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Towards a Theory of Evolution of Semiotic Systems

Abstract: In this paper I formulate briefly the main principles of evolution of semiotic systems. The neo-Darwinian theory of evolution does not take into account the semiosic nature of the systems under study, therefore its applicability to languages and cultures (and also to biological species as communicative semiosic systems) should be rigorously questioned. The semiotic theory of evolution should include the implications from the dynamic features of semiosis and sign systems. The two major tendencies in the evolution of semiosic systems are diversification — or introduction of new mutually incompatible systems and categories — and standardization — or development of mutual compatibility. The inclusion of agency as based on semiosis provides a non-Darwinian model, yet includes the Darwinian one as a restricted special case.

Keywords: language change; non-Darwinian evolution; semiosis; sign systems; theory of evolution

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1 Introduction

Cultural, linguistic, and biological processes may not have much in common, except their fundamental semiotic mechanisms. Instead of applying the classical biological models of evolution to explain the cultural dynamics or language change (which would mean biologization), it is reasonable to develop an alternative research strategy — to build a semiotic theory of evolution that would describe how the change occurs in various semiotic systems (and potentially applicable to culture, language, and living systems). In this study, we attempt to formulate some principles for such an approach.

According to the neo-Darwinian model, an organism is a system that includes a self-copying entity (genome), from which all the phenotypical features derive as the environment permits. Evolutionary change is then possible due to inexactness of copying (resulting in new genotypes) plus either

differential reproduction of genotypes (defined as natural selection) or randomly varying reproduction rates (defined as neutral evolution). According to this neo-Darwinian model, what an organism does depends completely on its genome and its environment, and so these two are the ultimate aspects relevant for evolution.

According to the semiotic model, an *organism* is a communicative system, both externally and internally. An organism includes semiosis, i.e. a problem-solving process that is responsible for the decisions the organism makes, including, among others, decisions on genome expression (thus phenotype building), behavior, and reproduction. (This feature of autonomous activity has also been called 'agency'.) The existence of semiosis means the capacity for learning, thus adaptive plasticity. Semiosis is an epigenetic process. Therefore the inclusion of the activity of an organism as based on semiosis provides a model that is fundamentally different from the neo-Darwinian one.

Until now, many of the attempts to build a theory of language evolution have tried to apply some principles of the neo-Darwinian theory of evolution to language change. However, this theory itself is fairly incomplete even for other species. Its main flaw consists in the assumption of the rigidity of change — it can happen via chance, due to errors, and it is conveyed via copying. This means that the flaw consists in the inability to take into account the plasticity and the capacity for learning — clearly universal attributes of living systems. In the case of language change, the aspect of learning is obvious. Now, whence we already have at least a sketch for the theory of evolution of organisms that includes the role of learning (see West-Eberhard 2003; Hoffmeyer, Kull 2003; Kull 2000; 2014; Kirby 2000), i.e. a semiotic theory of evolution, on this basis we can also try to build a theory of the evolution of sign systems (including language as a special case).

The semiotic approach has radically changed the understanding of biological evolution. Saussure's claim that the primary processes responsible for the formation of signs are synchronic and not diachronic holds more generally also for biosemiotics. For biology, this means that the explanations of sign phenomena, in the first place, must pay attention to the synchronic (or somewhat more generally, to the ontogenetic) mechanisms, and the diachronic (evolutionary, phylogenetic) processes can be seen as their resultants. Here, for the biological theory of evolution, the most interesting discussions begin.

The contrasting theories of evolution can be put very briefly as, either (1) genetic change precedes epigenetic change, or (2) epigenetic change is prior to genetic change, in an evolutionary adaptive change.

The *neo-Darwinian model of evolution* clearly speaks in favor of the former option — the first thing to happen is a new random mutation, which creates a

new phenotype, which can or cannot be preserved due to "natural selection", defined as the differential reproduction of genotypes. The *semiotic model of evolution* states the opposite — the first thing to happen is the change in phenotype (which includes changes in the usage of the genome, in its expression pattern), which can or cannot be affixed by random changes in the genome.[1]

For a long time, the neo-Darwinian model has been seen as having no real alternatives for explaining adaptive evolution. However, just in the recent decade, a remarkable shift in this view has taken place due to advances in developmental biology (Müller, Newman 2003; West-Eberhard 2003; Kull 2000; Markoš *et al*. 2009) — although the development of the non-Darwinian model has a long history, which has also much to do with semiotics and structuralism (see Skagestad 1979).

It is important to see that the evolvement of semiosis includes both the diminishing of semiotic freedom, when new codes (constraints) are introduced in habituation, and an increase of semiotic freedom, when new options appear due to the replacement or abandoning of codes in challenging the situation of confusion. Both of these tendencies are embraced by the concept of learning.

2 The Role of Semiosis in Evolution

In this section of the paper I attempt to outline some principles in order to frame the theory of evolution of semiotic systems. We are going to study the role of semiosis in evolution.

2.1 Semiotic systems are the systems driven by semiosis.

Thus it is necessary to say what is meant by semiosis. Here we have several complementary formulations.

1) Semiosis is the process of meaning making.
   Accordingly, semiotics is the study of meaning making. Meaning means that something is more than itself — it is plural. Meaning also assumes

1 As Newman (2012: 2) says, there are "many traits for which evidence supports evolution by a 'phenotype precedes genotype' scenario". Mary Jane West-Eberhard (2003: 157) claims: "genetic novelty is not necessary for phenotypic novelty to evolve: phenotypic innovation does not await mutation". On the details of this mechanism, see Kull (2014).

meaning. Therefore, meaning making, or semiosis, is the behavior in the situation of polysemy.

2) Semiosis is the process of interpretation, which is the process of problem solving, in a broad sense.
3) Semiosis, as minimum, requires an undetermined (arbitrary) connection of some (at least two) components.
   These can be joined (remembered, inherited), whereas this connection serves as a cause for a further process. Since this cause includes both the immediate and connected components, it turns out to be plural, thus the further process can use (utilize) this plurality, becoming an interpretation process. Thus, it can be said that the semiotic begins with repeated arbitrary bonds.
4) Semiosis is always an active process, in the sense that it is initiated by some absence.[2] Semiosis is an activity for removal of the absence.
5) Semiosis occurs in the condition of incompatibility. Semiosis is the process of resolving incompatibility, which is learning. This feature or aspect is the most fundamental among the characteristics of semiosis described here. Juri Lotman described it as non-translatability, which is a condition for meaning making (e.g. Lotman 1990: 14–15).
6) Semiosis includes a modeling relation. This is because the relation established by learning is always based on recognition (the iconic part of any sign). Sometimes it also includes an association of correlating events (the indexical part).

2.2 The evolution of a system is its irreversible (i.e. inheritable) change between generations.

1) Evolutionary change can be either adaptive (if it concerns a change in function) or non-adaptive (if it does not concern a change in function). There are several types of adaptive changes (among them exaptation as a shift in the function). Adaptation does not assume a Darwinian mechanism. Non-adaptive change is often called neutral evolution.
2) The term ‘functional relation’ (including biological function) and meaning can be taken as synonyms.

2 Cf. Deacon (2011).

3) The semiosphere has its diachronic aspect. The functional dynamics of the semiosphere can also be called its evolution. The existence of semiosis makes the evolution of semiotic systems vastly different from the dynamics of non-semiotic systems. The evolution of semiotic systems of different levels and complexity (including vegetative, animal, and cultural systems) has their functionality in common. Based on these assumptions, it is reasonable to explicate a semiotic theory of evolution. Accordingly, since semiotic systems include both cultural and non-cultural living systems, semioevolution includes bioevolution.
4) Semiotic evolution can be understood as the evolution of semioses, or communicative systems, or learning.
5) Systems without semiosis also change. These changes may co-occur in systems with semiosis.
6) Semiotic evolution is different from evolution by morphodynamic self-organization, by natural selection, by random walk or drift. Its mechanisms are different.
7) Self-organizing systems are of two very different classes — without semiosis, and with semiosis.[3] Close to this distinction is the opposition of morpho-dynamics and teleodynamics (Deacon 2011). Both can produce diversification. Self-organization of the first type is neutral in relation to adaptations, while the second is adaptive.

2.3 The functional cycle can serve as the general model of semiosis.

The functional cycle is a feed-forward process of connecting perception and action. It is a purposeful (teleodynamic) mechanism.[4] The functional cycle is a key mechanism of agency.

1) The semiotic theory of evolution is based on the understanding of living systems as semiosic systems or agents, whose interpretation process is the primary source for adaptations.
2) The agent's action is brought into conformity with perception. This is the major drive of behavior as well as of change of behavior. (Superficially, it is often described as a conformity between organism and environment.) Perception can belong both to the same and to

3 More on this can be found in, e.g., Queiroz (2010); Moreno *et al*. (1994).
4 In the sense of Uexküll (1982 [1940]).

another organism. Thus the conformity is both individual and social. If conformity is set, it may be stable enough to become inherited.

2.4 A basic precondition for evolution is the system's multiviality.

We define *multiviality* as a system's capacity to use many different routes to fulfill a particular task.[5]

1) This feature is often described as plasticity (the capacity to take different forms in different conditions) or polymorphism or polyethism (multiplicity of behaviors).[6] However, plasticity assumes multiviality, thus the latter is a more fundamental feature.
2) All functional cycles are multivial. In the process of habituation, there is a tendency for a functional cycle to become more restricted in its multiviality (less plastic).
3) Multiviality is the main provider of variability for an evolutionary change. Evolution occurs if some constraints are added (which is the same as turning inheritable, according to a common terminology) to multiviality.

2.5 Primarily, semiotic systems are quasi-stable.

This means that sign-relations establish themselves quite quickly and further repeat themselves in quite in the same way, both in autocommunication and in heterocommunication systems.

1) The change of a semiotic system can occur in two major ways:

    a) via random changes, leading to a random walk, which is inevitable, since the system's buildup is based on relational and not on absolute bonds;
    b) via directed changes, due to the intentionality (generally, ententionality) of semiosis.[7]

5 The term *multiviality* is from Latin *via* 'path'.

6 On these concepts see West-Eberhard (2003: 378–379).

7 On *ententionality* see Deacon (2011).

2) Semiotic systems are collective systems. Therefore, changes in single individuals or components usually cannot change the whole system. The system's change assumes the preference (or avoidance) of certain developmental paths by many individuals simultaneously. This may occur, for instance, in case of a general change of living conditions of the system.

2.6 Semiotic evolution has several specific features.

1) Semiotic evolution includes the following principal processes:

   a) finding a new solution in the situation of non-conformity; as a result, it creates a new habit;
   b) fine-tuning existing habits;
   c) changes in the production of artifacts (including the production of bodies of organisms).

2) Semiotic evolution produces rules. These rules are local, non-universal, with exceptions (as different from physical laws, which are universal and hold without exceptions).
3) Language change is a special case of semiotic evolution.[8]
4) Evolution is conditioned (shaped) by the collective findings.
5) If the change is collective, then natural selection is not required.[9] Natural selection (defined as the differential reproduction of genotypes) is inevitable if the change (a new feature) appears at first in one single organism; in this case, the only way for this new feature to become a feature of a group is a higher reproduction rate in the carriers of this feature.

8 For instance, Michael Shapiro (2002: 120) states: "While there may be several goals of language change, I wish to argue (anew) that the overarching telos of linguistic change is the establishment of a pattern — not just any pattern but specifically the semiotic kind Peirce called a 'diagram'. Since diagrams are panchronic signs, it is not surprising that they subtend both linguistic synchrony and linguistic diachrony. Diagrammatization can be seen as one species of the process by which unconformities in language are reduced or eliminated over time. These dynamic tendencies can be couched in Coseriu's terms: system is brought into conformity with type, while norms are brought into conformity with system."
9 See also Kirby (2000); Gabora (2013); Kull (2014).

6) A distribution of a new feature via imitation can be seen as formally similar to natural selection. However, the main difference comes from the fact that in the case of natural selection the source of variability is in the sink (in the reproducible pattern), thus passive, while in the case of imitation the variability is due to the one who reproduces the pattern (thus active). Accordingly, in the case of natural selection, the change is not selected by the organism, while in the case of imitation it is.

2.7 A general model of evolutionary change includes several steps.

A general model of evolutionary change includes the following steps:

1) finding a new solution by a group of individuals; this solution, generally, is a new (sign) relation;
2) inheriting this solution;
3) turning the change irreversible, i.e. making the habit inheritable; this latter process may be completely stochastic and unintentional; this is also the slowest part of the process.

2.8 Diversification and standardization are the main tendencies of evolution.

1) There are two major tendencies in the evolution of semiosic systems:

   a) diversification, or introducing a new distinction;
   b) standardization, or becoming more similar, coherent, or compatible to other communicants; this keeps species or groups together, leading also to norms and identities.

2) For instance, 'species' is a natural relational category resulting in sexual communication. Species arise as a result of mutual recognition by organisms at biparental reproduction. Thus true species exist only in biparental organisms. If a group of organisms secondarily loses its ability for biparental reproduction and continues to reproduce only

uniparentally (vegetatively), then its distinctness of variability disappears.[10]

3) The necessity for the recognition of the other is the basis for any communication. This, as a result, is the formative process for categorization as well as the persistence of groups, languages, cultures, and species.

2.9 Semiotic evolution may or may not include natural selection as a secondary process.

1) Evolution by natural selection can occur, strictly speaking, without any semiosis. It requires just self-reproduction on the basis of copying. Differential reproduction of structures is by definition called natural selection. In case of stochastic changes in the structure, in principle, almost any structure can appear (however mostly with extremely low probability). Threrefore, the theory of natural selection (neo-Darwinism) has been sometimes considered as a sufficient theory of evolution.
2) Evolution by natural selection is not yet semiotic. However, evolution by sexual selection (which was strictly separated from natural selection by Charles Darwin) can be semiotic.
3) Semiotic evolution may be the dominant type in the major changes of living (including cultural) systems.

2.10 Semiotic evolution is open-ended and non-deducible from physico-chemical laws.

1) Changes (both evolutionary or irreversible, and non-evolutionary or reversible) in a semiotic system include the additions and modifications of sign relations, and the heritance of the new relations via modifications in the memory or semiotic scaffolding. The potential number of new relations is immense, thus the evolution of semiotic systems is open-ended.[11]

[10] See Kull (1992). Thus the species is formed by the genetically slightly different organisms with their individual recognition window that is responsible for the pairwise recognition of individuals for mating. The usage of iconic signs is sufficient for this process to occur.

[11] See further discussion on this aspect in Pattee and Kull (2009), and Kauffman (2013).

2) Semiotic systems design themselves and introduce new rules that are non-deducible from (but allowed by) physico-chemical laws. However, semiotic evolution has tendencies and rules that allow predicting it to a certain extent.

3 Conclusion

The evolution of semiotic systems is based on the instantiation and inheritance of sign relations (or habits). New sign relations result from learning and can be seen as exaptations (changes of function, i.e. changing a relatum in a relation) in the work of preexisting sign processes. There exist several mechanisms of learning (e.g. trial and error mechanisms that leads to an iconic relation, conditioning that leads to an indexical relation, imitation that leads to an emonic relation, naming that leads to a symbolic relation), while all these work as problem-solving mechanisms that can establish new sign relations (or habits, or rules). The role of the copying mechanism is seen as necessary for inheritance of the relations, while the role of stochastic changes (like mutations) is seen as the mechanism that may turn the changes irreversible, thus evolutionary.

Thus we have briefly described the main features and components of the fundamental mechanisms of semiotic evolution. Since this covers (and also opens) a large area of processes and phenomena that asks for a detailed (re)description and (re)explanation on its basis, we can foresee a rich period for evolutionary semiotics to come.

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