8th Gathering in Biosemiotics – Syros 23 - 28 June 2008

ABSTRACTS

The Poetics or Semiotics of Purpose

Victoria N. Alexander, Ph.D.
Dactyl Foundation
64 Grand Street
New York, NY 10013
alexander@dactyl.org

Hackles have been raised in biosemiotic circles by T. L. Short's assertion that semiosis, as defined by Peirce, entails purposeful action and therefore is not found below the level of the organism [i]. This informal talk will be based on a longer paper (the first inklings of which were presented at Gathering 7), which examines Short's teleology and theory of purposeful behavior and offers a remedy to the disagreement. Remediation becomes possible when the issue is reframed in the terms of the complexity sciences, which allows intentionality to be disembodied and analyzed differently at different emergent hierarchies. Key tools used here, required for understanding transitions between hierarchies, come from poetics rather than semoitics.

[1] *Peirce's Theory of Signs*, Cambridge: New York, 2007.

The Play of a Metaphor in Ecosemiotics: Footprints, Handprints, Mindprints

Myrdene Anderson
Department of Anthropology
Purdue University
700 West State Street
West Lafayette, IN 47907-2059 USA
myanders@purdue.edu

Lucy left evidence of bipedal trundling some 3.5 million years ago in east Africa. Thirty thousand years ago, humans drew their (often left) hands on rockfaces or inside caves throughout the old world and later the new world as well. This manual cultural practice, perhaps even by children, persisted for millennia (R. Dale Guthrie). Before and throughout these eras and since, humans have celebrated mutual relationships with their significant surrounds, both 'natural' and 'cultural'. These relationships could be dubbed a 'mindprint'—the result of coevolution and codevelopment. Human cognition, culture, and language have been imprinted, as it were, with their contexts, their significant surrounds, and their Umwelten, and those surroundings bear the complementary evidence of human (and of course other) living interactors. More recently, in the past generation or two, humans have approached mindprints from several new angles. First came the notion of carrying capacity, then there was the first proposition of sustainable development (actually, an oxymoron), then a model of ecological footprint (William Rees and Mathis Wackernagel), and now a Environmental Sustainability Index. The recurring icon, index, and now symbol of 'footprint' has entered nontechnical vocabularies and political discourse, for example, in the expression of 'carbon footprint'. This metaphor indexes, however, the habits of hands and minds and money, not feet, and may have reached a saturation point regarding its capacity to nuance signification.

Biosemiotic Modeling of Signal Transduction in B-cell Activation: Implications for Simulation Methods

Argyris Arnellos[a], Spyros Vosinakis[a], João Queiroz[b,c], Charbel Niño El-Hani[b,c *], John Darzentas[a]

[a] Department of Product and Systems Design Engineering
University of the Aegean, Syros, Greece.
[b] Research Group in History, Philosophy, and Biology Teaching, Institute of Biology,
Federal University of Bahia, Brazil.
[c] Graduate Studies Program in History, Philosophy, and Science Teaching,
Federal University of Bahia, Brazil.
E-mails:
Argyris Arnellos (arar@aegean.gr) , Spyros Vosinakis (spyrosv@syros.aegean.gr),
John Darzentas (idarz@aegean.gr),
João Queiroz (queirozj@gmail.com), Charbel El-Hani (charbel.elhani@pesquisador.cnpq.br)

Many cell activities are controlled by cell surface receptors, which respond to ligands by triggering intracellular signaling reactions that elicit cellular responses. Improved understanding of receptor signaling has a number of potential theoretical benefits and practical applications. The process of signaling through receptors involves highly connected networks of interacting components. So far, it has been regarded that to understand the often counter-intuitive behavior of these networks we need to work with mathematical and computational modelling. In particular, the application of mathematical and computational models to the immune system and, in particular, to immune signaling have experienced an explosive blossom in recent years. These models aims at predicting how the components of a signal cascade function in order to decode environmental signals and at modeling signaling and cross-talk through members of different signaling pathways. It is true that we have detailed accounts of several signaling pathways and networks, including a multitude of molecules participating in intracellular signaling routes. But, as we obtain more and more information about signaling pathways, we face an increasing danger of losing from sight common organizational and functional aspects in these pathways. To avoid this danger, we need functional models of signaling pathways. But, albeit necessary and important, are these models sufficient to understand signaling pathways? Despite their importance, it is our contention that these models should be complemented with semiotic models that allow us to understand how molecules can act as signals, and, thus, mean something else to the cell than just the molecules they are in themselves. How can molecules be signs which stand for something else, say, a virus-infected cell, a prey, an internal state of an organism, and so on? In this paper, we review functional models of signaling pathways in living systems found in the literature, particularly focusing on immunological systems research and, more specifically, on signal transduction in B-cell activation. One of the conclusions we reach is that their purely mechanistic nature cannot account for the complexity of such an autonomous system and their emergent properties. Particularly, it seems that the referential aspect of signaling molecules (i.e., the fact that they refer to something more than themselves) cannot be grasped in such kind of functional models. We then develop further a Peircean semiotic model of signaling pathways in B-cells discussed in previous paper in order to substantiate the view that semiotic modeling is required for the referential aspect of signaling processes to be grasped.

* *Corresponding author*

Biological Systems as Integrating a Processor, a Regulator, and a Decider

Gennaro Auletta
Scientific Director of the Specialization "Science and Philosophy"
Pontifical Gregorian University
Piazza della Pilotta 4 - 00187 Rome (Italy)
auletta@unigre.it

Information acquiring can be considered a three-step or three-component process, in which a processor, a regulator, and a decider are involved.

Firstly, a *processor* is necessary, as a source of possible variety. The processor is the component that gives the input so that information can be acquired.

The next component is represented by a *regulator*, that is, a system able to work as the interface between the processor and the final detection event. In other words, the regulator provides the necessary coupling, without which we could not speak of information acquiring. I shall return to this point, but let me add here that we never have direct access to any source of variation, we only access its (delayed) effects. This is already true from a relativistic point of view.

Finally, we need a *decider*, that is, a device that, given a certain coupling, is able to give rise to a decision among a given set (in the simplest case, between two alternatives). In principle, this decision event can have no relation with the initial processor. It is only the coupling (second step) that guarantees that the final event says something about the state of the processor. In this way, we say that the decider has *selected* some information from among the different possibilities to which the processor gives rise.

Biological systems are constituted through the integration of these three aspects. In particular, organisms consist of a protein feedback web involving a genetic processor, a regulating metabolic system, and a separation between self and non-self. While a biological system may lack of metabolism, this is the hallmark of organism. These three subsystems can also be regarded as biological systems. The difference between a true organism and other forms of biological systems consists in their ability to integrate two opposite tendencies: the autonomy of the parts and the uniformity of the whole.

KEYWORDS: Information, entropy, cybernetics, processor, regulator, decider, genetic system, metabolism, membrane.

Three Types of Semiosis

Marcello Barbieri
Dipartimento di Morfologia ed Embriologia
Via Fossato di Mortara 64, 44100 Ferrara, Italy
brr@unife.it

The existence of different types of semiosis has been recognized, so far, in two ways. It has been pointed out that specific semiotic features exist in many taxa and this has led to the distinction between zoosemiosis, phytosemiosis, mycosemiosis, bacterial semiosis, endosemiosis and the like. Another type of diversity is due to the existence of different types of signs and has led to the distinction between iconic, indexical and symbolic semiosis. In all these cases, however, it has been widely assumed that semiosis is defined by the Peirce model, i.e., by the idea that any semiotic entity is a triad of ‘sign, object and interpretant’, and that interpretation is an essential component of semiosis. This model is undoubtedly applicable to animals, since it was precisely the discovery that animals are capable of interpretation that allowed Thomas Sebeok to conclude that they are also capable of semiosis. But can we really extend the Peirce model from animals to all other living creatures? Many biosemioticians accept this conclusion, and yet there are serious problems with it, because we cannot apply the Peirce model to the cell. The rules of the genetic code have been virtually the same in all living systems ever since the origin of life, which clearly shows that they do not depend on interpretation. It has been pointed out, however, that semiosis is not necessarily based on interpretation and can be defined exclusively in terms of coding. According to the ‘code model’, a semiotic system is made of signs, meanings and coding rules, all produced by the same codemaker, and in this form it is immediately applicable to the cell. The code model, furthermore, allows us to recognize the existence of many organic codes in Nature, and to divide them into two main types that here are referred to as *manufacturing semiosis* and *signaling semiosis*. The genetic code and the splicing codes, for example, take part in processes that actually manufacture biological objects, whereas signal transduction codes and compartment codes organize existing objects into functioning supramolecular structures. The organic codes of single cells appeared in the first three billion years of the history of life and were involved either in manufacturing semiosis or in *signaling* semiosis. With the origin of animals, however, a third type of semiosis came into being, a type that can be referred to as *interpretive semiosis* because it became closely involved with interpretation. We realize in this way that the contribution of semiosis to life was far greater than that predicted by the Peirce model, where semiosis is always a means of interpreting the world. Life, on the other hand, is essentially about three things: (1) it is about manufacturing objects, (2) it is about organizing objects into functioning structures, and (3) it is about interpreting the world. The idea that these are all semiotic processes, tells us that life depends on semiosis much more deeply and extensively than we thought. We realize in this way that manufacturing semiosis, signaling semiosis and interpretive semiosis are three distinct types of semiotic processes and that they gave very different contributions to the origin and the evolution of living systems.

What does it mean for biosemiotics if there is no more “junk” on DNA?

Thierry Bardini
Department de Communication - Université de Montréal
C.P. 6128 Succ. Centre ville Montréal (Québec) H3C 3J7 CANADA
Tel : (514) 343-5799 Fax : (514) 343-2298
thierry.bardini@umontreal.ca

On June 14, 2007, the ENCODE project consortium published in *Nature* the result of a systematic study done on 1% of the human genome, that deeply challenged the established view of both the composition and the functioning of the genome. Prior to this study, the consensus was that the human genome was made of between 20,000 and 25,000 protein-coding sequences (genes) interspersed in a sea of non-coding sequences also known as “junk DNA” (OHNO 1972). In other words it was often assumed that a vast majority, maybe even 98% of the base pairs of the human genome had no function but maybe that of being able to selfishly replicate (ORGEL and CRICK; DOOLITTLE and SAPIENZA 1980). By showing that “the human genome is pervasively transcribed, such that the majority of its bases are associated with at least one primary transcript” (ENCODE 2007, p. 799), this study might indeed have put an end to the use of the notion of “junk DNA.” Prior studies had already intuited this result, and some had even proposed potential alternative functions for a vast majority of non-coding sequences. John MATTICK and his colleagues, for instance, have proposed for some years already that many non-coding sequences be involved in genetic regulation and epigenetic processes. The ENCODE study confirmed this notion and thus challenged “the simple view of the genome as having a defined set of isolated loci transcribed independently.” It further proposed the hypothesis that “the genome encodes a network of transcripts, many of which are linked to protein-coding transcripts and to the majority of which we cannot (yet) assign a biological role.” This paper proposes to examine this situation form the standpoint of biosemiotics. It thus offers to update the answers already provided in biosemiotics to the “Sarkar challenge” (EMMECHE 1999) in light of this new and potentially extremely important results on the structure and functioning of the genome. Further more, it proposes to further question the relationship between a RNA-based genetic semiosis and the “chicken and Orphean egg” dilemma (EMMECHE 2002).

References

EMMECHE, Claus (1999). “The Sarkar challenge to Biosemiotics: Is there any information in a cell?” S*emiotica* 127 (1/4): 273-293.
EMMECHE, Claus (2002). “The Chicken and the Orphean Egg: On the Function of Meaning and the Meaning of Function”, *Sign Systems Studies* 30 (1): 15-32.
ENCODE Project Consortium (2007). “Identification and analysis of functional elements in 1% of the human genome by the ENCODE pilot project”, *Nature* 447: 799-816.
DOOLITTLE, W. Ford and SAPIENZA, Carmen (1980). “Selfish genes, the phenotype paradigm and genome evolution”, *Nature* 284: 601-603.
MATTICK, John S. (2007). “A new paradigm for developmental biology”, *Journal of Experimental Biology* 210: 1526-1547.
OHNO, Susumu (1972). “So much ‘junk’ DNA in our genome” in *Evolution of Genetic Systems*, edited by H.H. Smith, pp. 366-370, New York, Gordon and Breach.
ORGEL, Leslie E. and Crick, Francis H.C. (1980). “Selfish DNA: the ultimate parasite”, *Nature* 284: 604-607.

Applying semiotics and information theory to biology: a critical comparison

Gérard Battail
E.N.S.T., Paris, France (retired)
gbattail@club-internet.fr

Since the beginning of the XX-th century, it became increasingly evident that information, besides matter and energy, is a major actor in the life processes. Moreover, communication of information has been recognized as differentiating living things from inanimate ones, hence as specific to the life processes. Therefore the sciences of matter and energy, chemistry and physics, do not suffice to deal with life processes. Biology should also rely on sciences of information. A majority of biologists, however, did not change their mind and continued to describe life in terms of chemistry and physics. They merely borrowed their vocabulary from the information sciences.

The first science of information available to biological applications, semiotics, appeared at the end of the XIXth century. It is a qualitative and descriptive science which stemmed from efforts of linguists and philosophers to understand the human language and is thus mainly concerned with semantics. Applying semiotics to biology resulted in today's Biosemiotics. Independently, an explosive expansion of communication engineering began in the second half of the XXth century. Besides tremendous progresses in hardware technology, it was made possible by the onset of a science of literal communication: Information Theory (Shannon, 1948). Literal communication consists of faithfully transporting a message from a place to another, or from an instant to another. Because the meaning of a message does not matter for its transportation, information theory ignores semantics. This restriction enables defining information as a measurable quantity on which a mathematical theory of communication is founded. Although lacking implementation means at its beginning, information theory became later very successful for designing communication means. Modern ones, like mobile phones, can be thought of as experimentally proving the relevance and accuracy of information theory since their design and operation heavily rely on it. Information theory is plainly relevant to biological functions which involve literal communication, especially heredity. This paper is intended to compare the two approaches. It shows that, besides obvious differences, they have some points in common: for instance, the quantitative measurement of information obeys Peirce's triadic paradigm. They also can mutually enlighten each other. Using information theory, which is closer to the basic communication mechanisms, may appear as a preliminary step prior to more elaborated investigations. Criticizing genetics from outside, information theory furthermore reveals that the ability of the template-replication paradigm to faithfully conserve genomes is but a prejudice. Heredity actually demands error-correcting means which impose severe constraints to the living world and must be recognized as biological facts.

Investigations of the Social Subject

Mette Miriam Rakel Böll
Learning Lab Denmark, University of Aarhus;
Institute of Molecular Biology, University of Copenhagen;
Biosemiotic Group Copenhagen
metteboell@gmail.com

During spring 2008 I shall conduct several field studies involving people working in Irma (a retail chain) using the methodology of "Industrial Ethology". I would like to present you with the details of this work of which the purpose is to gain insights into the apparent fact that feelings are contagious and thus somehow are transmitted through a social context. By measuring the blood pressure, the hearth rate variability and filming people to construct ethograms of their postures and mimic while they engage in constructed interactions based on everyday work scenarios the intend is to study the transmission rate of feelings. By measuring several hierarchical levels of the organism (physiological, emotional and behavioral) the focus of investigation is the entire organism - the biological subject so to speak - and thus a biosemiotic entity.

Keywords: Industrial Ethology, Biosemiotics

Does biosemiotics assist in understanding complex medical interventions?

Martien Brands
Centre for Integrative Care
Amsterdam, the Netherlands
mbrands@tiscali.nl

Introduction

Conventional western ‘allopathic’ medical interpretation uses those signs that refer to a single deranged biological mechanism; however many patients have symptoms which cannot fit into that interpretation. Therefore, increasingly, psycho-social factors are taken into account; but a ‘hybrid’ diagnostic unit which combines physical symptoms with other factors does not exist. Medical ‘semiotics of the spoken language’ (Kristeva) is still difficult: one that can incorporate the complexity of the patient’s story into diagnostic interpretation.

Is there really a separation between types of elements of the patient’s story or does it exist in the interpretative framework of the doctor? Given the many communicative problems and medical errors with fatal consequences, this has semantic and pragmatic relevance for medical diagnosis and treatment. Complementary therapies address the interaction between bodily and mental states from their very conceptual perspective. Therefore some examples are analysed with a biosemiotic approach showing how they deal with the complexity of the patient’s narrative of illness and the possible consequences for the practice of medicine in general.

Design

Placebo–effects or better ‘context effects’ are often seen as responsible for therapeutic effects of complementary treatments. What in this case might make their interpretation so powerful as to explain whole-scale clinical effects? Before acknowledging the limitations of ‘context’ as explanation of clinical effects, the context of medical coding should be and is investigated by reformulating the medical diagnostic process in a true semiotic sense. Since Hippocrates the diagnostic process has been conceived as the interpretation of signs referring to objects, until Peirce’s introduction of the interpretant, which is here the focus of investigation.

Venn diagrams are used to map the different in coding processes of symptoms: ‘discrete’ categories with fixed boundaries are distinguished from flexible or ‘prototypical’ categories.

Results

The semantic field (Eco, Lyons) is a general frame for explaining the different denotations and connotations of symptoms presented by the patient; those depend on the respective interpretative frameworks of the practitioners. Ambiguity in denotation and connotation of symptoms may confuse the doctors when trying to interpret complex patients’ stories coming from a deterministic framework. Two examples of complementary therapies, homeopathy and chinese medicine both use prototypical categorization by probabilistic interpretation. Comparison of semiosis is possible by mapping semantic fields of respective forms of medical diagnosis. Co-morbidity (involvement of several organ-systems in the disease) especially calls for expansion of the traditional biomedical classification, as thereby one sign can have ambiguous denotation and connotation depending on whether it is interpreted from a single or multiple causality model.

Discussion and conclusion

The limitations of the traditional interpretant in biomedicine for incorporating particular individual signs are due to an incomplete coding of symptoms; many of them cannot become signs as they have an ‘empty denotation’. Many pitfalls of diagnosis may be due to this semiotic incompleteness of the single etiology model. Complex interventions require an interpretative model that can incorporate both biological and psychological phenomena. This can be applied to education, practice and further research.

Hierarchical categorical perception and semiotic integration

Luis Emilio Bruni
Department of Media Technology and Engineering Science
Faculty of Engineering and Science
Aalborg University
leb@media.aau.dk

This presentation is a contribution to a hierarchical (and heterarchical) theory of categorical perception (CP), considering categorical perception as a fundamental process (or phenomenon), which can be conceptualised and observed all along the biological hierarchy.

In this perspective the fields covering "categorical perception", "pattern recognition", "the binding problem" and "biosemiotics" are intimately interrelated. However these fields of research have developed for the most part separately and unaware of each other within a variety of disciplines, which makes also each of these research areas not a unified area in itself. One of the intentions of this conference is to contribute to bring closer the insight from these developments. Until now, there has been consideration of CP exclusively within the functional cycle of perception-cognition-action and it has not been considered the possibility to extend this kind of phenomena to the physiological level (besides considering the embodiment of CP in neural activity).

This presentation also has the intention to stress the importance of the semiotic function of categorical sensing and categorical perception, linking this kind of phenomena to the also hierarchical and pervasive "binding problem" in cognitive science and to research on how information presented concurrently to different senses is combined to form a coherent unitary percept.

Semioticians Make Strange Bedfellows! Or Once Again: ‘Is Language a Primary Modelling System?’

Han-liang Chang
Department & Graduate Institute of Foreign Languages and Literatures
National Taiwan University
No. 1, Sec. 4, Roosevelt Road,
Taipei, Taiwan, 10671
changhl@ntu.edu.tw

For all his profound interest in the semiotic implications of animal communication, Jakob von Uexkull rarely referred to language communication, let alone the linguistic model underlying semiology. It had to wait for half a century for his *de jure* progenitor Thure von Uexküll to shed light on Jakob’s ‘doctrines of sign’ by bringing them into rapport with the Saussurian linguistics. On a rare occasion where Jakob did refer to language in 1937, the author’s comments were negative and his observations on animal language fall squarely outside the realm of language. In 1952 Benveniste raised the issue again and concluded the analogy as a theoretical impasse.

However, Thure seems undaunted in negotiating Jakob and Saussure, and his insistence leads to labelling *Umweltforschung* as a ‘general semiotics’. Because of the subjective (subject-oriented) life nature of *Umwelt*-theory, an analogy can be established between ‘the laws of formation it postulates with the nature-plans’ and ‘the laws of formation of language.’ This is a daring postulate. For one thing, Thure fails to explain how the analogy holds. For another, one notices an apparent lack of a *tertium relatinis* in the author’s formulation, by virtue of which (1) nature-plans and language [-plans]; (2) formation of nature-plans and formation of language; (3) laws of formation of nature-plans and laws of formation of language can enter into homology. What is that *tertium relatinis*? Among other things, it has to be a meta-theory capable of dealing at once with the object-semiotics of nature-plans and language, and the meta-semiotics of biology and linguistics.

One may suggest the linguistic model as a candidate for this meta-system, but it seems dubious because language here is only one of the two comparata, two object-semiotics rather than meta-semiotics. Thure’s definition of general semiotics raises the special situation of iconic sign according to Peirce. The term and its definition equated by the copula ‘is’ are non-reversible. One can certainly nominate general semiotics as a candidate. But does the term (rather than terminology) solve the problem? The answer is obviously negative because it would raise the next question of ‘Which semiotics?’ i.e., ‘A semiotics based on which or what model?’ To answer this second question, one would have to ask and answer a third question: ‘Which semiotics has more explanatory power?’ or ‘Which model is a better one?’ etc. Here Benveniste seems to be useful again, who asserts: ‘language is the only interpreting and interpreted system’, i.e., as both object-language and meta-language, modeling system and modeled system. Now it is the very linguistic model as a ‘primary modeling system’, launched not by Benveniste, but by Lotman &Co, that has been under attack by Sebeok in his discussion of biosemiotics.

This paper will rehearse the above history and probe into the use and abuse of language as a ‘primary’ (Lotmanian) or ‘tertiary’ (Sebeokian) modeling system.

Alternatives of Biosemiotics

Sergei Chebanov
St. Petersburg State Technical University
31 Moika, Apt.12, St.Petersburg 191186, Russia
S.Chebanov@gmail.com

In my previous works I wrote that five types of language conceptions may be distinguished.

(1) Hermeneutics Sacra. Hermeneutics is the treatment of language as a sacred phenomenon, which exists in symbolically comprehending world. Any event may be considered as a text which meaning should be understand by a man. Hermeneutics represents the theory and practice of text interpretation based on: 1) there exist different strata and aspects of meaning; 2) the act of interpretation is an integral psychosomatic process, influenced by texts and expressions peculiarities, the psycho-physiological state of the recipient, his axiology and previous life experience; 3) there exist as well another integral complex of factors, determining the interpretation acts and the ability of whose interpretation is being transferred from the teacher to the pupil.

(2) Philology. The main object of philology is text which should be analyzed and commented. Text is considered to be an independent phenomenon, and the question whether individual referents really took place is scarcely concerned. Philologists are interested in fiction and publicist texts, and the reality of described events is for them usually not of importance. One of the main aspects of philological analysis is that of text aesthetics basing for the most part on stylistics. Philology supposes that text has a unique meaning that should be decoded by philologist and then forwarded to a reader.

(3) Linguistics is concerned mainly with language which is regarded as a building material for texts. The multitude of texts "worthy" of linguistic analysis by involving dialects, colloquial and professional speech. Linguistics has accumulated the great number of empirical knowledge on variety of languages, elaborated comprehensive systems on language relations and language evolution theories.

(4) Semiology (structural linguistics). Its fundamental idea consists in regarding language like a system of related signs, which are considered to be rather conditional. The treatment of language as a peculiar algebraic system with its own immanent laws having origin in de Saussure's works, reaches extremum in Hjelmslev's conceptions.

(5) Pragmalinguistics embraces the diversity of directions, methods and tasks, which may be faintly connected one with another either on conceptual or operational levels. Despite of the variety of approaches, the multitude of ideas and facts in their totality allows to declare a qualitatively new stage of language knowledge. The operative aspect of pragmalinguistics is represented by applied (computational) linguistics, creating diverse linguistic automats, developed with the use of computer tools.

Owing to historical circumstances the biosemiotics was issued as discipline studying semiotics means of live organisms. However four fundamental disciplines can be alternative of biosemiotics – bio-hermeneutics, bio-philology, bio-linguistics and bio-pragmalinguistics. To speak about bio-pragmalinguistics is impossible now because pragmalinguistics itself is in embryo. At the same time the bio-philology and in particular bio-linguistics develop very interestingly.

From my point of view the most adequate form of comprehension of semiotics means in living organisms is bio-hermeneutics. This question was a subject of special consideration in my theses to Gathering in Biosemiotics 7 (Groningen, 2007). Biohermeneutics is subject of special interesting for M.Boden, A.Marcoš, G.Witzany, and me.

Can Saussure's Orangery Manuscripts Shed New Light on Biosemiotics?

Jui-Pi Chien
No. 1, Sec. 4, Roosevelt Rd., Taipei 106, Taiwan
Department of Foreign Languages and Literatures,
National Taiwan University
jpchien@ntu.edu.tw

Since the 1970s, with the organized efforts of certain advocates, the study of biosemiotics has been divided into two strands: biological semiotics and semiotic biology. While advocates of the latter have been pursuing a model for the interpretation of codes and meanings within organic mechanisms, they have also looked back to history in order to ensure the continuity and validity of their scope. Several linguists and biologists in history have been credited with practicing or envisioning biosemiotics, but such efforts have undeniably exposed more stumbling blocks than sound connections.

Ferdinand de Saussure has turned out to be one of the main obstacles for such efforts. His theory has been dismissed as an unpleasant example of glottocentric, anthropocentric and dyadic tradition which does not provide much insight into surveys on biological and ecological phenomena at large. However, in the group of newly-discovered manuscripts entitled as “Dual Essence of Language,” the innovative approach to sign that Saussure proposes is not the one that later semioticians and philosophers gathered from *Course in General Linguistics*; he actually debases the latter as a “profound misconception” of sign. The model that he applies throughout his manuscripts is far from the mutual correspondence between a form and a meaning, but rather one of their coexistence as a “chemical mixture” (*mélange*) and the “machinery of negative categorization” which characterizes them both. The mechanism at work shared by form and meaning, synchrony and diachrony, is based on the general difference between signs of the same category. The network that such mechanism generates among signs is without limit, starting point or any fixed point. It not only enables a sign to absorb and locate new ideas at any time but also serves to change the boundary of general meaning from time to time. More often than not, Saussure portrays such dynamic networking in his conceptualization of *état de langue* as a complicated game played inside the mind of each speaking subject.

Indeed, Saussure had chemical and zoological sciences in mind when he took them as a starting point to speculate about the new science of semiology (or linguistics). Although they both have assisted him in highlighting the importance of making distinctions between things of different orders and avoiding the naivety of single substances or objects in linguistics, Saussure did, in a sense, admit that the study of isolated objects can still work in natural sciences when it comes to things within the same order, assuming that there are permanent features and boundaries in both chemistry and zoology. However, from our perspective today, it is argued that the principle of negativity and differentiation that Saussure envisions for linguistics should in a certain sense be applicable to natural sciences as well. Since the 1990s within the circle of biosemiotics, there have been voices suggesting probing “group properties,” the specification of “meaning” mechanism and the delimitation of “boundaries” of science as ways to improve and enhance such discipline. This presentation aims to elucidate Saussure’s contribution to these areas by drawing ideas from his Orangery manuscripts.

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

John Collier
School of Philosophy and Ethics
University of KwaZulu-Natal
Durban 4041, South Africa
collierj@ukzn.ac.za

Information theory is used widely in biology as a technology, but it is also used more concretely, in the sense that nothing else would do the same job. The most obvious usage is in the idea that the genes of an organism contains information about its phenotype, not to mention how it develops and uses its resources in both maintenance and growth. Nonetheless, a number of authors have recently argued that information is merely a metaphor, and a bad one at that. Elsewhere, I have argued that the use of information in biology is robust, and different from uses of information in physics and chemistry (Schrödinger's suggestions, it should be noted, involve nothing peculiarly biological). The first and major distinction of biological information is that biological systems have a separation of energy and information budgets. Further distinctions, which are ramifications of this distinction, are that biological information is functional, and it is often coded. The issue of where meaning and reference come in, however, is murky at best. The transition, more or less obviously, starts where a robust form of semiotics is required (rather than merely being instrumentally useful). My purpose in this paper is to ask how we can tell where this transition is.

The most obvious division is that a bearer of information is a sign for a system when the sign must be interpreted by the system for it to be functional for the system. I will argue that the widespread etiological approach to function cannot determine any such division. Therefore, if semiotics has an application in biology, we need a different account of biological function. I propose that an organizational role account of function is best for the job, and I argue that signs must be distinguished as such within the organization for them to really function as signs. Only the latter can allow error and correction of error by the system. A good example of a system that makes this sort of distinction is the immune system. Other biological signaling and control systems are less clearly semiotic. Even interorganism signaling is not always what it appears to be, though the problems here arise mostly from confusion about what is the signal, and who it functions for. I will look specifically at genetic information and intraorganism signaling by the hormone insulin to see if these are semiotic in any strong sense. My conclusion is that if we pay enough attention to what the message is and how it is interpreted a case can be made that both are semiotic processes.

Language and physics: implications for biosemiotics

Stephen J. Cowley,
University of Hertfordshire, UK & University of KwaZulu-Natal, South Africa.
s.j.cowley@herts.ac.uk

In Kantian tradition, the *a priori* world is separable from the mundane. While some in the biosemiotic community favour this 'two-world' view, others disagree. For example, Kull declares: "Physics and semiosis, are just two different ways of seeing the same world, each with their own separate points of view and methods" (2007, 171). The paper uses the case of language to critique the two-world view. Second, building on *human symbol grounding*, it sketches how we become observers who come to report experience of two worlds.

In post-Saussurian tradition, language became a verbal system whose units somehow mapped onto meanings (signifies). On this view, language escapes from physics as neither words nor meanings are grounded. Traditionally, therefore, naturalists follow Chomsky. While continuing to emphasise properties of what we ordinarily call *words*, biology is said to exploit a (minimal) universal grammar based in physical bedrock. Language *is a* grounded part of the natural world. This paper shows how a *distributed* view of language gives a naturalist alternative. Instead of tracing *words* to physical roots, emphasis falls on how we come to hear (and imagine) such items or, in Cowley's (2007) take *a language stance*. This is done by examining how human agency draws on *human symbol grounding* (Cowley, 2007). Since language emerges from co-action, there is no need for innate grammar. Language is triply grounded during the developmental process as it comes to exploit brain, culture and, later, first person experience. To learn to talk (or sign) is to become a human agent as brains come to be functionally reorganized. *As a result of experience with multimodal behaviour*, by the third year of life, children begin to *hear* differently. Given familiarity with local practices, they hear utterances as instances *of* words. Gradually, using this new ability, they come to harness the power of the language stance.

Verbal patterns are virtual constraints. However, given cultural experience, these come to be associated with recurring patterns. Alongside dynamics, we use them to gain access to a world based in non-local semantics. As the sensorium exploits this historical residue, we extend embodiment. This view is of interest to biosemiotics for two reasons. First, it offers a viable alternative to the *two-world* view. Second, the picture may serve to reconcile Kull's view of how physics relates to semiotics with Barbieri's biomechanical model of protein synthesis.

Barbieri, M. (2007). Is the cell a semiotic system? In M. Barbieri (Ed.) Introduction to Biosemiotics. Springer:

Cowley, S. J. (2007). How human infants deal with symbol grounding. *Interaction Studies*, 8/1: 81-104.

Kull, K. (2007). Biosemiotics and biophysics - the fundamental approaches to the study of life. In M. Barbieri (Ed.) Introduction to Biosemiotics. Springer: London.

The general theory of evolution

Terrence W. Deacon,
Department of Anthropology
and Helen Wills Neuroscience Institute
University of California, Berkeley
329 Kroeber Hall
deacon@berkeley.edu

NeoDarwinian theory, even in its most abstract expression as "universal Darwinism," can be classified as a *special theory of evolution*, in that it leaves nearly all of the mechanistic detail out of the account in order to focus on what is special about the selection process compared to other natural processes. In other words, although neoDarwinian theory is commonly considered a sufficient explanation of the process of biological evolution, this cannot be the case, because it makes certain non-trivial and quite complex assumptions that are left entirely unspecified. To the extent that the logic of natural selection is classically framed in *a posteriori* terms, such that new variations of structure and dynamics are understood as being generated *irrespective of any eventual functional consequence*, the specific mechanisms producing these variations can be considered irrelevant with respect to their adaptive consequences. Indeed, this allows for a wide diversity of mechanisms to be responsible for the alternative forms that are subject to selective preservation or elimination, and is the major criterion for defining multiply-realizable biological functions, such as flight, photosynthesis, and even thought. But in this respect, natural selection theory cannot be properly described as the *mechanism* of evolutionary change. It is rather an abstract description of the necessary minimal conditions for identifying mechanistic relationships that are capable of contributing to evolutionary change. Thus, for example, if we augment Donald T. Campbell's 1964 abstract characterization of universal Darwinism as "blind variation with selective retention [of certain of those variants with respect to permissive contextual conditions]" we leave *un*-specified all of the following physical attributes of the system in question:

1. the physical properties of the critical components,
2. how these components are produced or synthesized from spontaneously available substrates,
3. the mechanisms that generate variation in these components,
4. how these components and their production interact with and depend on intrinsic and extrinsic boundary conditions critical to the persistence of the system, and
5. what extra-systemic properties determine preservation (or reproduction) of certain variant systems compared to others.

Selection theories therefore are abstractions about what features of *any given mechanistic account* would qualify as describing an evolutionary process. In this analysis all *mechanism* is bracketed out of consideration in order to isolate the special relationships among possible mechanisms that makes an evolutionary process distinctively different. We are not therefore justified in describing natural selection as the "mechanism of evolution" and it is for this reason that it is sometimes described as an algorithm in modern discussions. An algorithm is a description applied to a mechanism, but not in itself a mechanism in the physical sense. So what *is* the mechanism of evolution, and can a general theory of this mechanism be provided that more completely describes all five of the above mechanisms to provide a sufficient explanation of the evolutionary dynamic?

The ***general theory of evolution*** replaces each of these assumptions by specific physical mechanisms which specify the necessary and sufficient physical requirements for reproduction of a thermodynamic system that exhibits all of the following properties:

1. does work sufficient to acquire the necessary substrates to generate all its critical system components,
2. does work to transform substrates into critical system components
3. does work that reconstitutes components' critical dynamical relationships to one another with respect to spontaneous and extrinsic sources of perturbation and dissolution
4. is sufficiently tolerant of structural-functional degeneracy to allow both component and dynamical variation without losing capacities 1-4.

In this paper I demonstrate that such a synergy of physical processes can spontaneously emerge only if certain very specific classes of physical processes are present. These include the presence of at least two component non-equilibrium self-organizing thermodynamic processes (termed morphodynamic or constraint-amplifying processes) which reciprocally generate the boundary conditions that each requires in order to persist. A simple model molecular system with these properties is described, called an autocell, and it is argued that the general properties of autocellularity can arise spontaneously in a variety of forms. Autocellularity is shown to be sufficient to generate a dynamical topology in which intrinsic components can come to exhibit semiotic properties; i.e. represent features of both other aspects of the system and critical features of the environment on which it depends.

This full specification of the dynamical processes required for true reproduction thus constitutes a complete *general theory of evolution*. In addition, this specifies the necessary and sufficient conditions for defining semiosis in its most basic form. It demonstrates that semiosis is emergent from non-equilibrium thermodynamic processes which exhibit a distinctive dynamical topology, which will be termed teleodynamics. One implication is that all higher order forms of both biological and semiotic evolution must ultimately include mechanisms that satisfy these basic requirements. This unambiguously defines the relationship of semiosis to other physical processes.

A practical model of the retina codification and its applications in localization and camera networks

Thibaud Debaecker and Ryad Benosman

UPMC – ISIR, Groupe SIMA,
3 rue Galilée, 94200
Ivry sur Seine, France
ryad.benosman@upmc.fr

The retina contains many levels of neurones –bipolar, amacrine, horizontal and ganglion cells accurately organized from cones and rods to the optic nerve. This structure probably eases the visual cortex and other brain areas tasks in pre-processing the visual information [3]. The presented work is focusing on the study of these specific structures, relying on a bottom up approach to propose a comprehensive mathematical model to the codification operated within the eye by the neural cells [7]. The presented model takes into account the foveolar structure of the retina [1], to produce a low-resolution representation of observed images, by decomposing them into a local weighted summation of elementary luminance information. It combines both the lateral inhibition mechanism and the foveolar structure of the retina and is focused on the local information theory within cells [2]. The initial aim of this work is to inquire on the possible effects of combining variable image resolution and a chain of image codification in order to propose a mathematical model of early retinal image processing, giving the relation between the “retina image” and the “optic nerve image”. We show that this codification is of great importance as it is in itself sufficient for basic spatial recognition and learning tasks. An implementation of a spatial location experiment is presented, it uses the image codification to perform tasks of scenes recognition and localization [4] [5].

In a second stage we will present the implementation of the method on a camera network [6] where cameras replace rods and cones. The camera network uses 42 cameras that observe a common scene but from different viewpoints. The retina codification model is applied on a visual vocabulary used by cameras to describe the scene they observe. The experimental results show, that the codification architecture is fully applicable in this case and will produce highly usable information eliminating local redundancies. Experimental results will show that the provided information can drastically ease different tasks known to be difficult like scene description and 3D reconstructions.

Bibliography

[1] Massimo Tistarelli and Giulio Sandini, On the Advantages of Polar and Log-Polar Mapping for Direct Estimation of Time-to-impact from Optical Flow, Transactions on Pattern Analysis and Machine Intelligence – Vol 15. No 4, April 1993.

[2] S. Thorpe, A. Delorme et R. Van Rullen. Spike based strategies for rapid processing. Neural Networks, vol 14, pages 715–726, 2001.

[3] Riesenhuber, M., and Poggio, T. Hierarchical models of object recognition in cortex. Nature Neuroscience, 2(11), 1019 1025, 1999.

[4] Tarr, M. J. Bulthoff, H. H. Image-based object recognition in man, monkey and machine. Cognition, 67(1-2), 1-20, 1998.

[5] E. Krotkov. Mobile robot localization using single image. Proc. IEEE Int. Conf. On Robotics and Automation, 978–983, 1989.

[6] M. Han and T. Kanade. Creating 3d models with uncalibrated cameras. In *IEEE Workshop on the Application of Computer Vision*, 2000.

[7] Debaecker, T. and Benosman, R. (2007). Bio-inspired model of visual information codification for localization: from retina to the Lateral Geniculate Nucleus. Journal of Integrative Neuroscience Imperial College Press, publisher. Pages 1-33.

A Peircean semiotic approach to alternative RNA splicing and cellular signaling pathways: Implications for the concepts of gene and genetic information

Vanessa Carvalho dos Santos[a], João Queiroz[a,b] and
Charbel Niño El-Hani[a,b] *

[a] Graduate Studies Program in History, Philosophy, and Science Teaching,
Federal University of Bahia, Brazil.
[b] Graduate Studies Program in Ecology and Biomonitoring,
Federal University of Bahia, Brazil.
E-mails
Vanessa Carvalho dos Santos (nessaoaks@yahoo.com.br),
João Queiroz (queirozj@gmail.com),
Charbel El-Hani (charbel.elhani@pesquisador.cnpq.br)

In this paper, we analyze the process of alternative splicing based on Peirce's semiotics and explore the consequences of this analysis for the understanding of the structure and function of genes as well as informational processes in cellular systems. We identify chains of sign triads in interactions that take place in networks of signaling processes involved in the regulation of alternative RNA splicing and discuss how they establish boundary conditions in the cellular context that determine specific patterns of alternative splicing. We work out a number of ideas related to Bruni's analogical-digital consensus and explore how they can be related to the downward determination of splicing patterns through cellular signaling. From these modeling efforts, we derive implications for the understanding of information as semiosis and genes as signs.

* *Corresponding author*

Firefly Femmes Fatales:
A Case Study in the Semiotics of Deception

Charbel Niño El-Hani[a,b], João Queiroz[a,b] & Frederik Stjernfelt[c]

[a] Research Group in History, Philosophy, and Biology Teaching, Institute of Biology
Federal University of Bahia, Brazil.
[b] Graduate Studies Program in History, Philosophy, and Science Teaching
Federal University of Bahia, Brazil.
[c] Center for Semiotics, University of Aarhus, Denmark.
E-mails
Charbel El-Hani (charbel.elhani@pesquisador.cnpq.br)
João Queiroz (queirozj@gmail.com)
Frederik Stjernfelt (stjern@hum.ku.dk)

Mimicry and deception are two important issues in studies about animal communication. The reliability of animal signs and the related problem of the benefits of deceiving in sign exchanges are rather interesting topics in the evolution of signs. In this paper, we intend to contribute to a semiotic understanding of deception by studying the remarkable case of aggressive signal mimicry in fireflies, investigated by the entomologist James Lloyd. We will also consider some ideas advanced by Lloyd about the reasons for communication to evolve towards increasing complexity. Firefly femmes fatales are specialized in mimicking the mating signals of other species of fireflies with the purpose of attracting responding males that become their prey. These aggressive mimics are a major factor in the survival and reproduction of both prey and predator. It is a case of deception through active falsification of information, less efficient than other variants of deception, such as concealment of information, but, despite the limitations of the mimicry at stake, it leads to efficacious capture of prey by femmes fatales fireflies, which are versatile and competent mimics, with fine-tuned deceptions. There are even nested coevolutionary interactions between those fireflies, leading to a remarkable system of deceptive and counterdeceptive signaling behaviors. We develop in this paper a Peircean semiotic model of firefly deception, including this complex network of deceptive and counterdeceptive maneuvers. We agree with Lloyd's claim that deception can trigger the evolution of communication complexity. The important issue here is to realize the extremely slow pace in the evolution of these more and more complex sign exchanges, as compared to the speed of human sign exchange and even as compared to human language development. Even if the deception operations charted here are played out time and time again between particular firefly individuals, the evolution of the next level of complexity – and thus the next utterance in the dialogue between species – is likely to take an immense amount of generations. While the single game is constantly acted out between particular insects out there, the "intelligent" step taking us to the next level of deception in this fly-over-fly game is performed by the evolution of whole species.

Representation in Biology – Expanding the Landscape

Marcella Faria
Center For Applied Toxinology CAT-CEPID, Instituto Butantan,
Av Vital Brasil 1500 05503-900 São Paulo –SP Brasil
marcella@butantan.gov.br

Biological representations are communicated through computers. The exponential growth of available data poses a challenge for experimental and theoretical researchers on the field. Besides concerns in synthesis and analysis of biological information, the simple retrieval of relevant information becomes a complex task. In this context, structures of representation are needed for efficient interpretation of experimentally generated data. The main assertion of the biosemiotics paradigm regarding computers refers to the emergence of meaning in workflows between human queries and experiments. An interesting attempt to represent biological data is Waddington´s epigenetic landscape. In the present work we shall discuss how the landscape framework has influenced systems biology and bioinformatics alike. Finally we shall examine the hypothesis that the consilience (*sensu* Wilson) observed at the level of biological information representation in different areas is brought about by a systematic grasp of the semiotic dimensions (*sensu* Barbieri) of biological information in particular, and of information in general.

Exploring the cognitive landscape of the Robin (Erithacus rubecula) wintering in a Mediterranean region

Almo Farina
Institute of Biomathematics
Faculty of Sciences and Technologies
The University of Urbino
Campus Scientifico Sogesta
61029 Urbino – Italy
almo.farina@uniurb.it

According to the eco-field hypothesis animals use spatial configurations as carriers of meaning to intercept resources that are rare and heterogeneously distributed in space and time. For every function associated to a corresponding resource a specific eco-field is requested, and the quality of each eco-field contributes to the overall habitat suitability in individuals and in populations.

Robin (*Erithacus rubecula*) is a common bird wintering across the Mediterranean region and seems a good candidate to test experimentally the eco-field hypothesis (Farina & Belgrano 2004, 2006). This species breeds in woodlands and forests, and migrates into open park-like rural landscapes (ecotones) outside the breeding period. It becomes common also in urban green fringes. Contrarily to other winter visitors, Robin maintains territorial habits even outside the breeding season. It uses song and alarm calls combined with flight chases to preserve the ownership of the territory from hetero- and con-specific intruders. It seems reasonable to link the intensity and variety of this acoustic repertoire with the quality of the selected territory.

In order to investigate such relationship, 100 foraging sites (15 m apart each others) were provided in a rural area in the Northern Apennines (Italy). In each foraging site, consisting of an artificial platform of a few square centimeters posed on a wood pole 1 meter high from the ground, six Mealworms (*Tenebrio molitor)* larvae were offered during 30 sessions from October to January 2008. The offered preys not removed by birds were counted three times every 40 minutes. Acoustic activity was recorded in 40 of these foraging sites at the sunrise, in the early morning and at the dusk by using digital recorders (Zoom-4). Sound data was processed by using either an automatic procedure of identification of the information on selected frequency classes and counting directly the number of acoustic activity of robin, as well.

From the first results it appears that robins show high preferences along the foraging sites. In particular, Mealworms posed close to shrubs and edges were removed completely during the first 40 minutes. Site preferences also seemed to change according to the daily climatic conditions. The visits to sites located in open conditions were reduced during raining time, but in cold days birds visit also sites that were located far from shrubs, edges or trees. The spatial distribution of the acoustic activity seems independent from the foraging activity at least at the scale of the experimental matrix, especially at dawn and at dusk. This fact allows us to argue that acoustic activity could bee used as a specific acoustic eco-field to maintain a territory and not as a simple indicator of foraging suitability.

Farina, A., Belgrano, A., 2004. The eco-field: A new paradigm for landscape ecology. Ecological Research 19: 107-110.

Farina, A., Belgrano, A., 2006. The Eco-field hypothesis: Toward a cognitive landscape. Landscape Ecology 21: 5-17

Examining the Vital Signs of Biosemiotics in 2008

Don Favareau

University Scholars Programme
National University of Singapore
10 Kent Ridge Crescent Singapore 119260
uspfdf@nus.edu.sg

Confusion reigns both among and beyond the cognoscenti, as to whether semiotics is an approach, or field, or discipline, or method, or theory, or science, or a disease.

– Thomas Sebeok

2008 marks the eight consecutive year we have been meeting together since our initial Gatherings in Biosemiotics at the University of Copenhagen in 2001. It also marks thirty-one years since the historic meeting between Thomas Sebeok and Thure von Uexküll in Vienna, ninety-one years since the death of Charles Sanders Peirce, twenty five hundred years since the first recorded use of the word *semeion*, two million years since the arrival of *homo habilis*, 3.5 billion years since the appearance of the first prokaryote, and approximately fifteen billion years since the collapse of the singularity into what would subsequently become entities, relationships, interaction and signs. Having joined the discussion only at the most recent of this abbreviated history of events, I will take the opportunity this year to review some of the developments that have occurred under the aegis of *biosemiotics* since the convention of that first Gatherings a mere eight years ago; to examine whether or not we have yet come up with a unified program (or even a unified framework) for falsifiable empirical study; and to continue to pursue the question regarding how to "formalize" biosemiotics from a well-justified domain of inquiry into the kind of empirically testable research program that would validate its status within the rest of the scientific community.

Biosemiotics and Self-Reference from Peirce to Rosen

Eliseo Fernández
Linda Hall Library of Science and Technology,
Kansas City, Missouri, U.S.A
fernande@lindahall.org

This paper continues and extends previous work on the functions of **self-referential** relational structures and processes in the articulation of semiotic ideas and hypotheses within biological theory. The inquiry proceeds through an exploration of the various ways in which self-referential loops are tacitly embedded in the interplay of some of the most basic and foundational notions of biosemiotics — notions which are ordinarily conveyed through the informal use of such terms as **signification**, **information** and **purpose**.

The examination proceeds by proposing a new way of understanding Peirce’s account of the triadic nature of semiosis. The manifold correlations that link representamens to their objects and interpretants are clarified through the disclosure and articulation of the implicit function of self-referential relations in semiotic action. These ideas are initially discussed at the level of human language and are subsequently generalized to the level of biosemiotics. This generalization is reached by considering how the disclosed correlations can be partially extended to the sphere of those basic semiotic transactions that obtain within and between organisms and among organic systems in general.

In a separate section there follows a brief account of the explicit role of self-referential processes in Robert Rosen’s modeling of organisms in terms of non-formalizable circularity, as clarified and expanded in a recent revival of his ideas through the work of several authors. The triadic structures within semiotic transactions and those arising in Rosen’s (M,R)-systems are compared.

Finally a new way of conceptualizing purposive behavior is proposed on the basis of the self-referential processes outlined. In this conception historically divergent intuitions about purpose and different forms of causation in the Aristotelian and Kantian traditions are to some extend reconciled. This convergence is reached through the mediation of Peirce’s and Rosen’s seminal ideas.

A Biosemiotic Approach to Neurophenomenology

Giorgi, F.*, Bonfiglio, L., Carboncini, M.C., Rossi, B. and Tramonti, F.
Department of Neuroscience
University of Pisa, Italy
giorgif@biomed.unipi.it

In the scientific tradition, consciousness is interpreted as either epiphenomenal or simply in a dualistic cartesian way. From these points of view, human awareness can only be appreciated as a function of an observable behavior in response to environmental stimuli. However, in more recent times, cognitive sciences have attempted to solve the mind-body dichotomy by considering man's interaction with the surrounding environment as no longer due to some kind of inner representation, but to active behaviors eventually leading to co-evolutionary processes of reciprocal influence. Nevertheless, the cognitive approach is still restricted to the analysis of third person aspects of human consciousness, for it remains essentially unknown how human intentionality can be functionally related to brain activity.

Neurophenomenology is a scientific discipline that attempts to combine neuroscience with phenomenological philosophy. The neurophenomenological conception of human cognition is centered on the idea that all living systems are naturally autopoietic, that is, capable of producing their own structural components and maintaining their organization in a bounded condition. From this point of view, cognition is seen as a form of adaptation, not in a representational way, but as an active construction of the internal organization in response to several environmental disturbances.

Consciousness is thus manifested in a relational context as a personal integration of one's perception and experience. However, the unitary sense of feeling, thinking and acting that results from this integration must be continually updated for allowing individuals to interact constructively with the surrounding environment. To attain this goal it is assumed that such processes as attention and short-term memory are maintained by automatic mechanisms of the brain neural activity. For instance, the coherent perception of different stimuli is thought to be attained by making temporally connected the activities of spatially distributed neuronal groups. Synchronization is thus the key brain activity that can actually guarantee a pre-attemptive behavior and a conscious response to the selected environmental stimuli.

In this paper we show that one of the essential mechanisms guaranteeing neural synchronization in the human brain is eye blinking. In fact, considering consciousness as a sequence of attention and memorisation processes, spontaneous blinking may have a role to play as an external pace maker setting the rhythm for these alternating phases. The rhythm implicated in this blinking appears therefore to define the temporal duration of each individual phases of perception. By attempting to explain this phenomenon riductionistically we can only aim at justifying the existence of their functional coupling in causal terms, that is, eye blinking should determine neuron synchronization by necessity and always precede it. However, by doing so we would miss to understand the actual significance of their temporal relationship, while by interpreting it biosemiotically we can actually account for both the functional necessity of neural synchronization and the contingency of its coupling with eye blinking as a potential mechanism to compensate its temporal decay.

* *Corresponding author*

Ecosemiotics and the Collapse of Ecosystems

Peter Harries-Jones
Department of Anthropology,
York University, Ontario
peterhj@yorku.ca

Arising from James Lovelock's propositions about Gaia: organisms interact in biotic feedback processes, indeed co-operate with other biota, to render Gaia's abiotic composition more suitable for life. Add to this a *semiosphere* (Hoffmeyer, 1996), a communicative order where meaningful adaptation and co-evolution and between organisms occurs. Add also second-order communicative patterns of mutualism and recursion emphasized by Gregory Bateson. Bateson argued that any condition of ecosystem collapse would be characterized first by a collapse in its communicative order rather, than from changed physical states. Recent evidence about disappearance of organismic 'go betweens' in this communicative order, such as bees and other pollinators, is a seeming confirmation of Gregory Bateson argument. The paper profiles decline of these go-betweens, especially the sudden disappearance in the United States of managed bee colonies. Lovelock (*The Revenge of Gaia*, 2006) does not consider the prospect that the communicative aspects of ecosystem order would precede physical degradation (entropy). This paper suggests a) that as a result of global warming there is a disjunction between bees feeding and pollinating cycles and the life cycle of plants b) that understanding differences in "timing cycles" is the key to understanding the disappearance of the bees and c) that visualizing this pattern requires a topology of timing cycles and their recursion. It concludes with some recent examples of such a topology and its application to the revived empirical science of phenology, or recursive patterning of life-cycles.

:

A Biosemiotic Approach to a Theory of Meaning

Jesper Hoffmeyer
Department of Molecular Biology
The Biosemiotics Group
Ole Maaløvej 5,
DK 2200 Copenhagen N, Denmark
jhoffmeyer@mail.dk

The semiotic approach to the study of the biological world implies that from the moment semiosis first began to manifest itself in the first living units, or cells, a new dynamic principle was superimposed upon the already established dynamics of emergence as exhibited by complex chemical systems (sensu Kauffman (2000)). From now on what happened to living entities would be greatly influenced by an interpretative activity that is free in the sense of being underdetermined by physical lawfulness. Translated to biology this means that cells would now engage in intentional activities: Their activities would not simply refer to the outer world but would do so only in a contextual setting of their internal self-referential system (the genomic system). Living entities became intentional systems - subjects in a sense - because they had established channels for an integration of other-reference (through surface receptors) with self-reference (Hoffmeyer 1998). At first they were of course only marginally intentional but this new dynamic principle, semiosis, would have a self-perpetuating logic to it, so that semiotic freedom started to grow.

This understanding establishes a basis for a new theory of meaning that reflects the deep dynamics of life itself. For meaning is nothing more and nothing less than the formation of interpretants in the Peircean sense, i.e., the formation of a relation between a receptive system and a supposed object due to the action of a sign that somehow itself is related to that same object. Interpretants are of course dependent on natural laws, but not in a determinate way, for the contextual situation in which the interpretant is produced greatly influences its formation. Contextuality is significantly influential even at the cellular level, as when for instance one lymphocyte will respond to a given neuropeptide gradient by moving upstream while an identical lymphocyte with another prehistory may instead start dividing itself upon recognizing the same neuropeptide gradient.

Meaning according to this theory remains a local and situated phenomenon. But this does not detract from the power of meaning. On the contrary, one might say that exactly this local situatedness of meaning as connected to the concrete life processes of each individual living organisms, implies that meaningfulness does in time come to play an ever more important role. The evolutionary growth in semiotic freedom is precisely the outcome of this globally distributed swarming variety of infinitely many semiotic processes that in all and every case involves the formation of chains or webs of interpretants.

Hoffmeyer, Jesper (1998). "Surfaces Inside Surfaces. On the Origin of Agency and Life." *Cybernetics & Human Knowing* 5(1): 33-42.
Kauffman, Stuart (2000). *Investigations*. Oxford/New York, Oxford University Press.

The Topos of Virtuality

Wolfgang Hofkirchner and Rainer E. Zimmermann

ICT&S Center, Paris-Lodron-Universität Salzburg, Sigmund-Haffner-Gasse 18, A – 5020 Salzburg /
Bertalanffy Center for the Study of Systems Science, Vienna.
Wolfgang.Hofkirchner@sbg.ac.at
Institut für Philosophie, U Kassel / Clare Hall, UK-Cambridge / Lehrgebiet Philosophie, FK 13, Hochschule
München, Lothstr. 34, D – 80335 München.
rainer.zimmermann@hm.edu

Cf. Rainer E. Zimmermann: Topological Aspects of Biosemiotics, tripleC 5(2), 2007, 49-63.
Cf. Wolfgang Hofkirchner: A New Way of Thinking and a New World View, Cybernetics & Human
Knowing Vol. 11/No. 1, 2004, 63–78.

Generalizing the conceptual approach to a theory of biosemiotics which is primarily based on insight from mathematical topology, we discuss here the relevance of the cognitive representation of the category of space in terms of the consequences implied by topos theory: We show in particular what kind of epistemic conclusions can be drawn from the results and by doing so establish important relationships among the concepts of social space, networks, systems and evolutionary games on the one hand and semiosis on the other. We can thus achieve a suitable reconciliation of both the onto-epistemic approach of the Kassel group and the evolutionary approach of the Salzburg group, respectively, carrying us forward among other things to fundamental aspects of a unified theory of information. While the first paper deals with general spaces, this second one deals with applications to virtual space proper.

Virtuality can be defined, in a general way, as “possibility space” – a term which resembles the phase-space concept in physics as well as the concept of “degrees of freedom”. It will be argued that virtuality in the sense of a space of possibilities is crucial for semiosis. Sign production is impossible without selecting possibilities. The respective ontological assumption has been termed by one of us elsewhere less-than-strict determinism. Self-organizing, evolutionary systems are endowed with possibility spaces. In the course of evolution, living systems show an ever increasing bandwidth of possibilities.

Does a Glass of White Wine Taste Like a Glass of *Domain Sigalas Santorini Asirtiko Athiri 2005*? A Biosemiotic Approach to Wine-Tasting.

Jonathan HOPE [1] and Pierre-Louis PATOINE [2]
[1] 6361 de Chateaubriand. Montréal, Québec H2S 2N5
jo_hope11@hotmail.com
[2] 1927, rue Alexandre-deSeve, apt 316, Montreal (Quebec) H2L 2W2
pl_patoine@yahoo.fr

Three samples of wine stand before you, two of which are identical. You're asked to taste and smell each, then indicate the odd one out. If you are an expert sommelier, you will perform much better than a novice (Salomon 1990, experiment 3). The reason why sommeliers can discriminate wines and novice drinkers can't, resides in their conceptual, procedural and linguistic capacities. Hence, knowledge plays an important role in the very tasting and smelling of wine (Hughson and Boakes 2001, Ashkenazi 2006).

As a recent functional magnetic resonance study of wine-tasting has revealed (Castriota-Scanderberg *et al* 2005), the cerebral activation profile of a sommelier significantly differs from that of a naïvedrinker. While the uninitiated's neural response to wine tasting relied mainly on the amygdala, implicated in emotional processing, the expert's involved the left insula and adjoining orbito-frontal cortex, both areas being associated with gustatory / olfactory integration, and the dorsolateral prefrontal cortex, which is related with high-level cognitive processes such as working memory and selection of behavioural strategies. But do those differences show that sommeliers and naïve tasters have different sensory experiences?

Many neuroscientists today defend the idea that: "patterns that underlie the qualities of experience lie in neural networks in the brain; stimuli may trigger the patterns but do not produce them." (Melzack & Katz 2004). This is what the Castriota-Scanderberg experiment suggests: the same stimuli produced by the same wine, activates different neural patterns in different brains, thus leading to different sensory experiences.

Biosemiotics can tell us a lot about this fascinating phenomenon. Our objective is to examine wine tasting using notions and principles properly semiotic. For instance, the now classical distinction between the environment and the surroundings (Uexküll, especially 1934, 1940) – the former, the world as it is known, the latter, the world ignored – can help us describe how same objects can produce different experiences. Semiosis (Peirce 1907), explaining how ignored elements are recycled or changed into meaningful ones, may also be of use in order to describe learning, skill aquisition, or the growth of knowledge at work in the epistemic and aesthetic wine tasting experience.

Individuation as a General Framework for Semiosis

Vefa KARATAY[1] and Yagmur DENIZHAN[2]
[1] Molecular Biologist
vefakaratay@yahoo.com
[2] Assoc. Prof. at the Electrical and Electronics Engg. Dept.,
Bogazici University, Istanbul/TURKEY,
denizhan@boun.edu.tr

It has already been suggested by some biosemioticians that the process of semiosis can be related to a processual interpretation of the concept of information based on Peircean semiotics. In that context semiosis is defined as "a triadic process of communication of a form from an object to an interpretant by mediation of a sign". However, concepts referred to in this definition -like "process", "form" and "communication"- have diverse definitions in various disciplines and ask for a firm grounding on basis of a more general framework. Without such grounding the models to be constructed can easily become prone to reductionistic fallacies, or alternatively, be regarded as too metaphorical to be scientifically appropriate.

A worthy candidate for such a philosophical framework may be the overarching notion of individuation, which is of central importance for ontology and has been elaborated by many leading philosophers like Kant, Peirce, Simondon and Deleuze, to name a few. Particularly Simondon's interpretation of individuation as a meta-process that describes the emergence of spatio-temporal forms (including processes and principles themselves) seems to provide a very relevant clue.

Adopting the point of view that semiosis entails a processual definition of information, we will attempt to establish semiosis within the framework of individuation. We will investigate whether a general framework based on individuation can encompass the relatively limited definitions of "process", "form" and "communication" accepted by single disciplines as special cases under specific assumptions.

Key words: Individuation, semiosis, information

Eye for Eye: On the evolution of Semantic Organs by Means of Signification

Karel Kleisner
Department of Philosophy and History of Science
Charles University, Prague
kleisner@seznam.cz

The eyes are regarded as the doors to the soul. Eyes of vertebrates mark the position of the head, which is a critical part of their body. The development of eyespots on body parts other than the head (which is found in many groups of insects, fish, amphibians, reptiles etc.) therefore has a good reason, as they potentially confuse an aggressor. Some kinds of eyespots tend to be almost as eye-like as the eyes themselves, which is no surprise either. It has been shown experimentally that, for instance, “eye-like” concentric structures with a central pupil are much more convincing than simple rings without a central spot. It has also been well known that eyespots displayed on the wings of butterflies may intimidate an avian predator or even deflect an attack. This is a good reason for the eyespots to be as much eye-like as possible. But the question remains: why do real eyes (i.e., organs of vision) themselves still look like eyes? Consider the differently coloured concentric circular structures – the pupil, iris and sclera – in many craniates including humans. The differences in the colouration and appearance of the eye structures are not important for the sense of sight. Here I propose that the role of the eyes is bimodal. The eyes are not only for seeing, but they are also intended to be seen. The eyes should therefore be considered as (1) semantic organs (semes) with a signalling role and as (2) organs of vision serving their usual physiological purpose. Because some imitations of the eyes (i.e., eyespots or fake eyes) play the same semantic role as real eyes, I propose that they should be regarded as *homosemiotic* (Kleisner, 2008). Only those eye imitations that are being mistaken for real eyes – that is, those that gain the same meaning as real eyes in the umwelt of a particular animal interpreter – may be further perfected in evolution, for example, by selection on the part of an avian predator. They thus become more and more similar to the interpreter's implicit representation of the eyes and are consequently recognized as eyes with increasing probability. *Generally, the evolution of semantic organs cannot proceed without signification. This principle is important for the evolution of mimicry and related phenomena.*

Linguistic semiosis and the bounds of human cognition

Alexander V. Kravchenko
Department of English, Baikal National University of Economics and Law.
Irkutsk, Russia
sashakr@isea.ru
sashakr@hotmail.com

In the biological theory of cognition (Maturana 1970) signs are relational phenomena observed by interacting agents in their cognitive domain (first-order consensual domain). Ontologically, linguistic signs are a kind among many other kinds of signs grounded in the physical context of interactional behavior, and as such they are purely phenomenological entities. What makes them different from other signs is that they are constitutive of a particular kind of recursive behavior in which components of the first-order consensual domain (physical spoken words) are used without the consensual domain, thus establishing a linguistic domain of interactions or a second-order consensual domain we call *languaging* (Maturana 1978).

An individual may interact with another individual in their consensual domain, or he may interact with another individual when there is no consensual domain, and do it with the help of language. By interacting with another individual outside his consensual domain, a speaker establishes the relational domain of linguistic interactions. It is a second-order consensual domain because utterances, being grounded in first-person experience, orient each of the communicating individuals with respect to their consensual domains. In doing so, they help establish common ground for understanding by referring to similar individual experiences. Thus speaking may be viewed as an alternative cultural medium that can override the natural medium and be utilized to control enactive experiencing (Bottineau, in press). In this, language as a relational domain of interactions serves two functions: extending the human sensorium (Morris 1938) and construing multiverses (Kravchenko 2003; Kull 2006). Linguistic semiosis is the process of construing multiple realities, and this is the only reality humans can cognize.

References.

Bottineau, D. (in press). Language and enaction. In J. Stewart, O. Gapenne and E. Di Paolo (eds), *Enaction: Towards a new paradigm for cognitive science*. Cambridge, Mass.: MIT Press.

Kravchenko, A V. (2003). The ontology of signs as linguistic and non-linguistic entities: a cognitive perspective. *Annual Review of Cognitive Linguistics* 1. 179-191.

Kull, K. (2006). Life is many: on the methods of biosemiotics. In G. Witzany (ed.), *Biosemiotics in Transdisciplinary Contexts*. Umweb. 193-202.

Maturana, H. R. (1970). *Biology of Cognition*. BCL Report # 9.0. University of Illinois, Urbana.

Maturana, H. (1978). Biology of language: The epistemology of reality. In G. Miller and E. Lenneberg (eds.), *Psychology and Biology of Language and Thought*. New York: Academic Press. 28-62.

Biosemiotic concept of species

Kalevi Kull
Department of Semiotics, University of Tartu, Tiigi Str. 78
50410 Tartu, Estonia
kalevi@zbi.ee

Species is a central biological phenomenon that requires – and has – a clear biosemiotic explanation. Vast majority of biological structures is a result of semiosic communication. The problem of the origin and nature of species can be solved via a semiotic explanation, if demonstrating a general mechanism that is responsible for the natural categorizations in semiosic webs.

In case of biparentally reproducing organisms, the necessary mutual recognition of individuals will lead to the limited variability of populations as related to the widths of individual recognition windows. Simultaneously, it leads to hiatuses between the relative sympatric species. Uniparental reproduction *per se* is insufficient for making species, because it lacks such self-limitation of variability due to the absence of requied communication.

Biological species is a relational phenomenon. Thus the features of a particular species cannot be deduced from the universal laws of physics and chemistry – and not only because of the chaotic variability of organisms, but because of the downward causation that creates the connections between organisms and keeps them together. The self-organisation of biparentally reproducing organisms into species is a special case of a more general process of semiosic categorisation. It is an example of a general consequence of communication – a decrease of difference between the regularly communicating individuals.

History of the biosemiotic view on species can be traced back more than a century. This includes somewhat similar views of G. Romanes, S. Butler, W. Petersen, G. Bateson, H. Paterson, etc.

Context and Variability as Problems in Plant Development and Biosemiotics

Jacqueline Lück [1] and Peter W. Barlow [2 *]
[1] Atelier de Structuralisme Végétal, Chemin du Val d'Arenc, Le Beausset, France;
[2] School of Biological Sciences, University of Bristol, Bristol, UK
p.w.barlow@bristol.ac.uk

There are two problems still to be solved by biologists; and perhaps they are problems which can also be considered from the point of view of Biosemiotics. The first concerns the role of 'Context' in development; the second concerns the generation of 'Variability' within a developmental system that is largely invariant.

With regard to 'Context', the hypothesis of Hermann Vöchting (formulated in the 1870s) that, in plants, "The developmental behaviour of a cell is determined first of all by the morphological position it occupies in the organism as a whole" still holds good [1]. Unfortunately, there are very few systems in higher plants where this hypothesis has been, or can be, examined experimentally. And, regrettably, it may even be the case that, nowadays, the paradigm of 'positional information' has been forgotten by plant biologists.

The question of 'Variability' is related to 'Context'. From a theoretical stance, we arrive at a view that is shared by animal biologists [2]. That is: the determination of cellular identity can be modulated, even within an internal context (the tissue environment) which is constant. What is required is that there should be a gradient of 'morphogen' along which there is a series of concentration thresholds which determine different cell type. Then, to achieve cell-type modulation, the entry into, and passage of cells through, the gradient must be variable.

The variable determination process is accomplished by a deterministic cell division system. The role of the division rule has been exhaustively explored in secondary phloem and xylem (wood) development of trees [3] where repeated groups of varied cell types in these two tissues can be found. Interestingly, the same basic concept as mentioned above applies to many animal systems, such as the segmentation pattern of chordates [see refs 4 and 5, where the similarities between the plant and animal systems are indicated]. Now, it has been found possible to construct a Petri Net [6] which accommodates all the cell types and the sequence of their formation. The Net explicitly combines context with variation. Although this developmental scenario can be precisely formulated in theoretical terms, is it possible that there can also be a complimentary formulation from biosemiotics?

1. Barlow PW, Carr DJ (editors). (1984). Positional Controls in Plant Development. Cambridge University Press, Cambridge.
2. Wolpert L. (1996). One hundred years of positional information. Trends Genet 12, 359-364.
3. Barlow PW, Lück J. (2006). Patterned cell development in the secondary phloem of dicotyledonous trees: a review and a hypothesis. Journal of Plant Research 119, 271-291.
4. Barlow PW, Lück J. (2004). Cell division systems that account for the various arrangements and types of differentiated cells within the secondary phloem of conifers. Plant Biosystems 138, 179-202.
5. Barlow PW, Lück J. (2005). Repetitive cellular patterns in the secondary phloem of conifer and dicot trees, and a hypothesis for their development. Plant Biosystems 139, 164-179.
6. Barlow PW, Lück J. (2007). Rhythms and morphogenesis. In Mancuso S, Shabala S (Eds) Rhythms in Plants: Phenomenology, Mechanisms, and Adaptive Significance. Springer, Berlin. pp.219-243.

* *Corresponding author*

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

Timo Maran
University of Tartu, Department of Semiotics
Tiigi Str. 78, 50410 Tartu, Estonia
timo.maran@ut.ee

Brood parasitism is a widespread phenomenon that has independently emerged in many bird genera. It has been a favorite object of study for behavioral ecology and other neo-Darwinian paradigms and has been interpreted in these as an example of co-evolutionary process or 'arms race' between parasites and host species. Brood parasitism could also be a relevant topic for biosemiotics as it involves similarity, recognition, deception, learning and communication. At the same time the specificity and complexity of the real cases of brood parasitism may show that the generalizations made in biosemiotics about semiotic processes in nature are too broad.

In this presentation I will discuss the semiotic, communicative and contextual aspects of brood parasitism. Attention will be mostly paid to the common cuckoo *Cuculus canorus* and its passerine host species. Recent biological and semiotic literature will be consulted and the diverse relations between the egg appearance, recognition abilities and behavior of the birds will be brought out. Mimicry theory will be used as the starting point for the interpretation but the need for more elaborate semiotic analyze methods will be argued. Relations to environmental context, species self-recognition, and supernormal stimuli will be discussed.

Special attention will be paid to the communicative involvement of humans in the mimicry system of brood parasitism. On the theoretical level this emerges in the form of cultural presumptions and selection of concepts used in describing the phenomenon; in practical research it becomes evident in the use of artificial eggs and fake birds in experiments.

Quantum Mechanical Underpinning of Biosemiotics

Koichiro Matsuno
Nagaoka University of Technology
Nagaoka 940-2188, Japan
CXQ02365@nifty.com

Biosemiotics set its foundational ground upon quantum phenomena in the material world. A quantum conceived within the framework of quantum phenomena in the material realm is intrinsically semiotic of itself. What characterizes each quantum is in establishing synchronization within the material organization called a quantum. Material bodies constituting each quantum are constantly participating in the activity of synchronizing among themselves. Synchronization is a triadic process, in which there is a tripartite relationship among a clock to be read out, another clock to be adjusted and the activity of adjusting one to the other. There is however no such material scheme of synchronization in classical sciences, since in the latter some immaterial scheme of synchronization has been imposed and declared globally from the outset. Empirical evidence suggesting the material process of synchronization is found in double-slit experiments of Thomas Young type, especially in those applied to material particles such as electrons as implied by Davisson and Germer in 1927. The empirical observation that a single electron can interfere with itself demonstrates attainment of synchronization even within the electron. Each quantum serves as a material embodiment of a physical scheme of synchronization. That is semiotic, more than anything else. At the same time, the notion of synchronization can go beyond the confinement of each quantum if interactions between quanta are allowed as a matter of course. Occurrence of interactions of material origin is semiotic when the process of synchronization is perceived in a bottom-up manner. A most conspicuous case of that in the bottom-up manner can be envisaged in the phenomenon called the emergence of life.

A Novel Mathematical Proof of Peirce Reduction Thesis and its Relevance for Understanding Biosystems

Ophir Nave
Department of Mathematics & Office for Interdisciplinary Research
Ben-Gurion University of the Negev
naveof@cs.bgu.ac.il

Peirce Reduction Thesis suggests that all relations higher than triads can be reduced to triadic relations. This thesis has important implications for understanding biosystems because it suggests that they can be reduced to triadic sign-relations. The aim of this presentation is to suggest a novel proof of Peirce Reduction Thesis. First, I formalize Peirce relations by using the mathematical concept of group G and its subnormal Series $G_{i+1} < G_i \ \{i = 1 \ldots .n\}$. In addition, I redefine those relations by using the terms "abelian objects" and "length relation". Then, by using the main result of Jordan-Holder Theorem I prove the thesis and discuss the implications of this proof.

Keywords: Peirce's reduction thesis, biosemiotics, group, semiotics and mathematics.

Why Do We Need Others?

Yair Neuman PhD
Ben-Gurion University of the Negev, P.O. Box 653, Beer-Sheva 84105,
Telephone: 972-8-6461844 (Office), Israel
yneuman@bgumail.bgu.ac.il

Despite the fact that living system are usually described as *self*-organizing systems, the identity of a living system cannot be established from *within* but only through a "mirroring stage" that involves coupling with another external system. Two illustrative examples are the immune-self and the psychological self. In both cases, the self is established through interaction with the non-self, and the non-existence of a non-self might leads to severe pathologies. In this talk, I would like to explain why mirroring is necessary for establishing self-identity both in biology and psychology. This abstract explanation, which relies on ideas from semiotics and mathematics, supports the primacy of the interactionist perspective and points to the relevance of biosemiotics for understanding the self.

Endomembrane System as a Representation of the Extracellular Medium

Mehmet Ozansoy[1] and Yagmur Denizhan[2 *]
[1] Dept. of Molecular Biology and Genetics, Neurodegeneration Research Laboratory
[2] Electrical and Electronics Engineering Department
Bogazici University, Istanbul - Turkey
denizhan@boun.edu.tr

As a basic biological system the cell must have a representation of the self and its environment. Part of this representation is contained in the genetic code. But the biosemiotic approach has also indicated the importance of the so called “analog code”. On the other hand, the partial representation in the genetic code seems to refer more directly to the “self” and only indirectly to the environment. Thus one may ask whether this indirect representation in the genetic code along with the analog code is sufficient for the cell to cope with the extracellular environment. To answer this question the nature of the indirect representation of the environment in the genetic code and its link to the environment must be analysed further.

The first place to look for such a link is the cell membrane, the interface between the cell and the extracellular space. Particularly in eukaryotic cells the membrane exhibits a complex structure extending from the apparent separator between the cell interior and exterior to the intricate endomembrane system, which includes the endoplasmic reticulum, the Golgi apparatus, lysosomes and other vesicles. This system compartmentalises some biochemical pathways and biosynthetic processes like phagocytosis, receptor internalisation, modification of the proteins to be secreted and their secretion to the environment. Already basic cell biology textbooks indicate the fact that the interior of the endomembrane system is topologically equivalent to the cell exterior, but the semiotic nature of this equivalence seems not to have been sufficiently addressed yet.

The attempt to interpret the internal space of the endomembrane system as a representation of the cell exterior leads to the following line of thought:

First of all, the internal space within the endomembrane system cannot be steadily adapted to the changes in the cell exterior since it does not have a direct contact to it. In view of this fact one may hypothesise that the medium within the endomembrane system must be serving as a conserved memory about the exterior conditions during the course of evolution of the eukaryotic cell. The fact that the endomembrane system cannot be synthesised by the cell de novo and must be inherited from the mother cell during cell division supports this hypothesis.

Key words: Endomembrane system, representation, inside exterior

* *Corresponding author*

What Makes Sammy Chirp?
The Biosemiotics of Interspecies Signalling and Communication

Stephen Philip Pain
Kongensgade, 15 1-sal,
5000 Odense C. Denmark.
biorhetorics@mail.dk

Abstract

In this paper I shall analyse how cat "chattering" or "chirping" functions within an urban context, basing my approach on the study of a young Norwegian Forest cat ("Sammy") and his daily interactions with nearby pigeons, crows (mostly rooks and jackdaws) and seagulls. I will also examine whether the cat and birds interact in a semiotic manner. What is the significance of increased vocalisation in both duration and intensity. Is the chattering species-dependent? How does attention play a role in chattering and cawing? The paper will look also at the evolutionary background and at how chattering develops in the lifecycle of a cat. In addition the author shall draw on recent cognitive research in feline communication, refer to comparative studies of chattering in other felines, including "big cats". The paper will include an ethogram of a cat's reactions to a whole host of bird songs and communication. It will propose the development of feline "entertainment" media so as to prevent "house cats" or captive felines from being stressed, and as a complement in the treatment of frustration-aggression disorders.. As with other papers, the author will finally seek to provide a biosemiotic model of how information in these communication acts are represented to the animals involved.

Keywords: Interspecies communication, Feline behaviour, Ethograms, Frustration-Aggression, *Umwelt*

Semiotic Approach in Biology: Relating Theoretical Bases to Applied Models

João Queiroz[a,b], Claus Emmeche[c], Kalevi Kull[d] and Charbel El-Hani[a,b] *

[a] Research Group in History, Philosophy, and Biology Teaching, Institute of Biology,
Federal University of Bahia, Brazil.
[b] Graduate Studies Program in History, Philosophy, and Science Teaching,
Federal University of Bahia, Brazil.
[c] Center for Philosophy of Nature and Science Studies
Faculty of Sciences, University of Copenhagen, Denmark.
[d] Department of Semiotics, University of Tartu, Tartu, Estonia.
E-mails
João Queiroz (queirozj@gmail.com),
Claus Emmeche (emmeche@nbi.dk), Kalevi Kull (kalevi.kull@ut.ee),
Charbel El-Hani (charbel.elhani@pesquisador.cnpq.br)

Biosemiotics is a growing field that investigates semiotic processes in the living realm in an attempt to combine the findings of the biological sciences and semiotics. ‘Semiotic processes’ are more or less what biologists have typically referred to as ‘signals’ and ‘information processing’ in biosystems, but these processes are here understood under the more general notion of *semiosis*, i.e., the production, action, and interpretation of signs. Thus, biosemiotics can be seen as biology interpreted as a study of living sign systems. In other words, biosemiotics is a field of research investigating semiotic processes (meaning, signification, communication, and habit formation in living systems) and the physicochemical preconditions for sign action and interpretation. In this paper, we discuss the theoretical bases for the biosemiotic approach, including current discussions about information talk in biology, central ideas in Peirce’s semiotics, and a Peircean account of information as a process. We also strive for doing applied biosemiotics, developing models of two semiotic processes in cellular systems, namely the processing of genetic information, focusing on transcription and translation, and signal transduction in B-cell activation. Even though we presented results from these modeling efforts elsewhere, our intention here is to go beyond these previous results in our ongoing effort to propose applied biosemiotic models.

* *Corresponding author*

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

Joanna Rączaszek – Leonardi
University of Bologna, Italy & University of Warsaw, Poland
raczasze@psych.uw.edu.pl

The view of symbols as constraints on dynamics, developed to understand control processes in living organisms (Pattee 1977, 1987, 1996, 2001), is attractive also for theories of language. This paper examines the notions of "symbol", "epistemic cut" and "semantic closure" proposed in Pattee's work from the perspective of a psycholinguist.

Earlier it has been shown that this framework helps identifying the kinds and time-scales of dynamics relevant to the explanation of natural language structures (Rączaszek – Leonardi & Kelso, 2007). What is even more significant, "unburdening" symbols of their role as "meaning containers" and acknowledging the inevitability of their reliance on context leads naturally to the efficiency of language (see e.g. Barwise and Perry, 1983), without losing the potential for the productivity of a system.

However one of the issues that need to be addressed is whether the framework introduced to describe communication and control in living organisms is sufficient to capture the communicative and coordinative processes of the natural language. One of the features that seem to characterize natural language is the ability to adapt its structures on-line to fulfill the interpersonal coordinative role; another one is the fact that symbols of language are seen by the interpreter as produced intentionally by the speaker. The paper is a reflection on the centrality and uniqueness of these properties for natural language and on the sufficiency of the frameworks designed to explain information in living organisms to capture them.

Bibliography

Barwise, J., Perry, J.R. (1983). *Situations and Attitudes.* Cambridge MA: Bradford Books/The MIT Press.

Pattee, H.H. (1977). Dynamic and Linguistic Modes of Complex Systems. *International Journal General Systems, 3,* 259–266.

Pattee, H.H. (1987). Instabilitites and Information in Biological Self-Organization. In: F.E. Yates (ed.) *Self-organizing Systems: The Emergence of Order.* Plenum Press, NY, London.

Pattee, H.H. (1997). The Physics of Symbols and the Evolution of Semiotic Controls. In: *Proceedings from the Workshop on Control Mechanisms for Complex Systems: Issues of Measurement and Semiotic Analysis.* Santa Fe Institute Studies in the Sciences of Complexity, Addison Wesley, Redwood City, CA.

Pattee, H.H. (2001). The physics of symbols: bridging the epistemic cut. *Biosystems,* 60:5-21

Rączaszek-Leonardi, J., & Scott Kelso, J. A. Reconciling symbolic and dynamic aspects of language: Toward a dynamic psycholinguistics. *New Ideas in Psychology* (2007), doi:10.1016/j.newideapsych.2007.07.003

A proposal on Biosemiotics

Walter Riofrio
Theoretical and Evolutionary Biology Researcher
Neuroscience and Behaviour Division,
Universidad Peruana Cayetano Heredia
Lima-PERU
Walter.Riofrio@terra.com.pe

In this presentation, we propose to use an evolutionary approach to help understanding some of the questions related with certain issues in biological information. Biosemiotics as the study of signs, of communication, and of information in living systems has to deal with the important problem of to explain the emergence of biological information in naturalistic terms. In our talk, we will present an argument showing how it is possible to shed new light on the emergence of a dynamic self-organization which conveys the capacity to react adequately, to some extent, due to interactions with signals inciding on the system.

It is our line of reasoning that the nature of biological information does not stop at the mere idea of genetic information but is rooted in the foundations of biological phenomena. We propose that information arises in the physical world as ‘information-with-biological-meaning’ or **bio-meaning**. In this way, information will always be ‘meaningful information for the system’.

We think that any matter-energy variation (sound wave, concentration of a chemical compound, change in pH, etc.) could be a ‘potential information’ carrier. The information (with biological meaning) is created on the inside of the system (biological systems). This ‘potential information’ becomes ‘information with meaning for the system’ since it has the capacity to produce *something* –an effect- in the system. The effect has a repercussion in the system, influencing its own dynamic organization.

The effect of the system that has meaning for the system can be in the maintenance or the increase of the system cohesion (Collier’s notion of cohesion). As well, the effect could produce some level of interference in the system cohesion, possibly interrupting one or more processes. In all cases, whether an effect in favour of or in contrast to cohesion, the system will develop some type of response that will be correlated to that meaningful information and the process or processes enveloped by the effect. Our biosemiotic proposal could work because we connect the emergence inside the system of meaningful information with the coordinated emergence of biological functions in the local interactions of a network of processes, and a combination of both, produces the emergence of a global property of the system called autonomy.

Consequently, it is from this initial emergence in the physical world that we can postulate that information (with meaning) has the possibility of increasing the levels of complexity and sophistication we observe in the biological world.

Interpersonal relationship in everyday life: a semiotic model

Ingolf Schmid-Tannwald
Faculty of Medicine, Department of Obstetrics and Gynecology
Division of Theoretical Medicine
Ludwig Maximilians University of München, Pettenkoferstr. 8 a
D-80336 Munich, Germany
ingolf.schmid-tannwald@med.uni-muenchen.de

General system theory is an interdisciplinary field of science studying the nature of complex natural, social and scientific systems thus providing a formal interdisciplinary scientific theory of interacting elements (subsystems) forming a whole (system) when taken together[1]. Within systems new properties emerge that are not yet present in the separate elements. Applying general system theory to human individuals their unique biological and interpersonal reality may be represented by two interacting elements within a hierarchically-structured system model (i.e. according to their appearance during evolution).[2]

Semiotics, the study of signs and symbols, provides a common denominator for various sign-systems (codes) or realities. Thus semiotics can describe the interactions *within* (horizontally) the elements and *between* (vertically) the subsystems, i.e. "up- or downward effects", top-down or bottom-up causation) of the system model of man by sign-related cause-and-effect relations. These are *linear* triadic sign processes ("semioses" or "flows of signs") being pushed forward by a signaling or an instrumental behavior of numerous interpreters (cells, structures or persons) as represented by a chain of numerous interconnected general models of semiosis.[3]

The interpersonal and somatic interactions are represented by sign-related cause-and-effect relations (i.e. by *circular* sign-processes or Situations- and Funktionskreise [4]) between the elements of the system and its surroundings. If we assume a person as the "surroundings" of another person then an interpersonal relationship may be represented by two hierarchically-structured system models of man. As an interpersonal relation is established and maintained by the mutual interest of both partners *in real time*, this mutual interest may be represented by horizontally conjoined *Situationskreise* (circular semioses) interconnecting both system models functionally. Thereby a supra-system is constituted enabling a never-ending code adaptation process by "meaning testing" and "actions testing" in the imagination of each subject on an interpersonal level. By code adaptation an interpersonal or common reality is constituted between both partners. In a similar way somatic (e.g. sportive, sexual) interactions are started and maintained by interconnected *Funktionskreise* on a biological level.

This model may be helpful for studying and teaching the fundamental rules of many kinds of interpersonal relationships in *real time* (e.g. the heterosexual couple and the emergence of procreation, the relationship of the physician and his patient with its various realities).

---

[1] L. v. Bertalanffy, General System Theory (Braziller, New York, 1968)

[2] Schmid-Tannwald I.: The Integration of the biological and the social reality of the phenomenon of man in a system model. Presentation at The STOQ International Conference on „Ontogeny and Human Life“. Pontifical University "Athenaeum Regina Apostolorum", Rome 15.-17. Nov. 2007; http://www.srmedia.org/

[3] Krampen M.: Models of semiosis. In: Handbuch Semiotik: Ein Handbuch zu den zeichentheoretischen Grund-lagen von Natur und Kultur. Hrsg.: Posner R., K. Robering, T.A. Sebeok. De Gruyter, Berlin, New York, 1997

[4] Uexküll Th. v., W. Wesiack: Theorie der Humanmedizin. Grundlagen ärztlichen Denkens und Handelns. 3. , völlig überarb. Aufl.- München; Wien; Baltimore: Urban und Schwarzenberg, 1998

A conversation of forms – bacterial colony as a symbol of teamwork and a pure aesthetic evidence

Michal Schmoranz, Zdeněk Neubauer
Department of Philosophy and History of Science
Charles University, Prague
tenhle@yahoo.com

When kept in convenient conditions, aerobic bacteria tend to build complex colonies with strain specific patterns. The colonies are suprisingly well organised considering that they are built by more than 10 000 times smaller primitive unicellular organisms. In microbiology the colour and shape pattern of the colonies used to be called „the secondary metabolism“. Nowadays we consider them to be an effect of the efficient microbial communication (Shapiro, 1998) and we know, that bacteria have utilized for communication hundreds of different biochemical messages (Ben-Jacob, 2004) however, we still do not understand the relevance or the aim of the formation of the colonies and their pattern. Moreover, we are also able to detect a complicated intercolonial behaviour including in some cases cooperation, agressiveness or restraint. The individuality of the colony should be therefore considered dependent on other colonies nearby, besides the effect of the culture media. The behaviour of the colony clearly shows an affiliation of the simple unicellular organism to the whole colony.

We do not need to suggest any environmental function or addressness (Portmann, 1960) of the phenomena observed. It is possible to see it as an expression illustrating the autonomy and authenticity of organisms as tiny as bacteria. Such an aesthetical way of view supposes the freedom of expression which can lead to an artistic ornamentalism, perfectionism, hypertelia or decadence. All these we call *a self representation of an organism*.

Bacterial social life is limited to a biofilm cooperation in nature. Despite this, they are able to build pure monocolonies. Defined laboratory conditions support the research of morphology and morphogenesis of the colonial body and show us the bacterial monocolony as an organism which creates *complex communication environment of unicellular organisms resulting in macroscopic pattern objects*. On our model organism Serratia marcescens we would like to demonstarte that bacterias strive to cooperate in building a colony of a *typical shape and appearance* and if grown on rich media they take advantage of relaxing of the nutrition stress and enhance the complexity and specificity of each colony made. This shows each colony as a unique piece of art. We understand the *appearance* of colonies as a manifestation of the most general dimension of Life, enabled by domestification (Palková, 2004) which also allows the colonies to experiment in their morphogeny and to partly resign on its functional aspects.

Ben-Jacob, E. *et al.*, Bacterial linguistic communication and social inteligence. *Trends in Microbiology* Vol.12 No.8, 2004

Shapiro, J.A., Thinking about bacterial populations as multicellular organisms. Annu. Rev. Microbiol. 52, 81-104, 1998

Palková, Z, Multicellular microorganisms: laboratory versus nature, European molecular biology organization reports Vol.5 No.5, 2004

Portmann, A, Neue Wege der Biologie, 1960

Organic codes at the level of chromatin

Jana Švorcová and Anton Markoš
Department of Philosophy and History of Science
Faculty of Sciences, Charles University
Viničná 7, CZ 128 44 Praha 2, Czechia
markos@natur.cuni.cz

Inspired by the theory of organic codes (Barbieri), we shall investigate the occurrence of such codes at the level of chromatin structure and function. Histone modification and their specific settings play a crucial role in gene expression, animal development, or chromosome condensation. The concept of *histone code* has been loosely used to describe the role of such modifications enabling selective expression of genes and gene modules. Does the concept, however, really reflect the predictability of the functional setting of modifications, or does it only provide a useful metaphoric framework?

What is especially intriguing at this level of cell memory is the fact that no notion of a "central dogma" is applicable here: in contrast to DNA, the memory is being continuously re-written and re-interpreted (as compared to mere "decoding" of the conservative message writ in DNA) .

We focus on the activity of methyltransferases and kinases as the most specific protein modifiers especially on the methylation of lysine residues in histones, which may represent the principal epigenetic modifications functioning as a cell memory. We discuss in more detail some typical modifications required for X chromosome inactivation, suppression of *Hox* genes or animal body patterning. We also discuss the mutual communication between modifications on several different levels. The discussion will confront current knowledge with the notion of *histone code* as outlined in Barbieri's semantic biology.

The failure of Evolutionary Epistemology
A lesson for Biosemiotics?

Tommi Vehkavaara
Department of History and Philosophy
FI-33014 University of Tampere, Finland
tommi.vehkavaara@uta.fi

Evolutionary epistemology (EE) can be characterized as a predecessor or a close relative of biosemiotics. Both are based on the idea that certain concepts that we mainly refer to human cognitive processes are generalizable and extendable to characterize also certain biological processes and phenomena.

The core idea of EE is to recognize the analogy between knowledge-acquisition or learning and evolutionary adaptation through natural selection. In Donald T. Campbell's and Konrad Lorenz's EE, an abstract "variation-selective-retention-and-reproduction" (VSRR) algorithm, abstracted from Darwin's conception about natural selection, is seen appropriate to model all examples of increased fit between one system and another — all increasing fit between system and environment is seen as a sign of some kind of evolutionary learning process or evolutionary knowledge-acquisition. Such evolutionary learning is not restricted at the genetic level.

The selection theory or 'Universal Darwinism' is taken as a basic theoretical hypothesis of EE in three different senses: 1. all knowledge processes *actually* use VSRR-method, 2. they exploit various lower level VSRR-processes, and 3. they have been produced by some earlier lower-level VSRR-processes. I.e. mere selection theory does not suffice for EE, but it includes essentially a hierarchy theory of knowledge levels. In it, three different hierarchies are joined together: historical production hierarchy, entailment or embeddedness hierarchy, and control hierarchy (downward causation).

In spite of its apparently strong and restrictive theoretical basic statement, the deeper inspection shows that selection theory (with hierarchy theory) does not really form a testable scientific hypothesis. Even though it avoids optimality adaptationism, it still tends to produce 'just so' stories of adaptive origin of cognitive systems and implicit VSRR-subprocesses. If some particular knowledge process does not seem to use unmotivated (blind) variation in its seeking of satisfying solution, it is automatically assumed that this subsystem has been produced by some and it is using some hidden subprocess in a lower level. These are assumed a priori, for the sake of intelligibility, just like the bad manners of sociobiologists in their project of explaining everything by natural selection. As a consequence, selection theory can never be falsified — speculative assumptions about some hidden VSRR-process can always be made.

Even though such dogmatic Darwinism is rare and sometimes perhaps even too radically rejected in biosemiotics, biosemiotics is not safe in falling on similar type of error. Useful interpretative or code-processing habits of organisms and other biosemiotic systems are easily assumed likewise to have been 'learned' at some level but self-organization (co-development) and exaptation are possible origins as well.

While for EE, one source of this failure was a too dogmatic commitment to Universal Darwinism, in biosemiotics the strong intuitions of superiority and generality of semiotic point of view or pansemiotic ideas tend to have analogous consequences. Common source of confusions and errors for both is the vagueness in the basic ideas of knowledge or sign/representation in their application to biological systems and processes.

”Felt in the blood, and felt along the heart”: Going Backward to Go Forward – Layers of Biosemiosis and the Logic of Abduction in Aesthetic and Scientific Creativity

Wendy Wheeler
Department of Humanities, Arts and Languages
London Metropolitan University
166-220 Holloway Road
London N7 8DB, UK
w.wheeler@londonmet.ac.uk

From the Reformation onwards, perhaps the most characteristic gesture of European modernity has been that of the radical break with the past. In such projects of radical scepticism, it is assumed that human progress derives from the capacity of clear-sighted individuals, once freed from the constraints of earlier structures of mediation, to read the world, and the world’s various ‘texts,’ afresh. Thus, the Protestant Reformation depended on individual interpretations of the Bible’s signs, and on signs of grace or election in individual lives, confirmed by the brotherhood of the faithful. Natural philosophy, later science, depended on signs deductively and inductively read, and confirmed by the brotherhood of scientific communities. For the former, guessing God’s meanings (abducting) in the absence of widely accepted doctrine became a source of sectarian division. For the latter, abductive reasoning simply became unspeakable. It is clear, though, that abductive inference is the only source of new hypotheses. In this paper, I shall suggest that such creative abductions do not derive from radical disavowals of the past, but, rather, that they depend, instead, on the ability of individuals (and cultures) to draw on the antecedent layers of their semiosic life which are produced, first by biological, and then later by cultural, emergent layerings. Finally, I shall offer the self-understanding of creative life explored in the work of William Wordsworth – ‘Felt in the blood, and felt along the heart’ – as a brief case study in poetic uses of such semiotic and biosemiotic abductions.