

Mutual understanding and misunderstanding in biological systems mediated by self-representational meaning of organisms

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Abstract. Modern biology gives many casuistic descriptions of mutual informational interconnections between organisms. Semiotic and hermeneutic processes in biosphere require a set of “sentient” community of players who optimize their living strategies to be able to stay in game. Perceptible surfaces of the animals, semantic organs, represent a special communicative interface that serves as an organ of self-representation of organic inwardness. This means that the innermost dimensions and potentialities of an organism may enter the senses of other living being when effectively expressed on the outermost surfaces of the former and meaningfully interpreted by the later. Moreover, semantic organs do not exist as objectively describable entities. They are always born via interpretative act and their actual form depends on both the potentialities of body plan of a bearer and the species-specific interpretation of a receiver. As such the semantic organs represent an important part of biological reality and thus deserve to be contextualized within existing comparative vocabulary. Here we argue that the study of the organic *self-representation* has a key importance for deeper insight into the evolution of communicative coupling among living beings.

1. Three models in biosemiotics

The key word of our title is *mutual*; we maintain that for genuine biosemiotics it is necessary to develop a model of a biosphere of communicating semiotic entities. To highlight the task, we shortly describe three competing models, each in some context being labelled as “semiotic” by different authors (the boundaries between them being not clear-cut).

1) At the level of *organic codes* (*sensu* Barbieri 2003) the task is a reliable translation from one coding system into another, according to a given (and finite) coding table. Hence, what is given beyond the physical system are rules obeyed by either a sentient being, or by a *hardware* of a sort. It follows that at this level, the quasi-semiotic process does *not* require understanding, and no meaning is being extracted during the process. Examples of this level are: genetic code, signalling cascades, perhaps also the bacterial biosphere. Here belong all cybernetic networks.

2) The second level concerns the understanding of signs in one’s *umwelt*. The being (animal) recognizes signs (*Merkmale*) in its environment and behaves accordingly. The paradigmatic example is the oak tree as given by Jakob von Uexküll (1956 — Fig. 1)



Figure 1. An example of different interpretations of the same object “oak tree” in the *umwelt* of a forester and a scared girl. After Uexküll 1956.

The tree is perceived differently in various *umwelten* of different living beings (the forester, the girl, an occasional tramp, the insect inhabitants of the tree, etc.). The tree, however, has no say in *how* it will be present in those *umwelten*. It is passive in relation to them as, say, is a stone or a cloud. More precisely: as a stone or a cloud, it also can evoke meanings for all those beings, but without manifesting any interest from its side, neither investing any effort from its side to signify something.

3) Finally, there is a level of sharing the common space and mutually and deliberately influencing other players of the game, by recognizing them as possible receivers of the message. Here belongs the concept of the *biosphere* as developed by S. Kauffman (2000), but above all, the concept of being-together (*Mitsein*) of Martin Heidegger (1995) as well as self-representation (*Selbstdarstellung*) by Adolf Portmann (1960b). Here, all living beings communicate *actively* with their cohabitants in the environment, and can display the whole scale of interactions, like orders, cheating, mutual warning, quorum sensing, mimicry, etc. What living beings communicate here is presentation and perception of likeness, i.e. gestalt of *some* cues by which the being gives itself to others, and the others will recognize it as such. We maintain that deep understanding of one's partner(s) is a prerequisite of such phenomena. Here, we shall concentrate on this level of communicating meaning.

2. Self-representation

Adolf Portmann suggested that the visible surfaces of the living organisms represent a new kind of organs: organs that perform the self-representation of the inwardness of organisms and interactions among organisms:

Such a surface is not merely a 'border', not just a barrier for the containment of an inner milieu or for the safeguarding of metabolism, that is, for mechanical protection. No. This surface becomes an organ with entirely new potentialities. [...] The surface display is a part of presentation of self of a living being. (Portmann 1990: 25)

Going along with this, the expression of pigment patterns and integument ornaments on the outermost surfaces are conceived as the non-random and active achievement of a specific kind or lineage of organism. These, often intricately patterned organismal surfaces, bear a semantic role, and despite its superficial nature they are as important as other biologically adaptive structures. In the following text, we introduce the different types of outermost organization developed by living beings with special attention to the importance of surface ornaments of organisms for the mutual interplay between and within various life forms. Our subject here is constricted mainly to the instances that may enter the sight of a receiver (optic channel), but a similar way of reasoning may be easily extended also to other forms of perception as chemical, electrical, acoustic, tactile etc.

Various shapes, patterns and colorations have evolved due to the possibility of being perceived by the other part, being recognized as a sign and interpreted within a specific context. In respect to this, appearances of different life forms may be divided into those having a primarily signalling role and those not having any signalling role, or they have gained such a role secondarily. For a good example of the latter consider the semi-transparent bodies of embryos or those of adult animals inhabiting the environments where the visual perception is confined or disabled (e.g. troglobionts, pedobionts). It is highly probable that the evolutionary transition from non-specific semi-transparent bodies to sophistically structured opaque surfaces (or conversely to full transparency), like pigment patterns, physical colorations, and integumental ornaments covariates with the evolutionary appearance of sight. This was an important evolutionary event that led to the increase of communicative abilities among organisms, in which the life got its face.

In Portmannian perspective, an aptitude for mutual understanding sprouts from the very accent on selfhood of every individual living being. The importance of this self-relation is manifested by the vital processes of self-construction, self-maintenance, self-identification and, definitely, *self-representation*. Perhaps these features characterize every living being, and just these are lacking in inanimate nature. *Self-*

representation of the inwardness of an organism, i.e. active presentation of the self, in which the very innermost is expressed via the very outermost, represents the keystone of Portmann's biological thought. This was aptly expressed R. B. Carter in his interpretative essay upon Portmann's writings: "Thus whereas Galileo said, 'Nature likes to hide', Portmann saw that nature likes reveal, but that very revelation quite often hides precisely what it is which makes that revelation!" (Carter 1990: 268).

Basically, the mutual understanding among organisms depends on what is exposed, and thereby unproblematically perceptible, as well as on something deeply inner what cannot be unveiled in any simple way. In this sense, every mutual understanding is mediated, on the one hand via externalization of inwardness in a process of self-representation, on the other hand via internalization of signals that fit meaningfully in the inwardness of a receiver; not quite dissimilar from empathy. The inwardness can never be fully discovered by the researcher. However, it may be partially approached by the study of outermost expressions of organisms such as specifically featured appearances emerged in the process of self-representation. Therefore the only way to understand the innermost is to analyse the outermost. Portmann's concept of inwardness (*Innerlichkeit*) may rightly resemble the Uexküll's term *Umwelt*; both of these concepts stand for *self-experience* of an organism, i.e. for something what cannot be directly approached by a human observer. The realm of self-experience of organisms was considered by both Uexküll and Portmann as the most prominent target area of their biological research.

3. Organs of self-representation (semantic organs; semes)

When we conceive visible surfaces of organism to be *organs of self-representation* it allows us to speak about these entities in the terms of homology and analogy. These two terms are crucial for every statement in comparative biology which deals with some parts of greater

wholes, such as body parts, organs or even sequences (Ghiselin 2005). Therefore, to conceptualize the *organs of self-representation* within the context of analogy and homology may help us understand the manifold diversity of organic surfaces in biological terms such as function, form, organization, phylogeny etc. Such a biological explanation is very important but still insufficient for the full understanding of these organs of self-representational meaning because their nature is not objective but interpretative. These organs are always dependent on the aptitude of the perceptual world (*umwelt*) of a receiver.

In spite of all this, if we want to introduce these semantic organs to the comparative terms of homology and analogy we should first specify what we exactly mean by these semantic "organs". In general, when we want to subject something to comparison, we should first know what it is to be compared. Therefore, some kind of definition of these *semantic organs of self-representation* is needed. But how these entities can be compared and even defined when we have already said that their performance may change according to the perceptual aptitudes of an interpreter? It is certainly an uneasy task because any rushed definition attempt may potentially lead to an inappropriate objectification. In what follows, we shall establish a preliminary definition of semantic organs in animals, using the optical examples, i.e. the semantic organs perceived by the visual interpreter.

Animal surfaces represent additional organs or rather organ systems *as real as* the other organs or organ systems such as liver, lungs, pancreas, nervous system etc. This does not mean, however, that the properties of the inner anatomical and molecular constitution of an organism have no effect on its external display. Semantic organs are visible motifs of animal display that are partially dependent on both outer (skin, coat) and inner (skeleton, muscles) constitution of a body. As Portmann (1960a: 222) has aptly shown, also the colour of inner organ systems such as blood vessels and molecular qualities of haemoglobin (redness) may contribute to the external appearance of an animal. The organs of visible surfaces are rather co-structured by various constituents in the same way as the lungs, for example, are interlaced with nerves, blood vessels, integuments etc.

Semantic organs of visible surfaces function meaningfully if interpreted by the seeing eyes of an interpreter. We have already proposed to call such *semantic* organs of visible surfaces abbreviated as *semes* (Kleisner and Markoš 2005). Semes do not represent only the property of a specific morphological arrangement of certain species, but rather they arise in the process of interpretation by being watched by a second part. Semes are coming into being during an interpretative act, so they are generated and specified in dependence on the *umwelt* of an interpreter. Lastly, semes are shaped within the *umwelt* of an animal where they are recognized as existent and potentially meaningful. In summary, *semes* as organs of visible (or anyhow perceptible) organic surfaces are, on the one hand, physically anchored in the inherited organization of the body of a living being, but on the other hand, their high profile is achieved in the act of interpretation within the *umwelt* of an “seeing” organism.

4. Mimicry and homosemiosis

If self-representation is considered as a genuine and important character of living beings, then acquiring, modification, or loss of species-specific appearance means something non-trivial because these changes in the very outermost level inform us about the changed inwardness of an organism. For example, take numerous cases of mimicry where the appearance (and often also behaviour) of a model is imitated by one or more mimic species. In the case of Batesian mimicry, the model is somehow protected (unpalatability, hurtful weapons, poison etc.), whereas the mimics are usually lacking any protection. It is apparent that mimic organisms gain a selective advantage by adopting *semes* of a model. In this respect, we can talk about a kind of *semetic parasitism*. But this bright advantage in survival is necessarily connected with a less apparent disadvantage in the terms of *self-representation*. That is the loss of species specific *semes* what makes a payment for reproductive success. The self-representation of mimics does not longer stand for the *presentation of*

the self, but it is the presentation of the *semes of a model* on the body of the mimic. In other words, bodies of the mimics serve as a projecting screen for the semes of the model. So, in fact, the display of a mimic represents the “self”- representation of the model.

The signalling role of a particular organismal display (wasp-like pattern, for instance) influences not only the receivers, but also the bearer of such a warning sign is often “aware” about its aposematic vestment; irrespective of the fact as to whether we are talking about the model (wasp) or the mimic (fake wasp) such as various hoverflies, clearwing moths (*Sesia*), longhorn beetles (*Clytus*, *Plagionotus*, *Strangalia*) etc (Fig. 2).



Figure 2. Two unrelated species of insects with homosemiotic “wasp-like” pattern. Left: Longhorn beetle *Strangalia maculata* (Central Europe); Right: Grasshopper *Phymateus saxosus* (East Africa)

The generation and use of warning coloration presupposes a certain kind “pre-understanding” by the bearer of the perceptual faculties (umwelt) of the signal receiver. A trained human researcher is able to distinguish model organisms from their non-allied imitators. He will also mark, for instance, the black and yellow pattern on the wing-cases of long horn beetles as analogous (nonhomologous) to the seemingly same pattern on the abdomen of the wasp — because of different phylogenetic and developmental origin of both patterns, despite all superficial similarity and congruence of warning function. Never-

theless, it does not matter whether the wasp is really a real wasp from genus *Vespula*, for instance, or an imitator from whatever group. It is important that both the real wasp and the fake wasp are interpreted as the same animal or the animal having the same meaning for a receiver (predator). In turn, a mimic relies on the fact that its appearance and behaviour will be interpreted by the receiver as enough wasp-like as necessary to avoid predation.

We cannot say much about the inner character of this reliance, but there is a lot of evidence that, for example, the aposematically coloured animals have different modes of behaviour in comparison with the cryptic ones (see, for example, Maran 2007, Wickler 1968). We propose the term *homosemiosis* for situations when signals (*semes*) emitted by model and mimic organisms are taken as the same in the perceptual world (*umwelt*) of a receiver. Homosemiotic organs are neither analogous nor homologous. Analogy means the correspondence in function (and similarity), but analogous organs are conceived as different organs (nonhomologous). Homology is the ontological sameness; homologous organs are the same organs because they are theoretically traceable to their precursor present in the immediate common ancestor, irrespective of the function and similarity. However, organs are homosemiotic, irrespective of the fact that they are analogues or homologous in the eyes of a human biologist, because they are recognized as the same organs in *umwelt* of the interpreting organism.

5. Conclusion remarks

The self-representation of organisms is the generator of semblances (*semes*) that play an important role in the evolution of communicative coupling among and within species. Based on the presented discussion, we propose adding a biosemiotic perspective to the comparative biological terminology by introducing a new term *homosemiosis* (from Greek '*homos*' = 'same', '*semeion*' = 'sign'); marking the phenomena where congruence of meaning appears (Kleisner 2008). The terms

analogy, homology and homosemiosis can be defined in the following way:

- (1) *Analogy*: correspondence of different organs having the same function or being superficially similar.
- (2) *Homology*: correspondence (sameness) of organs that are inherited from their precursor, present in the most recent common ancestor.
- (3) *Homosemiosis*: correspondence of organs that are interpreted as the *same* organs in the *umwelt* of a particular organism or group of organisms under investigation (irrespective of the developmental and phylogenetic origin of the organ).¹

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¹ Acknowledgements. This work has been supported by the Research Program CTS MSM 0021620845 and the GPSS Major Awards Program, a joint program of the Interdisciplinary University of Paris and Elon University.

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Взаимное (не)понимание в биологических системах на основе саморепрезентации организмов

Современная биология предлагает несколько рафинированных описаний информационных связей между организмами. Семиотические и герменевтические процессы в биосфере предполагают существование сообщества «чувствительных» членов, которые оптимизируют свои жизненные стратегии, чтобы остаться в игре. Перцептивные поверхности животных, семантические органы составляют специальный коммуникативный интерфейс, который действует как орган репрезентации органической внутренности организма. Это означает, что глубинные уровни и потенциалы организма доступны органам восприятия других живых существ в том случае, если внешние поверхности организма успешно их демонстрируют, и если принимающий организм интерпретирует их как значимые. При этом семантические органы существуют в качестве объективно описываемых. Они возникают всегда в ходе интерпретации, и их реальная форма зависит как от возможностей телесного плана носителя, так и от видоспецифической интерпретации принимающего. В таком виде семантические органы составляют существенную область биологической реальности и достойны вовлечения в сферу современной терминологии. В статье утверждается, что изучение саморепрезентации организмов имеет ключевое значение при глубинном понимании эволюции коммуникативных связей между живыми организмами.

Vastastikune mõistmine ja vääritimõistmine bioloogilistes süsteemides organismide enese-esituslike tähenduste vahendusel

Nüüdisaegne bioloogia pakub organismidevaheliste informatsiooniliste suhete kohta mitmeid rafineeritud kirjeldusi. Semiootilised ja hermeneutilised protsessid biosfääris eeldavad “tundlike” osaliste kogukonna olemasolu, kes optimiseerivad oma elustrateegiaid, et mängus püsida. Loomade tajutavad pinnad, semantilised organid, moodustavad spetsiaalse kommunikatiivse liidese, mis toimib organismi orgaanilist sisemust representeeriva organina. See tähendab, et organismi kõige sisemised dimensioonid ja potentsiaalid võivad jõuda teiste elusolendite meeleeelunditesse, juhul kui organismi välimised pinnad esitavad neid tulemuslikult ja kui ka vastuvõtja interpreteerib neid tähenduslikult. Seejuures eksisteerivad semantilised organid objektiivselt kirjeldatavate nähtustena. Nad tekivad alati interpretatsiooni käigus ja nende tegelik vorm sõltub nii kandja kehaplaani võimalustest kui vastuvõtja liigispetsiifilisest interpretatsionist. Säärasena moodustavad semantilised organid olulise osa bioloogilisest realsusest ning väärivad seostamist nüüdisaegse terminoloogiaga. Käesolevas artiklis väidame me, et organismide *ensee-esitus* uurimine on võtmehätsusega, et mõista sügavuti elusolendite kommunikatiivsete seosepaaride evolutsiooni.