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Avant 3/2, 108-121

2012

AVANT, Vol. III, No. 2/2012
ISSN: 2082-6710 avant.edu.pl/en

Complexity – emergence – ecological cognition

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Received 15 April 2012; accepted 20 June 2012; published online 24 December 2012.
translated by Ewa Bodal and Nelly Strehlau

Abstract

The present article constitutes an attempt at a review of a few selected questions related to the complexity paradigm and its implications for research on cognition, especially within the so-called ecological approach framework. I propose several theses, among others concerning the two contrary tendencies within the dominant methodology (the propensity to search for simplicity and the growing emphasis on recognizing complexity), as well as the ontological consequences of the phenomenon under discussion (ontological emergence and processual emergentism).

Keywords: complexity; ecological cognition; emergence; affordances; processualism.

The present article constitutes an attempt at an overview of a few questions related to the complexity paradigm and its implications for research on cognition, especially within the so-called ecological approach framework. I propose several theses, concerning, among others, the two contrary tendencies within the dominant methodology (the propensity to search for simplicity and the growing emphasis on recognizing complexity), as well as the ontological consequences of the phenomenon under discussion (ontological emergence and processual emergentism). I begin my reflections by presenting problems connected with the differentiation between an organism and a machine; I further consider to what extent the so-called cellular automata can help in studies on life; in this context, I touch upon the subject of emergence and, against this backdrop, I put forward a few remarks regarding ecological approach towards cognition in the context of the theory of complex systems. Subsequently, I refer to a number of problems/doubts that those commenting on the aforementioned research program are concerned with. The final part of the text is devoted to formulating general philosophical conclusions connected with an approach that could be described as processual emergentism. The following deliberations merely outline a research field and do not make any claims to having exhausted the subject in the case of any of the discussed issues. The majority of included comments have been based on the materials from a special section of texts devoted to the concepts analysed herein which was published in the journal *Ecological Psychology* (Turvey 2008; McClamrock 2008; Bickhard 2008; Chemero 2008; Petrusz 2008; Juarrero 2008). Thus, the essay constitutes a kind of a broad review of critically evaluated issues and an attempt to sketch the prospects for further research.

Complexity

As it turns out, complexity constitutes one of the more crucial issues in both contemporary science and philosophy. Despite our looking for simple rules and longing for fulfilling the dream of completely reducing reality to its smallest, indivisible, fully defined elements, out of which everything previously dismantled can be built anew (which I would term a "block model of the world"), everything turns out to be increasingly complex. It can be said that alongside the earlier (remarkably, often successful) tendency to seek simplicity, there has appeared a new, no weaker one, connected with noticing complexity. The environment is complex, as is the organism living and exercising cognition therein; finally, cognition itself appears to be a much more complex phenomenon than it might have originally been expected. The world, as a whole, presents itself as a set of complex states, or, more precisely, processes. It is defining complexity that remains a problem, as one could inquire whether the aforementioned elements of the world fit into one qualification of complexity, or whether we should talk about different kinds of complexity (Wrześniewski 1995). There are attempts to answer this question within the framework of a philosophical-scientific reflection on the phenomenon of complexity. In my opinion, it is impossible to provide one satisfying definition here. On the contrary, one should endeavour to develop several complementary definitions which would make it possible to encompass all kinds of complexity without falling into overt simplification at the same time (Gell-Mann 1996: 55). The definitions should not, I believe, be too broad, but they cannot be too restrictive, too narrow in their scope. As the complexity of the world and its dynamics is observed, there exists a clear tendency towards at least a partial abandonment of faith in the possibility of setting unequivocal conceptual frames.

To conclude these remarks, one ought to re-emphasise the significance of the existence of two differing tendencies in the history of human reflection. We used to live in the age of simplicity, but now we are increasingly noticing the complexity of reality and of the cognitive process itself. Contending the complexity of the world requires redefining the notion of simplicity as well. Since simple laws and dependencies lead to complex effects, such as chaotic phenomena (Baranger 2011: 7), there appears a problem with separating the former from the latter; to a degree, the old demarcation lines have become blurred. All in all, one could say that complexity has taken the kingdom of simplicity by storm, and that our picture of the world will never be the same as it was.

Organism - machine

The development of research on artificial life, robotics, neuron nets leads to new questions regarding the nature of life and cognition. Nowadays we simulate, build copies of units that live and cognize; one could wonder whether this results in a better understanding of the aforementioned phenomena. In this case we return to the old considerations of Kant, who posed questions about the differences between a living entity and a machine[38] (Turvey 2008: 241–242; Juarrero 2008: 279). His conclusions were radical: that human and other organic creatures are not machines, that this kind of a "thing" is "[...] the reason for and the result of itself" (Kant 1986: 328). A body is, thus, an autopoietic system (Maturana & Varela 1980: 135), to use a more contemporary term. It is characterized by a particular closedness, but also openness, a relationship with the environment. This last property is nowadays the subject of research on distributed cognition, enactivism, ecological cognition or robotics. In this context there exist some constantly returning problems, which concern the nature of life, and the related question regarding the legitimacy of using the term "life" when discussing artefacts. This is significant due to the fact that within the aforementioned studies biology remains a distinguished field, as it is machines that imitate biological processes, and not the other way round. The "game of life" constitutes only a simulation of life (Lubiszewski 2011) but the situation of a robot that would be able to cooperate with the environment, learn, repair its own flaws, or procreate in some way[39] presents bigger problems still. The border between the natural and the artificial has become rather strained in the recent years. The definition of life, which one could concoct from the literature of the field, is based on several determinants:

– self-replication

– self-repair

– adaptation

– learning

– being an open system.

There is, however, no agreement as to which of these conditions should be considered necessary, and which sufficient for life to come to exist. It is a phenomenon which does not allow for an unequivocal account. Reductionist descriptions and suggestions of a biochemical definition of life do not exhaust the spectrum of the answers. Today, life is defined as a very broad notion - firstly, one ought to answer the question, what

[38] Kant's questions were primarily concerned with teleology, which contemporarily takes on a naturalized form of teleonomy.

[39] This would be the situation of a robot capable (according to the possessed algorithm, the equivalent of DNA) of constructing, using the materials available in its environment; a microrobot capable, in turn, of independent development. It may sound like a fragment of a science-fiction plot, but it does not overly exceed our imaginings regarding the future.

kind of life are we asking about? Does the question regard a virus, a cell, a simple organism, or maybe a human being? A description utilizing the abovementioned features of a living unit would look slightly different for each of the specified levels. In the context of the theory of complexity we seek such a definition of life that would extend its scope to all its manifestations. In such an approach, life is a property of dynamic open systems, which retain their identity while interacting with the environment, and are able to produce and re-produce themselves. This kind of an autopoietic system is characterized by self-organization (Petrusz 2008: 272), its “behaviour is regular without being regulated” (Gibson in: Turvey 2008: 241).

Cellular automata and chaos

Cellular automata are mathematical models which consist of a defined grid of cells, a given initial state and the rules of moving between subsequent states. Hence, one of the most known automata is called the “game of life”: most briefly, it can be described as a machine simulating life, or, more precisely, two of its aspects: birth and death. Both in the discussed example and in others, the mathematical model is transformed into a computer program, which allows for a long-term simulation of the automaton’s behaviour. The life which we manage to simulate with the use of such an automaton is not compiled, the “cells” of the board on which the “game” is taking place can be only “dead” or “alive.” However, this simple phenomenon frequently leads to surprising results, such as complicated patterns which change periodically, fade after a certain time, or, theoretically, there is no end to changes in them. Visible problems arise when we try to include a more or less complex environment in this simulation, which consists in increasing and differentiating the entry population and changing the rules. Therefore, the discussed automata are very sensitive to slight changes of the initial parameters. This phenomenon is well known from chaos theory, where it occurs under the name of “the butterfly effect.” We are able to observe changes in a given set, but the possibility of prediction is very limited - “the lack of explanatory power runs deep” (Stewart & Cohen 1997: 76). One could ask how legitimate is it to talk about learning the rules governing life and complexity itself in this case. A lesson taken from research on chaos theory may, again, be of help. We describe chaos as deterministic in order to emphasize that it is not the everyday meaning of chaos (a commonplace lack of order), that order can emerge out of such chaos, but, frequently, this order is only partial, and, more importantly, the behaviour of such a system is unpredictable. Determinist processes underlie both the chaotic phenomena, and the behaviour of cellular automata. However, at a certain point there may occur a qualitative change which cannot be predicted from the basic rules. We talk of emergence then. Subsequently, this leads to an important assessment - in this case, we can describe a system (e.g., a so-called route to chaos) rather than establish rules, which, as in classic science, allow us to make predictions, obviously with a margin of error. Within the framework of the theory investigating the behaviour of systems which are far from equilibrium and being non-linear, determinism is preserved only partially. Classical causal determinism should be forgotten. Here, the determining of phenomena becomes a much more complex phenomenon, and causalism does not suffice (Petrusz 2008: 275-277). There appears the issue of interpretation, which, I believe, belongs to the field of philosophy. On the one hand, one could insist on the old image "despite it all" and claim that the image of the world resulting from the research on complexity is illusory. The impossibility of establishing initial conditions with infinite precision is then treated as a difficulty both technical and epistemological in nature, while the problems with predicting are blamed on the computer efficiency, inadequate for the scientists' needs. This resembles the situation of the proponents of classical determinism in the context of the debate on quantum mechanics. It is always possible - even despite one's experiences - to refer to "hidden variables" and insist on the falsity of the Copenhagen interpretation. In the extreme version of such an approach, Laplace's demon would still fare quite well. On the other hand, in the context of the research on complexity, a thesis is posed that the obstacles are lurking not in us, but in the very structure of reality. In one of the versions of this argument it cannot be predicted how the complex systems which are far from equilibrium may evolve as the system itself is the fastest computer capable of "calculating" all the necessary equations (Halpern 2004: 185). In order to learn what such an evolution will look like, we cannot but wait patiently and draw possible conclusions *ex post*, albeit without any guarantee that they could be reasonably related to future events. In such cases, a simulation fails from the point of view of ontology of reality as well. In order to conduct a simulation of a system in which every element might play the role of the proverbial Lorenz's butterfly, one would need to carry it out on the 1:1 scale. Simulating weather on such a scale turns out to be pointless from the very start. Simulating is an activity similar to drawing a map - what sense would it make to take a stroll though the town with a map imitating every slab of pavement?

To a large degree, living systems resemble chaotic systems; the exact level of aptness of this comparison is unknown, but the similarities do not seem accidental. Thus, life could be termed a chaotic, nonlinear property. The analogy between chaos and complexity turns out to be extremely important[40]. The very assumptions underlying the so-called complexity sciences deny the possibility of discovering the laws of complexity similar to the old, classic ones. Nonlinear processes, deterministic chaos, prediction problems, explanation being just a description -- all these phenomena result in scepticism regarding the possibility of establishing unequivocal rules. However, I believe one could talk about a new kind of science, a new approach to explanations. Just as after the quantum revolution the classical science turned out to be a useful approximation on a scale of a certain size, the awareness of the nonlinear character of complexity does not eliminate the old description. Still, one ought to realize how incomplete the classical descriptions are. As it is usual in such cases, the problem of reduction returns. In the methodology of research on cellular automata there can be found the conviction about the possibility of achieving reduction - reducing complexity to a few simple issues. From here, we are only a step away from deciding that there occurs a certain continuum from the physical and chemical phenomena to the biological ones. Since in chemistry we deal with the phenomena of self-organisation (e.g. the

[40] However, one ought to remember that complexity is a broader concept. A common feature of chaos and complexity can be found in non-linearity. Complex systems display chaotic behaviour, but chaos can also appear in simple systems (Baranger 2001: 10).

Belousov–Zhabotinsky reaction), we can assume that even the behaviour of an organism could be ultimately explained by studying the patterns of behaviour of such simple systems. Said tendency to notice complexity very clearly meets here the desire to return to the reductionism of a few simple rules. However, I think that this might be only another dream about reduction, and that the truth lies somewhere in between. Complexity is specific to various levels of reality, and although some generalizations can be provided, we are far from creating a science of complexity, within which, regardless of the scale, we would be dealing with the same general pattern of causality - as e.g. Chemero (2008) would want it. Still, this leads to forgetting about the problems regarding the nature of such potential laws. As it happens in the case of chaos, searching for the laws of complexity is encumbered with numerous stipulations. The reductionism we might talk about in such a case has little in common with its classic version, to which we are so used. In its classic version, reduction *de facto* boiled down to relating mechanical causes; our picture of the cause and effect relationship has not changed much. However, nowadays we are aware that the problem of determination is more complex (Bunge 1968: 30-38). In the world, there cooperate different kinds of phenomena determination, which cannot be reduced to simple causes and results found in unequivocal relationships (Petrusz 2008, Juarrero 2008: 278-280) . At this point we touch upon the aforementioned extremely crucial issue of how new things appear (emerge) in the world, that is, the issue of emergence. The difficulty in pointing to simple cause-and-effect dependencies has resulted in an attempt to admit that a radical novelty is a natural property in the world. Where we have a cause (an earlier, less complex stage) and a result (a later, more complex stage which has new properties, behaviour or structure), the element that would connect both states is still lacking. In my opinion, this "something" is ontological emergence, which refutes the idea of a universal microreduction (Silberstein, McGeever 1999).

Emergence - naturalization and cognition

Nowadays emergence has apparently become "disenchanted" as a result of naturalization. Scholars presenting a scientistic approach hold that emergence will soon become an element of a highly formalized and mathematized science concerning complexity. From a philosophical point of view, these demands can be read as a result of the tendency to look for simplicity and reduction. However, I think that such an attitude towards the matter does not solve the problem. Without prejudging the development of science, we now rather ought to agree on a version of ontological emergence according to which we abandon the hard reduction postulate even in its oblique forms - emergent properties are, on their own, natural, emergence does not require naturalization, but rather simply accepting it into our framework of perceiving the world. The problem lies in finding the middle ground between the tendency to reduce phenomena and irreducibility as an important characteristic of emergence. These tendencies can be seen as contradictory, but at the same time they seem to lead to the most adequate description of reality. While talking about ontology, one cannot however forget epistemology - traditionally, epistemological emergence is juxtaposed with the ontological (metaphysical) kind. The epistemological version can be termed "ostensible" - it is a result of the imperfection of our cognitive apparatus, a function of the state of knowledge at the given moment. What today is described as ‘emergent’ does not have to be so in a hundred years. This is relative emergence, which will be explained and ultimately “disenchanted.” Another epistemological issue is the question of emergence in the very cognitive process. Perception, thinking, experiencing emotions might be described as emergent phenomena. Emergentism is, therefore, an approach useful in the analyses of cognition itself as well. If we consider the cognizing subject in all its relationships with the environment, retaining at the same time the memory of its complexity as an organism, undoubtedly we arrive at the necessity of developing such a concept that would connect into a whole the theory of complexity and emergence in the context of ontology and cognition theory. In this case, the concept of so-called ecological cognition, originally developed by James Gibson, appears useful.

Ecological cognition, affordances and hypersets

In the context of the theory of complexity, cognition is described as a dynamic system, engaging the subject and the environment. Perception, as well as the mental “handling” of its effects, constitutes a process wherein, on various stages and levels, one can talk about emergent phenomena. Research on cognition is problematic due to several reasons. Perhaps the most important of these is the one which stems from the fact that, as Gibson put it, “All forms of cognitive processing imply cognition so as to account for cognition” (in: Turvey 2008: 241). This state of things constitutes a serious challenge, as it implies a variation on the old problem of the subject - object relationship, wherein we study a tool with the use of this tool. Cognition is never a given, it is a process which we try to grip by the means of a process that is numerically different, but, ultimately, qualitatively identical. Thus, we arrive upon a specific kind of an aporia - there appears a question: how can one reduce cognitive phenomena, is it not so that a dissection into primary factors results in an irretrievable loss of the subject of the inquiry? To what extent should it be a description of a dynamic system, retaining its identity and integrity, and to what - a dissection into primary factors? Can the diachronic and synchronic perspectives be reconciled? Can the dynamism characteristic for cognition be described in static terms? We can find here clear signs of dualism, which makes a fully unitary description impossible. Once again, as in the discussion about the issue of the essence of life, one ought to answer a key question: how precise should the description be, which determining factors should be taken into the account? It seems that it is easier to further multiply the question marks, rather than provide any constructive answers.

However, there exists quite a broad trend in the contemporary research on cognition, wherein scholars make attempts to answer the question posed above. Herein one can point towards the enactivist approach, the embodied mind concept, studies on distributed cognition or precisely the ecological approach. All these concepts offer answers to basic questions, such as: Where does cognition begin and end? What is the cognizing subject? What is the very nature of cognition? which are different from the classical ones (that is those Cartesian in spirit).

The subject seems to lose its former distinctness, separateness, it is fixed, embedded (immersed, anchored) in the environment, its borders become blurred (Bickhard 2008: 254-255). To put it differently, the inner/outer categories gain a new articulation. Within the ecological approach, one attempts in this way to understand the concept of affordances, which is key to this perspective. This issue has been taken up in his account by Chemero (2008). The author refers to two possible ways of understanding affordances: as dispositional properties of animals complemented by the dispositions which are contained in the elements of the environment (Turvey 1992) and, according to his own, previously proposed perspective, as higher-order relational properties of animal - environment systems (Chemero 2003; 2008: 263; Chemero & Turvey 2007: 31)[41]. Ultimately, Chemero deems both approaches to affordances as close to each other, insufficient and overly static. As he claims, there a theory of "affordances 2.0" is what is really needed (Chemero 2008: 265). They are to be more mutable over time, individual, based on a constant interaction of elements. The relation connecting all the elements of the system wherein cognition occurs ought to be re-formulated in order to emphasise the circularity of determination - every element (function, process) of a system is, at the same time, its own cause and effect (Chemero 2008: 259; Turvey 2008: 242; Petrusz 2008: 271). Such a system is closed to outside causative reasons: this feature is defined as autonomy. What Chemero has aimed to do is to describe affordances as a complex, autonomic system. Moreover, he attempts to delineate dependencies within the subject - environment system with the aid of the set and hyper set theory. The latter are better suited to outline the interesting relationship due to a specific property - they are their own elements (Chemero 2008: 257)[42]. That last property allows, in turn, to put the property of being a complex autonomic system into graphs of a circular structure (Chemero 2008: 258). In this context, complexity has been defined as a property of the system whose hypersets have loops on the graphs that present them. In this case, one can refer to a specific self-referentiality of the elements of a complex system.

However, the project of formalizing the subject - environment dependencies has not been finalized. The author uses examples to show how the subsequent layers of reality can be described as complex and autonomous systems - chemical reactions, cells and organisms (it could probably be shown that such a description fits the microworld as well). The problems begin at the point where the affordances, that is environment - animal relations, are described. The graph proposed by the author in this case depicts a system which is complex, but not autonomous according to his understanding (Chemero 2008: 264). Perhaps for presenting such a complex system a more advanced

[41] In others words, affordances are described as relations between the properties of environmental situations and skills of the animals. To be more precise, one should add that there exists at least one more meaning of the term "affordance," which is however connected with the notion of mental representations, and thus incompatible with Gibson's own ideas, as he is an anti-representationalist (Chemero & Turvey 2007: 31).

[42] The hyper set theory is based on the set theory suggested in 1908 by Ernst Zermelo, and completed by Abraham Fraenkel (Zermelo-Fraenkel's axioms). Within the hyper set theory one of these axioms is negated, which is the axiom of regularity (or of foundation): "Every non-empty set X contains an element disjointed with X" (see Murawski 2001: 189). Hypersets do not contain such an element, all the elements of a given set, and the set itself, are elements of the same set, that is the set is its own element ($X \in X$) (Chemero 2008: 257). In this case we talk about unfounded sets.

means od depiction should be used - e.g. computer graphics, where the dependencies could be pictured as more dynamic and more closely related to reality. It is not only the affordances themselves, but also the graphs which should be upgraded to a 2.0 version. However, in my opinion, the difficulty lies not in the methodological problems (the graphs become less legible for very complex systems) as much as in ontological and linguistic issues - not all elements of the system turn out to be autonomous according to the author's understanding, and the description of dynamic dependencies in the technical language of sets comes off as very static.[43] The author himself notices the indicated difficulties, but he believes that the chosen way of formalization is the right one, that the description of the affordances should be more dynamic, suited to an individual situation, that it needs to make use of the enactive approach to cognition. Ultimately, he suggests a rather complicated graph (Chemero 268), containing three elements: affordances, abilities denoted by sensory-motor coupling, and the nervous system. The entire relation is to be a combination of two macrofactors - the "perception - action" system and the autopoietic system. Only all those elements together are to present the animal - environment system, characterized by autonomy and self-organisation. However, it has to be noted that such a picture connects so many heterogenic components that it seems valid to ask about its adequacy. When it comes to the purposefulness of using graphs in describing complex phenomena, it is possible to raise a much more basic objection. And so Chemero describes the situations that interest him via graphs, but a question can be asked, does adding a "loop" to the graphs (complex system) explain the relation itself? In this context there appears again a need for a theory of emergency, as all "this" which happens between particular vertices of the graphs is precisely emergent phenomena. The discussion above can be summarized by saying that affordances are emergent states of things (situations), which engage different elements of the environment and the subject, related to the overriding cognitive relation. As such, it is with great difficulty (if at all) that they submit to our descriptive treatment, in any form.

"Worries" and problems connected with the ecological-complex approach

The issues discussed above can be grouped into several larger wholes. In his article, Ron McClamrock (2008) presents such a juxtaposition. He talks about "worries," dividing them into "conservative" and "progressive" ones. The former are related to the still vital reductionism and physicalism, and simple darwinism; they are "some kind of metatheoretical or even metaphysical roadblock" (McClamrock 2008: 245). The latter can be associated with the discovery of chaotic phenomena, the search for the theory of everything, and the description of the self as connected with the outside world.

[43] It can be added that the postulated closure, self-sufficiency of such a system is a relative property. It is balanced by the openness of the system, as interactions with the environment result in an inability to isolate living systems. The terms suggested by Chemero seem too scanty. In my opinion, this is the source of the author's problems with recognizing affordances themselves as complex, and, at the same time, autonomous systems.

Among the conservative worries the author emphasises, above all, those that touch upon the basic issues for the contemporary philosophy of science. These worries concern, first of all, the issues of causality and reduction. As McClamrock notices, despite the emergence of weakened versions of materialism (token, nonreductive), the tendencies towards rejecting contextual causality or macrocausality remain very strong (McClamrock 2008: 245). In this case, materialism is connected with physicalism, leading to the conviction that the properties (objects) deemed material may be described only in physical terms, whereas every other kind of description is supposed to lead to their being deprived of their causal ability, and discarded outside the borders of science. This attitude is echoed by methodological and metaphysical individualism (localism), within which attempts are made to avoid explaining phenomena by referring to the context (environment). Explanations are supposed to be based on the principle of microdetermination, and looking only for the closest causes. Fundamental questions immediately come to mind, such as: what does "physical" mean? When using this predicate, do we mean an object unambiguously located in space? Maybe one that possesses mass? Do simple physical entities occur in nature? These are the questions which microphysics attempts to answer with great difficulty. Today it is frequently physics which is distant from the "classical" language of physicalism and reductionism, used only to describe a certain section of reality - the world between the description of quantum mechanics and the aforementioned macrodetermination phenomena - and even this with numerous idealizing assumptions. Simplicity as a determinant of a "good" theory of explanation has ceased to suffice. Rather, it should be assumed that reductionist explanation does not come into conflict with other kinds thereof. Methodological individualism (localism) can be thus reconciled with contextualism and macrodeterminism.

The ideas described above have a wide range of influence, affecting also the sphere of the philosophy of the mind, and, more precisely, the issues of internalism and phenomenology (meaning here the first person descriptions of mental states). In this case there still lingers a post-Cartesian outlook on cognition, consisting in a belief in the possibility of locating precisely mental states and their identity, when the structural identity of brains occurs (McClamrock 2008: 247). That last conviction leads to the thesis regarding supervenience, which in this context frequently approximates very much the classical reduction. Additionally, the idea of the "Cartesian theatre" comes into play, that is the approach of strong internalism, according to which that which is mental becomes identified with that which pertains to the brain, which is enclosed within the skull. All the aforementioned beliefs have their basis in the already discussed assumptions of reductionism; similarly, when it comes to causality, all the distant causal relations should be explained via well-localized and close causes (the physical brain is in this case the best explanation for experience). McClamrock attempts to show that in this case the ecological approach together with the idea of a brain / organism system connected with the environment is much more adequate, as it is frees one from seeking the "closest," simplest causes. Cognition, as the subject itself, takes on a very clear processual shape, the mind is no longer a decision centre established once and for all; in a certain way it becomes "separated" from the brain: the borders of the skull are no longer its borders, the body and the environment acquire meaning as a no-less-important part of the coupled cognitive system. Does it then lead to an invalidation of the classically understood subject? I believe that this would be a far-fetched conclusion. The first person perspective remains our original, inalienable experience (*empiria*). Again, as in the previous cases, the tendencies towards one type of explaining should be met with recognition of the necessity of the existence of a different one - in this case, involving emergent macroproperties, such as the first-person experience or intentionality.

Apart from these problems, McClamrock discusses also the aforementioned “progressive worries” - the first of these being chaotic emergence, which is the basis for describing the systems characterised by nonlinear dynamics. As it turns out, the difficulty lies in reconciling the descriptions of the chaotic level and the one that is superstructured over it (McClamrock 2008: 248); it is not easy to achieve a model within which different levels interact as determining each other. Our being accustomed to the classically understood causality can have some bearing on this matter. Another obstacle lies in separating actual causality from what only impresses us as exhibiting such. In other words, one can ask: how to differentiate between actual causes and the illusory ones? Which regularities are important for an adequate description of the discussed phenomena, and which seem to be only an artefact of analysis? In accordance with the author’s conclusions, it ought to be emphasized that there is no one good answer; first of all, we need to agree on what we are looking for, and how accurate the description should be in order to suffice. Moreover, a more basic question needs to be answered: is the theory of chaos itself enough to explain to what degree it corresponds to reality? There is no agreement today even with regard to that last issue (Poznański 2003: 13-14). It is not far from there to another question about the point of looking for “the theory of everything.” According to the author, macroreductionism (which can be defined as reductionism *à rebours*) shares with the former, reductionist paradigm, the same dream about a complete theory of cognition and complexity. Such demands are, however, excessively ambitious, and the impossibility of fulfilling those expectations occurs already at the starting point. Thus, we ought to abandon such a quest and, instead, focus on the analysis of specific cases, “get dirty into detail” (McClamrock 2008: 249). One can notice that from this point of view we return again to the model of classical science. The author recommends a far-reaching caution; however, I believe that the issue can be dealt with differently and that more general inquiries do not have to be dropped. I return to this issue in the following paragraph.

That last issue discussed by McClamrock touches upon vital notions, which are not only ontological or epistemological, but, above all, ethical in nature. It is a vision of a self that is radically scattered and “world-permeated.” This self becomes “thrust back into the world” (McClamrock 2008: 250), and, in a sense, distilled within it, which, in turn, results in the necessity of posing a question about the existence of a specific “decision centre” which would possess ethical implications. The existence of such a “centre” is sanctioned by a long tradition of a self-determining self guaranteeing responsibility for one’s own deeds, the existence of an autonomous subject as the bearer of rules and obligations. Personal identity, which has also been subject to certain erosion, constitutes the ontological basis in this case. Within this new view of ethics and morality, a larger emphasis is put on environmental activity and the slow working out of appropriate dispositions as a part of interacting with other subjects. One can, then, talk about a renaissance of the virtue ethics, dating back to Aristotle and competing against the heretofore dominant vision of a world of ideas that is transcendent to an individual (Juarrero 2008: 281-282). Such a vision results in, among others, the issue of a larger responsibility in the context of a simultaneous larger uncertainty regarding foreseeing the consequences of one's own actions. The subject is stripped of the support provided by the classical paradigm, according to which one can make pronouncements based on imperturbable instances. Thus, the complexity of the world, contextualism and processualism give rise to new questions of ethical nature, to which there are no simple, unambiguous answers.

Philosophical conclusions - processual emergentism

In my opinion, the issues discussed here result from the aforementioned problems connected with the new ontological paradigm and the contradictory tendencies within contemporary science. I think that solving these problems would require not only a change of language, but of the entire paradigm of both science and philosophy. It appears problematic to dismiss the picture we possess and to understand that even if a description is pragmatically effective, it might be ontologically wrong (in the past we would have said it does not reach the "essence")[44]. Philosophy, which draws on science, does not have to limit itself to methodological issues; it should suggest a broader picture of the reality, which would not be philosophy of science as much as philosophy of nature. Obviously, in this case a certain "work at the foundation," the analysis of concepts and specific assertions, also counts, but it is likewise important to build an overall vision of the reality (picture of the world). I think this is the role of philosophy. It is not a science in the meaning of empirical or axiomatic sciences. Perhaps there is no chance for a "philosophical theory of everything," but philosophy can suggest metaphysical hypotheses regarding the phenomena described by science, not necessarily falling into some kind of cheap mysticism. In this sense it can propose a "theory of everything," albeit with serious stipulations regarding its perfection and absoluteness. It will never be able to fulfill the severities of a classical scientific knowledge paradigm; it has no such ambitions (Lemańska 1998).

The new outlook at the structure of reality and of cognition itself provides an opportunity to draw from this state of things far-reaching philosophical conclusions. One of the crucial elements of such a picture is the idea of emergence, formation of creative novelty; in this context, as Robert B. Laughlin (2006: 208) notes, one can pose a thesis regarding the transition from an era of reduction to an era of emergence. The philosophy of process might provide useful context in this case, as this discipline seems predisposed for this role due to its being oriented towards describing a dynamically

[44] Hard science and philosophy differ fundamentally in the way they describe reality and in the standards they impose upon themselves. In science, a reductionist description, which unambiguously localizes properties and entities in space and time, can be enough, but it can be insufficient in the field of philosophy - in the philosophical context it can be the same thing as "errors." What can be an inessential problem for a scientist - e.g. the impossibility of performing an infinitely precise measurement or the incompleteness of induction - can constitute a real challenge and a source of radical claims regarding the world for a philosopher.

changing reality. Within the processual paradigm, new life is given to the old Heraclitean variabilism, and it is stability, not change, which is treated as something fundamentally mysterious, requiring an explanation (Bickhard 2008: 254). Therefore, the philosophy of process attacks our pre-judgments regarding the nature of reality, resulting from a culture based on stability. Because of this, as in the case of ethics, a change in thinking encounters large difficulties; frequently, we do not fully realize how deeply certain views are rooted, and how they work by means of a certain inertia (Bickhard 2008: 252). However, I believe that the attempt to deem variability or process to be a basic property of the world does not solve ontological issues; there is still a long way to go before understanding the nature of complex dynamical processes. In other words, I am convinced that while it is necessary to increase our appreciation of the processual vision, both stability and variability remain equally mysterious[45]. Both of these poles demand being described and accounted for in the structure of reality. As in the discussion between the emergentists and reductionists, in the dispute between the followers of Parmenides and of Heraclitus it is advisable to retain moderation and look for a consensus. To put it somewhat simplistically, I am convinced that "the truth lies in the middle" and that it is possible to construct a precise picture of the world even from the apparently inconsistent elements. At this point it is more important to shift the emphasis and appreciate the dynamic - holistic elements. Obviously, the world is a dynamic process, but there are structures emerging from it (Metallmann 1933), which are characterized by a relative stability. Philosophy may help in reconciling different descriptions of reality - monism and dualism, diachronics and synchronics, reductionism and holism do not necessarily be treated as opposites. We might refer again to our attachment to a "block" description of reality, while a process often connects within itself heterogenous elements. One should always remember about contextualism and perspectivism within the theory of cognition. The lack of radically unambiguous answers within contemporary ontology does not have to be a disadvantage, quite the opposite - it is a result of the relationship between the world and the cognizing subject. And this is precisely the conclusion to which research on complexity, emergence and ecological cognition leads.

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[45] Similarly, in the case of considering emergence a natural property of reality (Bickhard 2008: 254), emergence does not become subject to automatic "de-mystifying."

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