the synthesis between these disciplines, cybernetics needs to shift from the computational paradigm to the functional paradigm, and biosemiotics have to extend its principles from living organisms to agents in general, which together make a pragmasphere or functional universe. Agents should be considered in the context of their hierarchy and origin because their semiosis can be inherited or induced by higher-level agents. Artificial agents represent a functional envelope for humans in the same way as the body represents the functional envelope for germ cells, and the cell is a functional envelope of the DNA. The principle of "life from life" can be extended to "agents from agents" because agents are produced only by agents of comparable or higher functional complexity. All agents originated from life because living organisms appeared before artificial agents. Thus, the pragmasphere is an extended biosphere.

To preserve and disseminate their functions, agents use functional information, which is a set of signs that encode and control their functions (Sharov 2009). Functional information does not exist without agents, and in this respect, it differs from anonymous physical information associated with correlations, complexity, or negative entropy. Functional information includes stable memory signs, transient messengers, and natural signs. The ability to perceive natural signs is constraint by the presence of heritable sensors. The origin and evolution of functional information is discussed in terms of transitions between vegetative, animal, and social levels of semiosis, defined by Kull (2009). Vegetative semiosis differs substantially from higher levels of semiosis, because signs are recognized and interpreted via direct code-based matching and are not associated with ideal representations of objects. Thus, I consider a separate classification of signs at the vegetative level that includes proto-icons (binding of proteins and complementary binding of nucleic acids), proto-indexes (adaptors, signal transduction), and proto-symbols (protein synthesis based on the genetic code). Proto-symbols are components of the genetic proto-language which appeared much earlier in evolution than animal and human languages. Animal and social semiosis are based on classification, and modeling of objects, which represent the knowledge of agents about their body (Innenwelt) and environment (Umwelt). Because most artificial devices are not yet capable of learning and evolution, their functional information has human origin. However, future artificial agents may have increased abilities to generate their own functional information, and synthetic organisms may be capable of adaptive evolution.

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10th Gathering in Biosemiotics – Braga, Portugal 2010

The Invention of the Clever Hans Effect: Was Sebeok Right?

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A considerable part of Thomas Sebeok's writings deals with cases of human-animal interspecific communication, including highly controversial ones. The aim of this paper is to analyze his thought about one of the most popular cases of guessingly successful, human-communicative-channel-using interspecific communication during the 20th century - the case of "Clever Hans". From 1904, this stallion and his owner W. V. Osten astonished both the public as well as the scientific community. This affair was according to mainstream history of psychology and behavioral science solved and scientifically explained by the German psychologist Oskar Pfungst (1874-1932). His "behaviouristic" explanation, i.e. the discovery that the horse, instead of acting really intelligent, solely reacted to his trainers unwitting cues, became known as the "Clever Hans effect". Sebeok was among the first researchers (outside of the narrow field of history of psychology) who thoroughly documented the solution of this enigma by Pfungst. His authority and explanatory principles was exceedingly positively assessed by Sebeok and it can be shown that Pfungst's work was highly influential on his understanding of human-animal communication, above all in his extréme anti-anthropomorphism. For Sebeok, Pfungst, his method and his theory was a guide how to explain nearly *all* cases of anthropomorphic skills in animals. Sebeok used Pfungst in his writings about Clever Hans and the "Clever Horses of Elberfeld" as a figure of a "man of science" fighting against parapsychological obscurantism. However, some recent findings show that such a high appreciation of this historically somewhat nebulou figure may be inadequate. First, the "Clever Hans effect" was discovered by several researchers *efore* Pfungst. Second, it shows up that the actual author of the often cited book *Clever Hans: The Horse of Mr. Osten* (1965, orig. in German 1907) might not have been Pfungst himself (the major part was for unknown reasons probably written by his teacher and supervisor, Carl Stumpf). Finally, there were other scientist involved in the solving of the "Clever Hans" enigma, (and later the case of the "Clever horses of Elberfeld"), who came with different explanations that oppose the "behavioristic" one. The aim of this paper is neither to deny the existence of the "Clever Hans effect" *per se*, nor to criticize. Sebeok for his utilization of this matter. On the historical cases of Clever Hans and kindred animals, we want to demonstrate some theoretical, methodological as well as historical aspects that might be of some interest for biosemioticians. (Paper supported by the Grant Agency of the Charles University, GAUK 113607/2007)

10th Gathering in Biosemiotics – Braga, Portugal 2010

On the emergence and evolution of dicisigns in biological mimicry

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As a corollary to our analysis of firefly signaling (El-Hani, Queiroz & Stjernfelt, forthcoming), we analyze the capacity of producing propositions (i.e., dicisigns) as a general requisite for a semiotic system to act as a mimic. We will show that Peirce's mature theory of signs brings an important contribution to the building of a general semiotic theory of mimicry, since it is quite helpful in addressing semantic and pragmatic aspects of biological information. As it is well known, the semiotic processes involved in biological mimicry most often do not result from learning processes taking place in the individual semiotic system, but from the fine-tuning of inherited capacities by natural selection among variants over thousands or millions of generations. Still, the concrete sign exchange takes place within the lifetime of a single individual - and those signals, indicating and describing at the same time, should be conceived of as dicisigns. This calls for an investigation of the Peircean notion of the dicisign, which is a generalization of the notion of proposition. One the one hand, it liberates assertion from the confines of language and points to its appearance also in pictures, gesture, etc. That is, it generalizes propositions from being a human privilege so as to also embrace simpler dicisings found in biology.

El-Hani, C.; Queiroz, J.; Stjernfelt, F. (forthcoming). Firefly Femmes Fatales: A Case Study in the Semiotics of Deception. *Biosemiotics.*

10th Gathering in Biosemiotics – Braga, Portugal 2010

Enkinaesthesia, Biosemiotics, and the Ethiosphere

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The dynamic plenisentient interrelation of agent and world is specified in kinaesthetic terms. Kinaes- thetic activity, with its temporal-spatial-energic qualities, is always affectively-laden, and through the formation of intercorporeal resonances, the activity necessitates enkinaesthetic entwining with those agents with whom, and those objects with which, we are in relations of perpetual community. I will argue that the capacity for enkinaesthetic dialogue is an a priori nomological condition for agency and the generation of a felt anticipatory dynamics both within and between agents.

Enkinaesthesia emphasizes not just the neuromuscular dynamics of the agent, that is, its givenness and ownership in its experience but also the entwined, blended and situated co-affective feeling of the presence of the Other (agential and non-agential alike) and, where appropriate, the enkinaesthet- ically anticipated arc of the Others action or movement, including, where appropriate, the Others intentionality. The Other can be sensing and experiencing agents and it is their affective intentional reciprocity, their folding, enfolding and unfolding, which co-constitutes the conscious relation and the experientially recursive temporal dynamics that lead to the formation and maintenance of integral enkinaesthetic structures and melodies. Such deeply felt enkinaesthetic melodies emphasise the dia- logical nature of the feeling of being as the feeling of being-with or being-among, and demonstrate the paucity of individuating notions that treat agents as singular.

Enkinaesthesia, as the openness to and reception of myriad subtle multi-drectional cues in dialogical relations, provides grounds for saying, following Heidegger, that it is this which constitutes the pri- mordial mood of care for human relationships and the deep roots of morality. If this is the case, then we might think of it as composing an 'ethiosphere' consistent with the semiosphere and the biosphere as presented by Hoffmeyer (1996 & 2008).

10th Gathering in Biosemiotics – Braga, Portugal 2010

On the relationship between first-order languaging and second-order language

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A primary goal of twentieth century linguistics was to establish correlations between language forms or structures and functions or meanings. This approach in its various guises – formal, functional, cognitive - dominated twentieth century scientific approaches to language. More recently, advances in the theory of dynamical systems, grounded in our understandings of neurobiology and ecosocial systems, have opened up the possibility of a different approach. This approach stresses the centrality of co-acting agents who extend their worlds and their own agency through embodied, embedded processes of *languaging*, rather than uses of an abstract language system (Cowley 2008; Thibault 2008).

The term 'languaging' questions two core notions of the code view: (1) the idea of a determinate language system that people 'use'; and (2) the language system consists of coding relationships between determinate forms and meanings. The relationship between material expression and meaning must therefore be rethought. Languaging was Maturana's (1970; Maturana and Varela 1987: 234, 246) term for designating the forms of social structural coupling of co-acting human agents that occur through languaging activity. The term 'languaging' emphasises the dynamical, processual, dialogically coordinated character of the sense-making activities which embodied, ecologically embedded agents engage in together to make sense of their worlds. Languaging is a culturally shaped extension of the agent's neurobiological capacities rather than a tool that is picked up and used, or instantiated from an abstract system of options (Cowley 2006; Thibault 2004a, 2004b). Moreover, languaging behaviour is embedded in action and perception, rather than existing as reified text-internal verbal patterns.

I shall argue that languaging behaviour consists of coordinated inter-individual patternings of pico-scale bodily (vocal, facial, etc.) events in real-time. Moreover, these bodily dynamics are directly cognitive *and* expressive. I shall refer to these bodily dynamics with the term *first-order languaging* (Cowley 2006, 2008; Thibault 2008, In Press). Further dimensions of sense-making are integrated to the first-order dynamics through experience. Rejecting code-like expression/content dualisms, I argue for a continuum between lower scalar body dynamics, which are already cognitively significant, higher-level cognitive and semiotic operations and the lexicogrammatical patterns of a given language (Thibault 2008, In Press; Cowley 2008). Lexicogrammatical patterns are second-order systems of cultural constraints and norms. They belong to the domain of *second-order language* on a slower, cultural time-scale with respect to the very fast time-scales of first-order languaging. I shall explore some aspects of the relationships between the dynamical pico-scale bodily dynamics of *first-order languaging* and the higher-scalar cultural constraints of *second-order language*.

10th Gathering in Biosemiotics – Braga, Portugal 2010

We the living:
The reception of Uexküll in Norwegian ecophilosophy

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Arne Naess (1913-2009) and Peter Wessel Zapffe (1899-1990) are two out of three classics within Norwegian ecophilosophy, which has been acclaimed for its influence on 'radical environmentalism' internationally (cf. Peter Reed & David Rothenborg (eds.), *Wisdom In The Open Air: The Norwegian Roots of Deep Ecology*, University Of Minnesota Press 1992). Both Naess and Zapffe introduced fundamental disciplinary concepts (e.g. 'biosophy' by Zapffe, 'ecosophy' and the distinction between the deep and the shallow ecological movement (thus 'deep ecology') by Naess). And they both based part of their philosophies on Uexküll's work – though Uexküll was admittedly much more central to Zapffe than he was to Naess, for whom Uexküll mattered first of all in the development of his early (pre-environmentalist) philosophy. For a start, we can say that while Naess in the main neglected the experiential and interpretative aspects of Umwelt theory, Zapffe added pessimism to the mixture.

Uexküll plays a significant foundational role in Naess' published dissertation *Erkenntnis und Wissenschaftliches Verhalten* (Jacob Dybwad, Oslo 1936) as well as in Zapffe's colossal main work (and doctoral dissertation) *Om det tragiske* [On the tragic] (1941). Interestingly (and fittingly), the *Journal of philosophy* characterized Naess' 1936 work as "a valuable contribution to a naturalistic, behavioristic description of [...] cognitive 'content,' and the procedure of science". In Zapffe's work, Uexküll plays the role as *the* biologist, depicting the worlds of the living and not least the radical difference between the living and the non-living. By using Uexküll's Umwelt theory as a stepping stone, the existentialist philosopher Zapffe makes two basic points:

1) that there is a "brotherhood of suffering" ranging "from the amobea to the dictator", and
2) that humans are unique in having several additional "interest fronts"; not only biological interests but further social, autotelic, and metaphysical interests.

Despite the fact that Uexküll was first of all, in the context of Naess' work, influential at an early stage (and was read by Naess in a slightly simplistic manner), we see here how Zapffe's reading of Uexküll is informing also when we are considering the thoughts Naess was later to develop on the topic of self-development through identification with others. In Zapffe's case, Uexküll's Umwelt theory constitutes a central ingredient in his lifework as such. In order to understand the paradoxical tension between the sympathy/identification with animals on one hand and the explicit anthropocentrism in Zapffe's ethics (where the human experience of wilderness ranks higher than anything else) on the other, we have to start by understanding the biological outlook on which he build his existentialist ecophilosophy.

10th Gathering in Biosemiotics – Braga, Portugal 2010

A road to empirical biosemiotics - better formed concpts?

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In several recent e-mail discussions by biosemioticians (see http://biosemiosis.blogspot.com/), quests for more empirical biosemiotics and the method of biosemiotics were raised. Part of the discussions related to these quests concerned the metaphysical terminology and contents of pansemioticians and some Peirceans and the usability of their conceptions in science. These are tricky issues for number of reasons.

- There seems to be no specifically biosemiotic data (differing from non-biosemiotic biological data). This means that whatever empirical data that can be gathered do not dictate its interpretation or the theory through which it is interpreted. Everything seems to be describable without a biosemiotic theory (though not necessarily explained as well).
- There seems to be no clear or commonly agreed understanding how to apply, redefine, or operationalize the used semiotic (or mental) concepts whether they be Peircean or of any other origin.
- There seems to be neither clear insight nor reasons how far the semiotic concepts of biosemiotics should be abstracted.
- Current biosemiotic theories are rather ideas that are meant to be theories, i.e. they are not yet well defined, but the legitimation of their concepts is still based on common sense metaphors – the pragmatic meaning of these concepts is not explicated well.

In order to get empirical biosemiotics (that would still be identified as biosemiotics), it is proposed that more concern should be given to semiotic concepts of biosemiotic theories, the methods how they should be derived, defined, and empirically operationalized as has been pointed in the discussions. Instead of trying to apply Peircean metaphysical and semiotic conceptions to biosemiotics, it is suggested that certain Peirce's methodical principles and concepts (e.g. pragmatic concept of meaning, ethics of terminology, principles of abstraction and abduction) were helpful and clarifying if used within the developing the biosemiotic theoretical concepts. That might result the production of more definite and 'operationalized', and thus testable biosemiotic hypotheses even for those who use non-Peircean semiotic concepts in their biosemiotic theory. Moreover, for those who tend to start from Peirce’s concepts in their biosemiotics, Peirce's own methodical principles would exhibit to which extent Peirce's concepts are legitimately extendable and applicable in biosemiotics.

10th Gathering in Biosemiotics – Braga, Portugal 2010

Fitness Cues and Fitness Indicators
Can evolutionary psychology and biosemiotics become complementary sciences?

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Current thinking in biosemiotics often seems hostile towards evolutionary psychology. Equally, evolutionary psychology still looks at human beings as merely information processing systems, thereby totally ignoring the semiotic nature of our interactions with the environment. However, in this paper we will argue that both fields of expertise can perfectly function together as two sides of the same coin, with evolutionary psychology investigating the evolved mental organs that underlie our interaction with our environment, and biosemiotics investigating the evolved cues that activate those mental organs. The perspective taken is similar to the *Umweltforschung* developed by Jakob von Uexküll as a precursor of biosemiotics and owes a lot to the ecological psychology develop by James Gibson.

Central in our discussion is the concept of fitness cues. Fitness cues can be defined as features – signs – of an individual's environment that convey useful information about local fitness opportunities – ways to increase one's survival chances or reproductive success. As Miller (2009) has pointed out: '*Natural selection cannot favor animals' responding to any cues that do not identify an opportunity to promote their survival and reproduction'*. With our project, we tested this Millerian hypothesis.

We set up a large-scale experiment (N=249 // 124 males & 123 females // age between 16-54, with average 34,4 years old) in which respondents were shown 109 sets of two pictures: a neutral one, and a manipulated one in which fitness cues were either inserted or enhanced using Photoshop CS2. Within 3 seconds, respondents had to choose which of both was the most appealing one to them. Our findings clearly demonstrate that not only do we react – often unconsciously – to the signs that make up fitness cues, but moreover, we *only* seem to react to signs that constitute fitness cues.

In our final discussion, we offer a more refined fitness cue model, distinguishing between fitness cues, fitness indicators, costly signals and supernormal stimuli.

Key words – Evolutionary psychology, biosemiotics, fitness cues

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Von Neumann's Theory of Self-Reproducing Automata: A Useful Framework for Biosemiotics?

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As interpreted by Howard Pattee, John von Neumann's Theory of Self-Reproducing Automata (1966) has proved to be a useful tool for understanding some of the difficulties and paradoxes of nucleic acid biosemiotics. But is its utility limited to molecular systems? Although the Theory of Self-Reproducing Automata was descended from von Neumann's work on the Universal Turing Machine, the two models are concerned with very different domains: the Universal Turing Machine with *abstract algorithms* and the Theory of Self-Reproducing Automata with *self-reproduction* of material structures. Although the structure of DNA was unknown to von Neumann when he proposed it, the Theory proved a good model for the semiotic, material, and evolutionary activities constrained by the genetic code.

Tying this molecular biologist's world of self-assembly and replication in the cell to von Neumann's abstract model has been part of the ongoing work of Pattee (e.g., 2001, 2008). By attempting to fill gaps in the Theory of Self-Reproducing Automata with actual biological mechanisms, Pattee was able to formulate several general principles of symbols, codes, and languages. These principles have attracted the attention of biosemioticians (Umerez, 2009).

With Pattee's work in mind, this leads to the question of whether von Neumann's Theory of Self-Reproducing Automata can be a *more generally useful model* in biosemiotics. One way of answering that question is to look at the Theory as a model for one particular high-level biosemiotic activity: human language. If the model is not useful for *language*, then it certainly cannot be generally useful to biosemiotics.

The Self-Reproducing Automaton ("Universal Constructor") and the Universal Turing Machine share two key properties: *programmability* (or configurability or instructability) and *universality*. With the proper input instructions, the Universal Turing Machine can be configured to *compute* any function and the Universal Constructor can be configured to *construct* any machine (including itself).

Applying properties like programmability and universality─and questions like computation vs. construction─to human language allows us to retrace Pattee's steps at a different hierarchical level. The result is a reframing of several familiar but important issues in biosemiotics.

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Biocommunication of Cancer Cells

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Whereas reciprocal cell-cell communication serves as appropriate tool to organize and coordinate growth and development, cancer cells show different behaviour. The (i) change in control functions of growth regulation and (ii) the invasion of far reaching tissues in the case of metastasis were long considered to be results of randomly derived damages (mutation) of genetic information. Current knowledge indicates that the genetic content arrangements of organisms strongly depend on viral infection events which doesn't act as lytic disease-causing agents but in most cases as non-lytic persistent viral settlers in both in cellular cytoplasm and in host genomes. Especially the highly colonized mammalian genomes show persistent non-lytic viral settlements represented by both a variety of intact endogenous retroviruses or „defective" retroviral parts such as transposons, retroposons, LTRs, non-LTRs, SINEs, LINEs, and other mobile genetic agents. Interestingly some „defective" retroviral parts now serve as „effective" modular tools for cellular needs in that the great variety of non-coding RNAs constitute a fine-tuned hierarchy of regulatory functions being essential to all steps and substeps of replication, transcription, translation, repair, recombination and apoptosis. If this highly balanced regulatory network is disturbed, either by microbial infections or by environmental or social stress factors, counterbalanced regulation control can get disregulated and loss of reciprocal biocommunication competence of cells may occur. In this respect (a) carcinogenesis is the result of communication breakdown whereas (b) invasive cancer cells behave accordingly the retroviral-mediated embryological programme of placenta invasion.

Keywords: reciprocal cell-cell communication, persistent viral settlers, cellular key regulations, biocommunication breakdown

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Autopoiesis and Interpretive Semiosis: Translation as a Biological Phenomenon

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Translation has long been viewed as the 'coding-switching' either within or between languages. Hence, most of its discussion rests on linguistic and cultural aspects involved in translation. However, the fundamental, biological mechanism for translation has not yet gained its overdue attention. Therefore, it is intended in this project to examine the potential biological mechanism of translation from Humberto Maturana's notion of autopoiesis. Autopoiesis is a mechanism that, by selecting and adapting, allows a closed system to interact with its medium but in the meantime remaining its 'homeostatic' organization as a self-producing system. An autopoietic system, then, is a system that relies on the ontogenic structural coupling taking place between the system itself and its medium. Maturana suggests that when an autopoietic system and its medium form a relationship of mutual ontological structural coupling; that is, when they become the medium for the realization of autopoiesis for each other, they would establish a consensual domain. In Maturana's viewpoint, language is established by the recursive generating of new components in the consensual domain. Hence, it can be seen as a generative system of consensual interactions, which would have selected interactions through the structural coupling of a diverse consensual domain. Furthermore, regarding the communicative function of language, Maturana reiterates that it is by establishing an ontogenic structural coupling that the linguistic communication can take place.

By seeing language as the interlocked interactions in the consensual domain, I think there is a strong indication that language is not something objectively outside of human, nor is reality. More importantly, I would suggest that Maturana brilliantly solves the aporia of whether language is a product or a process. In the consensual interaction, language can be the product but it will in return become the new medium that triggers new interaction—in this sense, it becomes the process again. It is by the reciprocal ontogenic structural coupling of the consensual domain that identifies the recursive mechanism of language.

Translation, as a special kind of linguistic communication, can then be situated in the system of language-as-consensual domain. In translation, the most distinctive feature is that the translated (i.e. what is to be translated) and the translatant (i.e. what is translated) would form a relationship which is at the same time based on the similarity and distinction between the two systems. Moreover, the translated and the translatant also create a peculiar interaction that on one hand the translated induces the generation of the translatant; on the other hand, the translatant would in return form what Benjamin terms as the 'afterlife' of the translated. This 'afterlife', if viewed from a semiotic perspective, is the interpretive system of the translated, which serves to complete the meaning of the translated. Hence, the translated and the translatant would generate reciprocal interlocked interactions, which may change the structure of each other (for similarity) but remains the organization (distinction) of each individual system. In this sense, the fundamental mechanism for translation is the reciprocal ontogenic structural coupling, which also identifies that translation, as the translating process, is based on the consensual domain created by the translated and the translatant. Furthermore, translation, as the product of the translating process, is what Maturana terms as the 'description' of the consensual domain, which specifies the interaction of the two systems. The dynamics of translation would, then, come from the autopoiesis of the recursive interactions of the translated and translatant. This identification of translation as autopoiesis would also be the indication that translation is not merely inter-/intralingual code switching, but a recursive process of interpretation, as what Marcello Barbieri suggests, an 'interpretive semiosis'.

10th Gathering in Biosemiotics – Braga, Portugal 2010

The linguistic measure- what does it say about language and evolution?

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There are numerous methods for the analysis of the text which can be considered as a sequence of characters. With an aid of linguistic complexity measure, we can search for example for low complexity regions in repetitive sequences of DNA. In a similar way, it is possible to analyse human text. However, the comparison is not simple and one must take into consideration what is actually the symbol carrying some meaning in human languages.
Should we ever compare genetic and human texts? Genetic texts are multicodes, e.g. messages are superimposed and overlapped. One letter can belong to various messages simultaneously. Unlike human texts, which are read letter by letter only one way – and a wider field of interpretations appears first on the semantic level. In spite of these problems, the results show very similar values of complexities of genetic texts (proteins or proteome sequences) as compared to human languages in case that one word as one character is used. Does it say that human and genetic texts are similar or does it reflect any common quality shared with the both types of texts?
The complexity is a feature of all systems – even random generated. Maybe just the systems with evolution – genetic or human languages – share similar values of complexity and this value reflects the common origin by evolution.