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What kind of evolutionary biology suits cultural research?

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Michel Foucault (1971[1966]) demonstrated remarkable parallelism and mutual influences between biology, linguistics and economics. The parallelism can be considered obvious, when taking into account that all three fields of research in principle study semiotic systems; together with humanities in general, they are areas of semiotic research, not physical sciences. However, the extent to which theories and models used in these fields are based on a semiotic approach varies. For instance, a model of evolutionary change may or may not take into account the processes of interpretation and meaning-making.

There is more than one version of the theory of evolution. Besides the neo-Darwinian version (the "standard theory", developed since the 1930s on the basis of the Modern Synthesis), there are others, among which at least one (the epigenetic theory, also called "Extended Synthesis") is close to semiotic biology. It is particularly important to pay attention to this when applying biological models in cultural research, for the choice of initial assumptions in which the models of evolution differ may result in remarkable differences in conclusions.

The existence of alternative theories has been characteristic of the whole history of the study of evolution. What makes the contemporary period remarkable, in this context, is the epigenetic and semiotic turn in evolutionary theory. That this turn or shift has already largely happened could be observed at the recent conference "New trends in evolutionary biology: Biological, philosophical and social science perspectives", held in London during 7–9 November 2016, and organized jointly by the Royal Society and the British Academy. Below I shall give an overview of this meeting, but some more words about the preliminaries and context are also pertinent.

It is not usual for these two institutions to organize events together, as the Royal Society specializes in natural sciences, and the British Academy is concerned with social sciences and humanities. However, if the discrimination 'semiotic versus physical' points at a deeper divide than 'human versus natural' (or 'culture versus

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nature'), the collaboration between (semiotic) biology, social sciences and humanities is genuine for these are sciences that study meaning-making.[2]

The meeting in London was intended to discuss the contemporary change in the theory of evolution – the replacement of the standard theory (also called Modern Synthesis, neo-Darwinism, etc.) by a more relevant (and also more fundamental) one, that is variably called the Extended Synthesis or post-Darwinism, yet can also be called a semiotic theory of evolution.

To put it briefly, this contemporary approach can show, "why genes are usually followers, not leaders, in evolutionary change" (West-Eberhard 2003: 29). The core of this turn can be described as follows.

The basis of the standard theory was formulated by Charles Darwin, later it became somewhat more limited as connected to genetics by neo-Darwinians, and updated and mathematized as the Modern Synthesis during several decades since the 1930s. It claims that evolutionary innovation is caused by random changes in the genome, followed by differential reproductive "success". This means that an evolutionary change begins from stochastic changes in genetic memory that create diversity, and is afterwards tested by differential reproduction of genetically different variants (which is, by definition, natural selection). In this case, the "meaningfulness" of any forms and changes exclusively relies upon the fact of survival, or fitness. Moreover, speaking about the meaning of the changes will always stay metaphorical or illusionary for a neo-Darwinian approach.

According to the alternative mechanism, the evolutionary change would begin with the organisms' new responses or new solutions to the problems they face (a new choice between options), using their resource of plasticity; this meaningful plastic change may become stabilized by soft (epigenetic or ecological) inheritance. If the stabilization lasts long enough, random changes in the genome (especially due to recombination, but not only) may lead to hard inheritance of the change. Since a plastic change of an organism's processes can be meaningful in the first place (because it is carried out by a perception–action cycle – called a 'functional circle' by Jakob von Uexküll), this mechanism can be called a semiotic one.

Both these mechanisms describe adaptive changes, yet in addition many non-adaptive changes exist in evolution – the well-studied genetic drift, as well as meaningless plastic changes (those that arise without the involvement of a choice between options) that may become hereditary.

The way towards the contemporary change in the theory of evolution has been paved by earlier developments in the study of life, knowledge of which can help to understand the turn.

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2 See also Cobley 2016.

Theoretical biology

Theoretical biology with its more-than-a-century-long history has been developing a view that largely includes most of the statements that are now overthrowing the strictly Darwinian view. Notably, the whole field of theoretical biology as known under this name started with monographs by Johannes Reinke and Jakob von Uexküll that were very critical of the Darwinian account of life processes. Later, the Theoretical Biology Club in London in the 1930s (see, e.g., Niemann 2014; Peterson 2017) and Waddington's Symposia "Towards a Theoretical Biology" in 1966–1970 developed an approach that was largely structuralist.[3] Much the same tradition, together with a view critical of neo-Darwinism, has been followed by the annual Estonian Spring Schools in Theoretical Biology conducted since the 1970s, as well as the series of symposia organized by the Konrad Lorenz Institute in Altenberg, Austria, and their book series.[4] An Altenberg symposium held in 2008 was even thought to have become something like the Woodstock of Evolution (Whitfield 2008).

For a better understanding of the structure of biological thought, it could be instructive to characterize some of it via the opposition between structuralism and functionalism. For instance, Elliot Murphy writes:

> Whereas many have characterised the central debate in nineteenth-century biology as being between evolutionists and creationists, a more accurate classification (as Darwin himself noted) would distinguish teleologists[5] (who regarded adaptation [as] the single most important aspect in evolution) with morphologists (who held that commonalities of structure were the defining biological characteristic) – a dichotomy stressed by E. S. Russell's *Form and Function*. The formalists (or, following Chomsky's terminology, 'internalists') include such figures as D'Arcy Thompson, Brian Goodwin, Richard Owen, Stuart Kauffman, Geoffroy St. Hilaire, Richard Goldschmidt, Nikolai Severtzov, Louis Agassiz, Karl Ernst von Baer and Goethe (whose plant studies lead him to coin the term 'rational morphology'). They focused on form and structural commonalities as their explana[n]dum, leaving aside the question of adaptive effects as a secondary concern. (Murphy 2012: 49–50)

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[3] See also an overview of two of these symposia by Waddington (1968).

[4] My own first encounter with the non-Darwinian views occurred at a Theoretical Biology Winter School in Borok, Russia in 1976, where Sergei Meyen and his colleagues expressed their support to the nomogenetic theory of Lev Berg and Aleksandr Lyubischev. What decisively changed my understanding of evolution was a result in mathematical modelling of the effects of biparental reproduction on variability that proved the communicative origin of species (I published it in Estonian in *Schola Biotheoretica* in 1985).

[5] It can be noticed that the terminology seems to be confusing – usually, it is Baer who has been considered to be a teleologist, and not Darwin. It depends on how we position adaptation (and learning).

This is the same opposition between functionalism and structuralism to which Stephen Jay Gould devoted his *opus magnum*, *The Structure of Evolutionary Theory*, using it as his main thread of argument (Gould 2002).

Accordingly, described as neither neo-Darwinian (selectionist) evolutionism (functionalism, in Gouldian terms) nor creationism, there is a third way of formalism, or structuralism, or internalism (as these concepts were treated in the quotation above from Murphy). Indeed, the scholars listed by Murphy (in a rather haphazard manner) are those more often referred to in writings representing the *third way* than in the Modern Synthesis ones.

Moreover, formalism, structuralism, and internalism are the approaches on which the 20th-century semiotics was based to a large degree. Thus the third way hints directly towards biosemiotics even if not using the term. And more than that: post-structuralist and cognitive approaches in semiotics go hand in hand with analogous trends in the evolutionary (epigenetic) thought of the late 20th century.

Yet there is more than that: since semiotics is not just about structure, but is fundamentally about meaning or function, the third way is another approach to functionality, and to the phenomenon of adaptation. The functionalism/structuralism opposition is not sufficient to describe the situation, while the new approach provides a non-Darwinian model of adaptation.

Instead of a lengthy description of the predecessors of the current change, for instance a survey of the role of Karl Ernst von Baer, James Mark Baldwin, Lynn Margulis, and others, let me point out two more recent events paving the way for the Royal Society meeting in 2016.

2011 meeting at the Linnean Society

One of these was a meeting organized by the British entomologist Richard Vane-Wright five years earlier, almost at the same location and with the same aims. It took place on 8 September 2011 at the Linnean Society of London – remarkably in the same location on Piccadilly where the articles by Charles Darwin and Alfred Russel Wallace caused a turn in evolutionary biology in 1858.

The 2011 conference was titled "The role of behaviour in evolution – 'organisms can be proud to have been their own designers'"[6]. The speakers were Peter Corning, Denis Walsh, John Dupré, Patrick Bateson, Anne Magurran, Gregory Grether, Birgit Arnholdt-Schmitt, and Kalevi Kull; the audience included Peter Saunders, the late Mae-Wan Ho, and Robin Bruce. By no means a large event, it certainly was an influential step towards the conference held in nearby Carlton House Terrace five years later.

[6] The subtitle was a reference to Kull 2000. Vane-Wright used it as a motto already in an earlier paper (Vane-Wright 2009). See also Vane-Wright 2011.

Moreover, the 2011 meeting resulted in a special issue of *Biological Journal of the Linnean Society* (Volume 112, Issue 2, 2014) titled "The role of behaviour in evolution". The contributors were R. I. Vane-Wright, Peter A. Corning, Massimo Pigliucci, Patrick Bateson, Gregory F. Grether, Kalevi Kull, Denis M. Walsh, John Dupré, Adrian M. Lister, Andrew Packard with Jonathan T. Delafield-Butt, and Robin W. Bruce. As it includes works that describe the role of agency and further details of a non-Darwinian mechanism of adaptation (*incl.* Bateson 2014; Kull 2014; *etc.*), it has a direct bearing on the turn in evolutionary biology.

The third way of evolution

Evolutionary biology is a field heavily intertwined with ideology (see, e.g., Kolchinskij 2014). For instance, Darwinism of the early 20th century was often related to the eugenics movement; the vulgar Darwinism of Trofim Lysenko was supported by Soviet Communist ideology in the 1940s-50s, as was the Synthetic Theory of Evolution in the following decades; neo-Darwinism is supportive of and supported by neoliberal ideology; etc. This makes effecting the turn considerably more difficult. Obviously, it cannot be brought along by a single scientist, or by a single event. However, a whole series of discussions may make it happen.

The logical precision and completeness of the description of mechanisms discovered is certainly important. However, the terminology is often so imprecise – particularly as to the most general concepts especially in focus as concerns the change – that it is hard to formulate the necessary distinctions in an unambiguous way. For instance, even the term 'natural selection' – despite its mathematically clear definition in many works on population genetics – is defined very loosely (and variably) by most biologists.

In 2014, a group of scholars supporting the idea of the *third way of evolution* was formed. This project was launched by James Shapiro, Raju Pookottil (creator of the website) and Denis Noble, the last-named being the present leader of the group, whose reformulation of metaphors for general biology (Noble 2006; 2013) has been remarkably influential. The group is presented by an internet portal[7] that briefly introduces the work of scholars (currently 60 in number) that has been instructive for rearranging the theory of evolution, or replacing the neo-Darwinian theory. Thus, the change is becoming truly collective: no earlier single attempt has been able to establish it, so the collective effort appears to be the only way to go in this situation.

The sharpness of the contrast can be seen, for instance, in a pair of articles presenting the opposing views quite recently published in *Nature* (Laland *et al.* 2014; Wray *et al.* 2014). A set of interviews with some members of the third way of evolution (Mazur 2015) provides an insight into some aspects of the paradigm shift.

[7] See http://www.thethirdwayofevolution.com/.

The meeting itself: Royal Society, London, November 2016

The three-day conference "New trends in evolutionary biology: Biological, philosophical and social science perspectives" took place at the Royal Society of London, with close to 300 attendees. This 'Scientific Discussion Meeting' was organized by Denis Noble, Nancy Cartwright, Patrick Bateson, John Dupré and Kevin Laland in collaboration with the British Academy.

There was a balanced overlap with speakers of the former meetings that paved the way for this one: there were Gerd Müller and Eva Jablonka from Altenberg 2008, while Patrick Bateson and John Dupré had been presenters at the 2011 Linnean Society meeting. From the members of the Third Way of Evolution interviewed in the book by Mazur (2015) the programme included Denis Noble and James Shapiro.

The preparation period for the meeting had lasted over two years, and as the organizers confessed, the programme had to be modified even after acceptance by the host organizations, largely because of the reluctance by some neo-Darwinist biologists to take part.[8] However, the final programme included supporters of rather opposing views, which benefitted the resulting discussions, I find. The following provides a few brief notes made on spot about the talks, in the order they were given.

Day 1. In his welcome speech, Denis Noble reemphasized the importance of the fact of the British Academy and the Royal Society being the event's joint organizers – which is in itself rare – and called for discussions between the humanities and natural sciences on evolutionary biology which is a very vigorous field of science. He also mentioned that the organizers had been trying to balance the programme of the meeting since the outset.

The programme was opened by Gerd Müller's programmatic lecture "The extended evolutionary synthesis". Müller started with pointing out how the definition of evolution has changed: for Darwin it was 'descent with modification', for population geneticists 'change of gene frequencies in populations'; evolution has also been defined as 'species diversification', or as 'generation of organismal complexity' (evo-devo, systems biology, behavioural biology), or as the origin of mind, language, society, culture (anthropology, linguistics, social sciences).

According to Müller's claim, the Modern Synthesis (seeing natural selection as the only directional factor in evolution) can explain genetic variation in evolving populations very well. What the Modern Synthesis does not explain, however, is phenotypic complexity, the origin of body plans, phenotypic novelty, non-gradual forms of transition, non-genetic factors of change. He also pointed out that the microevolution–macroevolution distinction obscures the issues that emerge from the current challenges to the standard theory.

[8] Some of these discussions are described in Mazur 2016.

By describing a number of challenges for evolutionary biology of the past two decades, Müller provided an integrative view, for which he used the niche construction scheme of Odling-Smee, but adding more recursivity to it.

Müller claimed that a more complex and more pluralistic picture that we have reached now – the Extended Synthesis – is based on new evidence from multiple fields; it integrates them and has a heuristic value; it has its own predictions that are different from the Modern Synthesis framework (see also Pigliucci, Müller 2010; Laland *et al*. 2015).

Douglas Futuyma in his lecture "The evolutionary synthesis today: Extend or amend?" responded to the position outlined by Müller, stating that most of the phenomena Müller described have been known already for a long time and have been integrated by the contemporary Modern Synthesis. He further demonstrated how several of these phenomena (including niche construction, plasticity, the Baldwin effect, restricted phenotypic variability, constraints on developmental directions, etc.) can be explained by the standard theory, according to which an improbable new thing begins with a single thing (change in a genome), and turns into a feature of a population via natural selection.

Sonia Sultan in her paper "Developmental plasticity: Re-conceiving the genotype" described experiments with *Polygonum* plants that showed trans-generational plasticity, pointing out how the genetic information accessible for natural selection is dependent on the environment. According to her, a theory of adaptation that would describe adaptation on the individual level is still missing.

Russell Lande ("Evolution of phenotypic plasticity") spoke about correlated variation in the wild, showing how evolution of plasticity accelerates phenotypic evolution and adaptation. As he describes an evolutionary change, it begins with a rapid transient increase of plasticity, followed by slow genetic assimilation – all explainable on the basis of the assumptions of standard theory. At this conference, Lande, together with Futuyma, were the strongest supporters of the view that the basic assumptions of Modern Synthesis are capable of covering the explanations of phenomena related to learning and plasticity.

Tobias Uller ("Heredity and evolutionary theory") described a strong self-referentiality in the evolution of organisms. The standard theory does not demonstrate clearly enough that variability, selection, and heredity are all changing themselves.

John Dupré ("The ontology of evolutionary process") spoke about the importance of process ontology in biology, noting that life consists of processes rather than things. He recalled that the Theoretical Biology Club of the 1930s (including Joseph H. Woodger) was strongly influenced by Alfred Whitehead's process philosophy. Even genomes are not static, not to mention other systems of life. An organism should be viewed as a hierarchy of developmental processes which are stabilized, not by inertia, but by activity.

Paul Brakefield ("Does the way in which development works bias the paths taken by evolution?") analysed the phenomenon of developmental bias using the data on eyespot pattern evolution on butterfly wings. He showed, for instance, that there exists flexibility in size but not that much in colour of eyespots. Thus the way development works and the restrictions it poses can contribute to shaping evolution.

Kevin Laland had titled his presentation as "The middle ground between artificial and natural selection: Niche construction as developmental bias". After John Odling-Smee, Laland is one of major proponents of the niche construction model. He sees niche construction as opposite and complementary to natural selection. He also contrasted the niche construction view with Richard Dawkins' extended phenotype perspective. However, the niche construction model uses natural selection as a necessary component of the evolution mechanism (see Odling-Smee *et al*. 2003). To put it simply, organisms can strongly affect the selection pressure by the way in which their behaviours change their own environment. According to this model, the behavioural bias or the developmental bias and natural selection work together. Ecological inheritance plays an important role in this. An organisms' decision-making is a factor that influences natural selection.[9]

Day 2 began (after a brief welcome note from Denis Noble) with a lecture by James Shapiro ("Biological action in Read-Write genome evolution"), in which he gave many examples of endosymbiosis, hybridization, horizontal DNA transfers, regulatory functions by non-coded RNAs etc., as examples of how living organisms regularly use generic activities to facilitate their own evolution. In particular, he noted that hybridization is a trigger for reorganization of the genome (see also Shapiro 2011).

Paul Griffiths ("Genetic, epigenetic and exogenetic information in development and evolution") described a new measure of biological information, formalizing the concept of information as specific difference making. He saw it as a generalization of Francis Crick's conception of information, aiming to build a measure applicable both at the genetic and the epigenetic levels.

Eva Jablonka ("The role of epigenetic inheritance in evolution") recalled Karl Popper's strongly critical evaluation of Darwinism (see Niemann 2014). While Ernst Mayr (1980: 17) has claimed that "soft inheritance does not exist",[10] Popper, to the contrary, viewed organisms as active agents, making it possible for an evolutionary change to start from the phenotype, not from the genotype. Once again repeating Mary Jane West-Eberhard's

[9] One can see a similarity between constracting a niche and constructing a scaffolding (as described, e.g., by Hoffmeyer 2014). However, according to Laland, scaffolding is a special case of niche construction.

[10] The whole sentence runs: "It was perhaps the greatest contribution of the young science of genetics to show that soft inheritance does not exist" (Mayr 1980: 17; Mayr dedicated this article to Bernhard Rensch).

maxim that genes are followers, not leaders,[11] Jablonka also spoke about the role of what has been called adaptive improvization (Soen *et al.* 2015). She made the summary: "(1) Phenotype first – the activity (phenotypic accommodation) of the organism is fundamental, and drives evolutionary processes. (2) Hereditary variation – there is more to heredity than genes. Evolution can occur on different (interacting) axes. (3) Selection – there is more to selection than natural selection. (4) Natural selection is not the only process that can lead to cumulative evolutionary change". Proceeding from this, she asked: "Together, does this mean that all we need is just a cosmetic change to the Modern Synthesis? What would count as a revision?"[12]

Greg Hurst ("Extended genomes: Symbiosis and evolution") introduced some interesting deviations from the standard model that stemmed from the role of symbiosis. He spoke about the holobiont as a level (and a unit) of selection and demonstrated how microbial variation can produce inter-individual phenotypic variation that affects survival and reproduction. "Symbiosis affords opportunity to develop otherwise unavailable phenotypes," he said.

In his lecture "Evolution viewed from medicine and physiology" Denis Noble described how organisms can and do harness stochasticity in order to generate functionality – providing explanations for these mechanisms. Due to this, the evolutionary process is directional, and this is a huge change, not a mere tinkering or minor change in Modern Synthesis. This, as he said, turns neo-Darwinism on its head. This is a major change that has implications in economics, political theory, and various other disciplines, philosophy included. As a consequence, the evolutionary equations that have been used for modelling evolution have to be revised. Noble also emphasized that conceptual change in biology is not based on one experiment, but on cumulative evidence.

Andy Gardner in his talk (""Anthropomorphism" in evolutionary biology") analysed a formulation common in neo-Darwinian biology that "organisms strive to maximize their fitness". He showed the similarity between the adaptation concepts of William Paley and of Darwinians. According to Gardner, Darwin's theory, viewed on such an approximation, has an enormous predictive power for biology.

In his talk "Adaptability and evolution", Patrick Bateson, after recalling the work of James Mark Baldwin (the Baldwin effect as an adaptability driver), Jean Piaget (his *Behaviour and Evolution* from 1979, also mentioned by Eva Jablonka), and Michael Conrad (adaptability is related to the uncertainty of the environment), spoke about the importance of play and playfulness in creativity and innovation. Play, as he said, enhances adaptability. Generalist species are more playful than specialist species.

A round table discussion with Andy Gardner, Marcus Feldman, Tobias Uller and Douglas Futuyma closed the second day. In her introduction to the discussion, Nancy

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[11] West-Eberhard 2003: 29 – see above, p. 635.

[12] These quotations derive from the slides used during the talk.

Cartwright compared sciences as either testable operational (as Karl Popper put it), or research programmes (as characterized by Imre Lakatos). She admitted that Darwinian evolution was a viable research programme. Another distinction, when speaking about selection, concerns the problem whether there is viability selection or fertility selection. (Or – is there selection?) As to the main discussion point, Eva Jablonka asked Douglas Futuyma what he would consider a major extension and not just cosmetics of evolutionary theory. Futuyma responded that there was a comfortable assimilation of new ideas into the Modern Synthesis, but what would be really new would be a mechanism for adaptation that is not based on selection; that would be really surprising.[13]

Day 3 of the meeting saw more speakers from the field of anthropology, with the particular theme of applying the concept of niche construction in the sphere of culture.

Samir Okasha ("Evolution and the metaphor of agency") demonstrated how the metaphoric agential thinking that has become widespread in neo-Darwinian discourse is misleading and should be avoided, particularly as it inhibits the correct usage of the concept of agency in biology. Organisms, at least as far as they can make true choices, are agents. The speaker assumed that organisms have a single overall goal. However, in order to make a true choice, there is no need for a single overall goal; it is enough to have local simultaneous options.

Karola Stotz spoke in her presentation ("Developmental niche construction") how the environment is also a creator of variation, and how species-typical knowledge is acquired via social networks, referring among others to Jean Piaget, Paul Weiss, and Scott Gilbert. Broadening historically the niche construction concept, she quoted West and King (1987: 552) who suggest asking "not what's inside the genes you inherited, but what the genes you inherited are inside of" (see also Oyama 2000).[14]

Tim Lewens ("Human nature, human culture: The case of cultural evolution") pointed out that the study of cultural evolution does not need the culture/nature distinction. Moreover, with reference to Christina Toren, the cultural/biological distinction is problematic. Thus, it can be claimed that social process is fundamental, whereas the type of culture is its product.

Agustín Fuentes ("Human niche, human behaviour, human nature") provided some archeological data that demonstrated a growth of violence in the course of cultural evolution, also pointing out during the discussion that semiotics is of vital importance in understanding the human niche.

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[13] It is remarkable that it already exists – a model explaining the mechanism of adaptation without natural selection, while still assuming only random mutations (see Kull 2014; Hughes 2012).

[14] It should also be noted that the concept of 'developmental niche' is very close to the semiotic niche as described, for instance, by Jesper Hoffmeyer (2008).

Andrew Whiten ("A second inheritance system: The extension of biology through culture") spoke about the role of social learning and social inheritance, and gave many examples of it.

Susan Antón ("Human evolution, niche construction and plasticity") asked how much the phenotype having been considered unimportant has influenced the study of human evolution.

Melinda Zeder ("Domestication: A model system for evolutionary biology") spoke about evolvability in a human-engineered niche, and ecological inheritance. She pointed out how in case of domestication the changes in different genes can be connected.

In the final *round table discussion* with Robert Foley, Christina Toren, Melinda Zeder, Tim Lewens and Eva Jablonka, some take-home messages were expressed. Foley explained why the modified theory of evolution is more suitable for social sciences and humanities than the earlier one. Toren noted that, in addition to process ontology, also process epistemology is needed. Jablonka stressed that the first question to be asked is how a social system is maintained across time; once this is understood, we could start to study how it is changing or how to change it. Jablonka also said: "Natural selection is only a special case of differential stabilization", and, concerning methodology, she claimed that thick descriptions are important also in biology and ecology. The discussants found it was important to think how to make biologists interested in the work of the social sciences.

Concluding remarks

Agency, learning, niche construction, meaning-making – these are phenomena common to living beings. Anthropology and cultural evolution studies that deal with these phenomena can benefit from biology that includes them. A turn towards this kind of biology was the aim of the meeting.

The views of a scientist can change, and often do change, before there is enough evidence for a new view. For example, my view on mechanisms of evolution moved away from Modern Synthesis already in the late 1970s, as a result of taking seriously the work of Karl Ernst von Baer, Lev Berg and Sergei Meyen, and being influenced by the group of Conrad Waddington. However, the difficult, hard problem for biology is to explain the origin, role, and reality of meaning.[15] Only a theory that can deal with this can without losses suit anthropology and cultural sciences. The mechanism of evolution that is relevant to this has to be capable of explaining adaptation and functionality independently from natural selection. Here, the work of last decades is decisive.

[15] This is where biosemiotics enters – via Uexküll 1928, Hoffmeyer 2014, Deacon 2011, and others (see also Favareau 2010; Emmeche 2002; Kull *et al.* 2009).

As it has been explained by several scholars, the non-selectionist adaptation-making mechanism is based on the capacity of organisms to find solutions in new situations and keep these if they met their needs. Organisms themselves do not test their behaviour against survivorship – they do it against the fulfillment of their current needs, and this is usually enough to keep their line alive, maybe for millions of years. Random genetic processes build or transform stochastic constraints that are channeling behavioural possibilities and make the forms inheritable. Assortative mating, that is unavoidable in the case of biparentality, results in a certain inbreeding and reduction of intraspecies genetic variability. Strictly speaking, adaptation (and speciation) is possible without natural selection.

As has often been the case in recent decades, if only some aspects of the new view get described, its interpretation in the framework of Modern Synthesis will be presented soon. However, what really changes the theory of evolution is a model that demonstrates adaptation without natural selection. And, as was said above, this result already exists.

Thus, functionalism and structuralism become integrated in the current turn, resulting in a semiotic biology that could best suit not only social sciences and humanities, but also biology itself. The neo-Darwinian theory will stay as a restricted special case of a much richer and deeper theory of evolution (see also Ingold, Palsson 2013).

Denis Noble and his colleagues organized a meeting at the Royal Society that may prove to have been historic. Not because of any new results *per se* (the results as well as their new interpretations were published earlier) but for the collective shift in viewpoint. It was not a scientific turn – that had already happened some years earlier. However, it was a social turn in evolutionary biology (irrespective of the fact that in the Society for the Study of Evolution, and in the European Society for Evolutionary Biology the turn still seems to be ahead) – the meeting in which, I suppose, the majority of the attendants felt it.[16] For me, the scientific turn in evolutionary theory had happened already at the meeting of the Linnean Society in 2011, while the important scientific results themselves were on the table even earlier.

Above all, for different interpreters the science moves differently. There are many evolutions in one evolution. The history of life – the history of semiotic systems – is plural, and everything that is meaningful is essentially plural.[17]

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[16] See, e.g., an account of this meeting by Perry Marshall (Royal Society's "New Trends in Biological Evolution" – a bloodless revolution; http://cosmicfingerprints.com/royal-society-evolution/).

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References

Bateson, Patrick 2014. New thinking about biological evolution. *Biological Journal of the Linnean Society* 112(2): 268–275.

Cobley, Paul 2016. *Cultural Implications of Biosemiotics*. (Biosemiotics 15.) Berlin: Springer.

Deacon, Terrence 2011. *Incomplete Nature: How Mind Emerged from Matter*. New York: W. W. Norton & Co.

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.

Favareau, Donald (ed.) 2010. *Essential Readings in Biosemiotics: Anthology and Commentary*. (Biosemiotics 3.) Berlin: Springer.

Foucault, Michel 1971[1966]. *The Order of Things: An Archaeology of the Human Sciences*. New York: Pantheon Books.

Gould, Stephen Jay 2002. *The Structure of Evolutionary Theory*. Cambridge: The Belknap Press.

Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton: Scranton University Press.

– 2014. The semiome: From genetic to semiotic scaffolding. *Semiotica* 198: 11–31.

Hughes, Austin 2012. Evolution of adaptive phenotypic traits without positive Darwinian selection. *Heredity* 108(4): 347–353.

Ingold, Tim; Palsson, Gisli (eds.) 2013. *Biosocial Becomings: Integrating Social and Biological Anthropology.* Cambridge: Cambridge University Press.

Jablonka, Eva; Lamb, Marion J. 2014[2005]. *Evolution in Four Dimensions: Genetic, Epigenetic, Behavioral, and Symbolic Variation in the History of Life.* Cambridge: The MIT Press.

Kolchinskij, Eduard I. 2014. Edinstvo evolyutsionnoj teorii v razdelennom mire XX veka. St. Petersburg: Nestor-Istoriya. [Колчинский, Эдуард Израилевич 2014. Единство эволюционной теории в разделенном мире XX века. Санкт-Петербург: Нестор-История.]

Kull, Kalevi 2000. Organisms can be proud to have been their own designers. *Cybernetics and Human Knowing* 7(1): 45–55.

– 2014. Adaptive evolution without natural selection. *Biological Journal of the Linnean Society* 112(2): 287–294.

Kull, Kalevi; Deacon, Terrence; Emmeche, Claus; Hoffmeyer, Jesper; Stjernfelt, Frederik 2009. Theses on biosemiotics: Prolegomena to a theoretical biology. *Biological Theory: Integrating Development, Evolution, and Cognition* 4(2): 167–173.

Laland, Kevin; Uller, Tobias; Feldman, Marc; Sterelny, Kim; Müller, Gerd B.; Moczek, Armin; Jablonka, Eva; Odling-Smee, John 2014. Does evolutionary theory need a rethink? Yes, urgently. *Nature* 514(7521): 161–164.

Laland, Kevin; Uller, Tobias; Feldman, Marcus W.; Sterelny, Kim; Müller, Gerd B.; Moczek, Armin; Jablonka, Eva; Odling-Smee, John; 2015. The extended evolutionary synthesis: Its structure, assumptions and predictions. *The Royal Society Publishing Proceedings B* 282: 20151019.

Mayr, Ernst 1980. Prologue: Some thoughts on the history of the evolutionary synthesis. In: Mayr, Ernst; Provine, William B. (eds.), *The Evolutionary Synthesis: Perspectives on the Unification of Biology*. Cambridge: Harvard University Press, 1–48.

Mazur, Suzan 2015. *The Paradigm Shifters: Overthrowing 'the Hegemony of the Culture of Darwin'*. New York: Caswell Books.

– 2016. *Royal Society: The Public Evolution Summit*. New York: Caswell Books.
Murphy, Elliot 2012. *Biolinguistics and Philosophy: Insights and Obstacles*. London: Lulu.
Niemann, Hans-Joachim 2014. *Karl Popper and the Two New Secrets of Life: Including Karl Popper's Medawar Lecture 1986 and Three Related Texts*. Tübingen: Mohr Siebeck.
Noble, Denis 2006. *The Music of Life: Biology Beyond the Genome*. Oxford: Oxford University Press.
– 2013. Physiology is rocking the foundations of evolutionary biology. *Experimental Physiology* 98(8): 1235–1243.
– 2016. *Dance to the Tune of Life: Biological Relativity*. Cambridge: Cambridge University Press.
Odling-Smee, F. John; Laland, Kevin N.; Feldman, Marcus W. 2003. *Niche Construction: The Neglected Process in Evolution*. (Monographs in Population Biology 37.) Princeton: Princeton University Press.
Oyama, Susan 2000. *Evolution's Eye: A Systems View of the Biology-Culture Divide*. Durham: Duke University Press.
Peterson, Erik 2017. *The Life Organic: The Theoretical Biology Club and the Roots of Epigenetics*. Pittsburgh: University of Pittsburgh Press.
Pigliucci, Massimo; Müller, Gerd B. (eds.) 2010. *Evolution: The Extended Synthesis*. Cambridge: The MIT Press.
Sandstrom, Gregory 2016. Trans-evolutionary change even Darwin would accept. *Social Epistemology Review and Reply Collective* 5(11): 18–26.
Shapiro, James A. 2011. *Evolution: A View from the 21st Century*. Upper Saddle River: FT Press Science.
Soen, Yoav; Knafo, Maor; Elgart, Michael 2015. A principle of organization which facilitates broad Lamarckian-like adaptations by improvisation. *Biology Direct* 10: 68, 1–17.
Uexküll, Jakob von 1928. *Theoretische Biologie*. (2te Aufl.) Berlin: J. Springer.
Vane-Wright, Richard 2009. Lives of meaning: Organismal intelligence and the origin of design in nature. In: Smith, John MacDonald; Quenby, John (eds.), *Intelligent Faith: A Celebration of 150 Years of Darwinian Evolution*. Winchester: O Books, 23–48.
– 2011. Whatever happened to the Organic Selectionists? *Antenna* [Royal Entomogical Society] 35(2): 57–60.
Waddington, Conrad Hal 1968. Towards a theoretical biology. *Nature* 218: 525–527.
West, Meredith J.; King, Andrew P. 1987. Settling nature and nurture into an ontogenetic niche. *Developmental Psychobiology* 20(5): 549–562.
West-Eberhard, Mary Jane 2003. *Developmental Plasticity and Evolution*. Oxford: Oxford University Press.
Whitfield, John 2008. Biological theory: Postmodern evolution? *Nature* 455: 281–284.
Wray, Gregory A.; Hoekstra, Hopi E.; Futuyma, Douglas J.; Lenski, Richard E.; Mackay, Trudy F. C.; Schluter, Dolph; Strassmann, Joan E. 2014. Does evolutionary theory need a rethink? No, all is well. *Nature* 514(7521): 161–164.