Philosophy of Evolution

Renáta Kišoňová · Michal Kutáš

Edícia kognitívne štúdia

fftu

Philosophy of Evolution

Renáta Kišoňová · Michal Kutáš

Edícia kognitívne štúdia

fftu

Peer reviewers

Doc. Mgr. et Mgr. Andrej Démuth, Ph.D.
RNDr. Mgr. Reginald A. Slavkovský OP, Ph.D.

The publication of this book is part of the project *Innovative Forms of Education in Transforming University Education* (code 26110230028) — preparation of a study program Cognitive Studies, which was supported by the European Union via its European Social Fund and by the Slovak Ministry of Education within the Operating Program Education. The text was prepared in the Centre of Cognitive Studies at the Department of Philosophy, Faculty of Philosophy in Trnava.

fftu

ISBN 978–83–7490–600–5

Content

1. Introduction

The textbook offers an outline of several topics and issues related to examination of the phenomenon of evolution, predominantly from the philosophical viewpoint.

The first chapter explains the basic terms which they will sooner or later encounter in dealing with evolutionary theory. In the other two chapters, they will become familiar with the evolutionary theory origin. The fourth chapter concerns Charles Darwin, Darwinism and Darwinist opposition. The fifth chapter introduces various non–Darwinian evolutionary theories popular in the present discourse. The sixth chapter deals with the analysis of natural and cultural evolution. In the seventh chapter, the reader will find more detailed knowledge on Meme Theory. The eighth chapter concerns the information as a precondition and product of evolution. The ninth chapter deals with selected problems related to examination of the evolution of language. The last two chapters analyse royal philosophical disciplines — gnoseology and ontology — at the background of evolutionary theory.

In the context of philosophy, evolution is grasped at several levels and meanings, it is therefore appropriate at the very beginning to specify our understanding of this notion, which is applied in the whole text. Evolution is understood as a happening. In our opinion, it is an irreversible happening characterised by constant novelty. It has its memory, while some of its forms remind the past ones, however they are put into practice differently. It is a happening always bringing something new, usually also more complex. Stating

that it has a memory does not mean that it does not forget. It often forgets in favour of releasing new possibilities, while it does not have to represent final forgetting — forgotten information can be reminded in other relation and become a cornerstone of new meanings. As Czech philosopher Zdeněk Kratochvíl states, for all these reasons, we can picture the evolutional history as a gradual unwinding of a script–covered roll. Reading the roll, we constantly learn something new, while something of the old is being revealed. (Kratochvíl, 1994)

The objective of the textbook is to familiarise readers (predominantly students of humanities) with notions related to examination of evolution, with history of such examination and key philosophical problems related to evolution (evolutionary ontology, evolutionary gnoseology, information as an ontological category, Darwinism versus creationism, etc.).

2. Explanation of Basic Terms

Keywords: *evolution, ontogenesis, phylogenesis, macroevolution, microevolution*

It is necessary in the integration of several scientific disciplines to understand their basic principles. All disciplines examining evolution have indistinct boundaries. It is therefore impossible to define them by a clear dividing line between them. Biology is generally defined as a theory on life, subject of psychology, ethnology, philosophy and other disciplines dealing with evolution, however, it is also one of the faces of study of life. This textbook is named *Philosophy of Evolution* and it would therefore be appropriate at the beginning to "legitimize" the role of philosophy in the sphere of evolution examination. The phenomenon of evolution is predominantly related to biology, palaeontology, morphology, ethnology or psychology and other exact sciences in the scientific tradition. What can philosophy say about evolution? Since its creation, philosophy has been an effort to comprehend intellectually the world as a whole by the mankind. It represented a spiritual support of human advancement in expanding culture. As the Czech philosopher Josef Smajs, upon whose concept this text is significantly based, points out, it has started to fulfil a new role over the last decades — it is becoming a philosophy of human survival. If we want to survive in an ecologically threatened culture we need new philosophical knowledge of reality without asking whether there are other energy sources under the polar ice and at the bottom of the ocean.

We need knowledge answering the question what will happen to current culture in the future (maybe a short one), what will happen to the human as a biological species? (Šmajs, 2008) We would like to point out already at the beginning that there is no single theory on the philosophy of evolution. There are various theories on interpretation of evolution, its finality, intentionality, while some of them incline towards creationist approach and others reject it. The focus of theories on the philosophy of evolution is currently at the conflict between nature and culture (predominantly Šmajs J., but also ecophilosophers Carter A., Nelson M. P.), while traditional "big metaphysical issues" (time, being, intentionality, creation, etc.) are standing in the background. Czech philosopher Josef Šmajs can be considered the "father" of the *nature / culture* duality. His original ontological concept will be presented to the reader of this textbook.

The notion of "evolution" etymologically originates in the Latin *evolutio*, meaning advancement, development, progress. *Evolutio* is derived from the verb *evolvere*, meaning to develop in the sense to *unwind a roll*. Evolutional happening, however, had not predetermined what the roll would contain, as if its unwound part was only being created in its unwinding. (Kratochvíl, 1997) If evolutional happening concerned unwinding of a roll known in advance, we could use the term *explicatio*, instead of *evolutio*. *Explicatio* means development in the sense of interpretation, it is a term also used by Mikuláš Kuzánsky, for whom naturalness of *explicatio Dei* was an interpretation of God. (Kratochvíl, 1997)

The term evolution was introduced in biology by the German biologist Albrecht von Haller (1708 — 1777). Through this term, he was trying to express a theory according to which an embryo develops from transformed homunculi. The most distinguished evolutionists paradoxically did not use the term evolution. They discussed *descent with modification* (Darwin), *transformism* (Lamarck), *Transmutations — Theorie* (Haeckel). The term evolution started to be used in its present meaning by Herbert Spencer (1820 — 1903). (Gould, 1977)

However, a complex meaning of this notion is not determined by etymology but mainly by its context in present scientific and cultural environment. The term evolution was established in philosophy by the already mentioned Spencer. He used it to denote the process of gradual transformation of a structure from a simple state to a complex one. Evolution is thus predominantly a development in his conception. However, we only talk about development if the change includes quality, while it can have progressive as well as regressive trends. If only a quantitative part of a reality (being, system) changes, we do not talk about development. If only, for example, the car speed is changing we do not see it as development. We could only talk about certain occurred development in this system if its quality changed (e.g. as a result of a collision with an obstruction). The notion "development" can have two meanings: it is either an individual development of an organism from a fertilized egg cell to its death — that is the so–called individual development, *ontogenesis*; or it can mean a historical process which led to the creation of individual species of organisms — so–called development of species or *phylogenesis*. Development of species showed deep transformations of the organic world from its inception roughly three and a half billion years ago up to now. The phylogenesis clarifies evolutional relations of various types of living as well as extinct organisms, changes in their development lines (creation, splitting, changes in traits and extinction of taxa).
The term phylogenesis was introduced in the scientific language by the German scientist Ernst Haeckel (1834 — 1919) in 1866. It is originally derived from the Greek *phyle*, meaning phylum and *genetikos,* which can be translated as "related to birth". Phylogenesis relates to ontogenesis — these two ways of development mutually condition each other. Haeckel claimed that ontogenesis is a short and fast repetition of phylogenesis, which was later called *biogenetic law*. Presentation of new species, evolution at the level of species is called *microevolution* or infraspecific evolution; when talking about changes overreaching individual species, such changes

are included in *macroevolution* or *transspecific evolution. (*Wuketits, 1997*)*

All modern biology supports the well–known quote of Theodosius Dobzhansky (1900 — 1975), a distinguished biologist and evolution theorist, who stated that "nothing in biology makes sense, unless it is approached in the light of evolution". Natural scientists rarely agree on the fact that all creatures living on our Earth, often very complex, have evolved from simple and primitive forms of life, and even that life was created from a dead matter. Very diverse species of nowadays thus relate together due to their common origin and have so far been the last phase of a very long development. If evolutionary theory only determines this, then it is not only a hypothesis anymore but has to be marked as a fact. (Weissmahr, 1994)

Evolution is thus defined from the viewpoint of natural sciences as a change in the course of time which draws our attention on spirally unwinding history whose living proof is also us ourselves. The research field of evolution is so large that it includes space and stars as well as life, including human life, our bodies and our technologies. (Margulisová, 2004)

Recommended Literature

CARRUTHERS, P.: *Evolution and the Human Mind*. Cambridge University Press, 2000, 238–253.

MAYER, E.: *What Evolution Is*. Basic Books, 2002.

3. Understanding of Evolution in History

Keywords: *realism, nominalism, Lamarckism*

When the work of Charles Darwin *On the Origin of Species* was issued in 1859 it was by no means the first expression of the idea of evolution. Courageous (we can even say evolutional) images of the creation and origin of life can already be observed in the works of Ancient philosophers (Anaximander, Heraclitus, Democritus, Lucretius). Some Greek philosophers (e.g. Xenophanes, Parmenides) were proving through fossil findings that contemporary animals (even the human according to Parmenides) originate from long extinct species and that life originated from prehistoric mud. It is obvious that already in the Ancient period various beings in the nature were somehow hierarchically arranged by people. The basis of these arrangement attempts was the concept of scale structure of the world, according to which the world is arranged from variously complex formations which became evident in creation of a certain scale. An idea of a triple natural world, already found in Aristotle and particularly evident in the 18th century within the German Naturphilosophie, was specific for the idea of a structure in the form of "scala naturae". The idea of Aristotle's predecessors on the origin of life from an organic matter, so–called self–generation or *generatio aequivocu* was also maintained in the Aristotle's biology. Aristotle is also considered to be the discoverer of ontological dependence, respectively ontological motion. Aristotle changed the original 'cosmological' motion of Ancient Greek philosophers and

Plato, according to whom the world had been created from chaos, to ontological motion; structuring, defining, separating and leaving a being get mature in the world. This motion is eternal and does not provide room for mythical notions (chaos). Aristotle, therefore, became the main representative of this ontological motion before Hegel. (Patočka, 1964)

According to Aristotle, ontogenesis, or trait development of living organisms, is a model of ontologically dependent process. Thus understood development is non–mathematicisable, since it is something internal, something creating being as existing, separating the particularity of natural motions, including its teleological nature. Development of an individual has its internal and integrating objective (telos). (Sýkora, 2004). Aristotle also had a theory of a minor (irrational) and major (rational) part of a soul, more inspired by biology than politics or ethics. His ideas anticipate biological evolution in several aspects. He distinguishes a nourishing soul present in all living organisms including plants, a sensory soul and a soul which is a source of motion (only present in animals) and a reasonable soul (nús) only present in humans and eternal. (Popper, Eccles, 1977) Aristotle often emphasizes that these various souls are "forms" or "essences". According to Popper, irrational souls or essences of the Aristotle's theory can be considered as an anticipation of modern gene theory: like DNA, they plan activities of an organism and lead it towards its objective, towards its enhancement.

In the Middle Ages, theory on self–generation spread widely and was also popular in the modern period. However, a more cardinal problem of the Middle Ages was the relationship between the universality and the particularity, the relationship between abstract universalities and particular individualities, or the relationship between ideas and phenomena. Two contrasting theories were created in solving this problem. According to one of the theories — *realism*, ideas are real; according to the other theory — *nominalism*, only particular material individualities are real and existing independently of consciousness. Thus only the world of phenomena is

real, ideas are only our names for a certain group of similar beings. The dispute between nominalism and realism on the reality of ideas is a dispute on the existence of biological species in biology. A biological species is either a real, existing entity (realism) or a help for biologists in orientation in the living nature (nominalism). While a biological species needs to be created and invariable for realists, nominalists consider a transformation of one species to another, since for them species is a group, we would nowadays say a set, of individuals with certain social features.

Actual evolutional thinking could only be created when nominalistic theories started to be accepted, respectively when nominalistic understanding of biological species was adopted. It occurred not sooner than at the turn of the 18th and 19th centuries. Other precondition of acceptance (and creation itself) of the evolutionary theory was understanding of naturalness (nature) as variable, spontaneous and active. Modern authors understood naturalness only as a spatial occurrence. There was no room for evolutional understanding of nature, as it was also prevented by comprehension of basic terms through which modern times express materialisation of the naturalness: comprehension of material as an inertia (materia inertia), time as a coordinate, space as a passive empty container without sides. (Kratochvíl, 124) Nonetheless, evolutional thinking was gradually trying to enforce, although in the sphere of natural science.

In the works of G. L. L. de Buffon (Natural History, General and Particular, Birds), CH. Bonnet (Philosophical Palingenesis), P. L. de Maupertuis (Essay on Cosmology), J. B. Robinet and C. F. Kielmeyer (Philosophical Essays on Natural Ascent of Being), we encounter Neo–Plato and Renaissance theory on the evolution of nature through gradual execution of perfection, concentrated in god, creator of the nature. While French natural scientist G. L. L. de Buffon (1749 — 1788) in his work Natural History, General and Particular excluded the human from the scale arrangement of nature, the scale of the Swiss zoologist Ch. Bonnet included the human as the

first and major member. In Philosophical Palingenesis, Bonnet stated 18 key scales of the nature — from the human through four–legged animals, birds, reptiles, fish, etc. to the elements of water, fire, air, and thus reminded the principle of continuity already anticipated by Aristotle and later supported by G. W. Leibniz. And on this Neo–Platon, Renaissance and Leibniz metaphysical basis, the idea of the real process of evolution is created. Neo–Platon and Leibniz idea of evolution (comprehended metaphysically as a transformation from moné through *proodos* towards *epistrofé*) acquires a scientific character in works of the aforementioned philosophers.

Many factors observed in the nature have provided a proof on the fact that nature is actually evolving from less perfect forms towards more perfect ones and that the world is a creation of development. J. W. von Goethe exceeded the Aristotle understanding of the linear arrangement of living beings in the step scale of the universe presented by Bonnet. Goethe formulated the law of compensation, i.e. the principle of adding and removing, according to which the nature only supports a part of an organism at the expense of another part. Living organisms are highly evolved in their features and it is thus not easy to rank them linearly into a certain scale. Evolutional approaches also occurred in the works of encyclopaedist D. Diderot, who assumed that small changes of all substances during the existence of the Earth can explain the creation of a variety in the organic world. Diderot's perception of nature and its development lies in the concept of dynamic forces which supposedly determined the evolution of cosmos where also humans and human society need to be integrated. Similar opinion is held by Ch. de Montesquieu. The French philosopher J. B. R. Robinet and the German anatomist C. F. Kielmeyer adopted an idea of historical changes in the scale of development, while Robinet perceived this scale as an expression of physiological differentiation of an organism, and Kielmeyer assumed that animals are varieties of a particular prehistoric type. According to him, they are attempts of the nature to create a human as a top of evolution.

Also the Swedish natural scientist C. Von Linné, at first persuaded about constancy of species became a target witness of a significant breakthrough in evolutionary theory following experiments, biogeographic and geologic observations. Linné even attempted to relate at that time still very deep abyss between a human and animal and stated that as a natural scientist, he wanted to observe a human according to all parts of the body and by doing so; he could hardly find a single feature which could distinguish a human from an ape. (Wuketits, 1997)

Phylogenetically perceived *concept of affinity* thus starts to appear in the 18th century. A new dynamic model of hierarchic arrangement of the world is developing based on the classical scale of idealistic philosophy, and attempts to clarify actual historical relations of such hierarchization appear. A decisive step in the phylogenetic interpretation of the hierarchy and scales was made by Lamarck, who formulated the first integrated theory of evolution. He first suggested his evolutionary theory at a lecture for his students in 1800. A few years later, he issued *Zoological Philosophy*, explaining his evolutionary theory. According to him, the key cause of evolution is a natural force characteristic of all living, forcing the living nature to arrange in a more complex forms. Lamarck does not attribute any objective or intention to this „vital force". It is a natural force of a material, not divine character. Another cause of evolution according to Lamarck is the outer environment. Changes of temperature, light, food contents, etc. have an impact on organisms and make them change.

As we know, Lamarck related the idea of evolution supported by his friend Buffon and the idea of scale introduced by Bonnet with a specific theory of evolutional process mechanisms, which later entered the history of science as *Lamarckism*. Lamarck's theory was already anticipated by Erasmus Darwin, grandfather of Ch. Darwin, in his work *Zoonomia* (1794 — 1796). Interpretation of evolutional changes of organisms by Lamarck is related to the expressions *adaptability of organisms to the surrounding world* and

individual adaptation. According to him, organisms changed their way of life after changes of their surrounding environment as a result of new needs, and these newly occurred needs led to changes of organs, and thus to the creation of new or disappearance of old body organs. Lamarck further assumed that individually acquired traits are hereditarily transmitted to offspring. On this basis, he formulated his two laws: the first law — in each animal which has not reached the peak of its evolution so far, a particular organ gradually enhances a more frequent and permanent usage; constant non–usage of a certain organ makes it unobservably weaker and finally leads to its extinction. The second law: everything organisms acquire or lose as a result of conditions is hereditarily transmitted to offspring, assuming that acquired changes are common for all genders or procreators. In spite of incorrect (contemporary) interpretation of heredity principles, Lamarck's significance in the history of evolutionary theory is undoubtable, since he formulated the mechanisms of *biological* evolution as such. However, this clever natural scientist remained misunderstood in the contemporaneous scientific community.

Recommended Literature

SMITH, J., M.: *The Theory of Evolution*. Cambridge University Press, 1993.
BEER, C., IMMELMANN, K.: *A Dictionary of Ethology*. Cambridge: Harvard University Press, 1992.

4 . Darwin's Theory of Natural Selection. Evolution as an Outrageous Theory?

Keywords: *Darwinism, theory of selection, genetics, Darwin, Mendel, Neo–Darwinism, creationism*

The following chapter is going to deal with key theses of Darwin's theory of natural selection and with what it experienced (acceptance and changes in the form of Neo–Darwinism as well as outrage and condemnation of Darwinism by creationists and other „isms").

The way of evolutional thinking has been opened not only by biologist Lamarck (who remained misunderstood during his life) but also Darwin's fellow countrymen and contemporaries Herbert Spencer and Charles Lyell. The term „survival of the fittest", which Darwin resumed, was introduced by Spencer. Lyell, the founder of historical geology, contributed in a determining way to the issue of constellation of factors in evolution with his *uniformitarianism*. Charles Darwin resumes Spencer's and Lyell's ideas. According to Darwin, more individual beings of each species are born than can survive and since there is therefore a constant fight for existence, under the same complicated and frequently changing conditions, each being advantageously differentiated from another has to have a better prospect of further endurance and thus of being selected for raising by the nature. According to the heredity principle, each diversity was created by a natural selection and its new changed form tends to be transmitted from generation to generation. (Darwin, 1967)

According to Darwin, progress in the nature takes place as an automatic process through the survival of the fittest individuals. However, Darwin was not led to the theory of natural selection by biologists — breeders but by a book by economist Thomas Malthus — *Population — Fight for Existence*, where Malthus was demonstrating that everything living in the nature increases in geometric series, while living conditions increase in arithmetic series. It causes that a fight for life arises between individuals of the same species. Studying Malthus's book, Darwin has an idea to relate variability with adaptation and change of species. Adaptations according to Darwin are traits of an organism which help it win the fight for existence. Darwin's evolutionary theory can be summarised as follows: talking about any biological species, a whole spectrum of small divergences predominantly due to a coincidence always occurs. Some of them give their bearers a bigger chance in the fight for life. That is how natural selection occurs. It means that only those forms which prosper best under the given natural conditions survive. Gradual selection in a certain direction can cause that new forms differ from an original one to such an extent that a new biological species is created. This evolutional process occurs when a species appears in a new environment either due to migration or a change of external conditions.

Evolutionism was also supported by another Darwin's contemporary, the English natural scientist Alfred Russel Wallace, who formulated the theory of natural selection independently of Darwin. However contrary to Darwin's theory of selection, his theory of hyperselectionism resulted in the key feature of creationist belief based on correctness of arrangement of objects in the nature, believing in definitively determined place of all parts in an integrated whole. (Gould, 1988) Mainly two significant scientific personalities, whose work also became an integral part of the history of evolutional thinking, Thomas Henry Huxley and Ernst Haeckel contributed to expansion of Darwin's work.

Six years after the issuance of Darwin's *On the Origin of Species*, scientific community experienced another great milestone

— year 1865 entered the history of biology as the year of *genetics* origination. Gregor Johann Mendel gave a lecture for *Brno Society for Natural Sciences*, presenting his theses on the heredity process. As it often happens in the history of the famous, Mendel's lecture remained misunderstood; the teaching of heredity was rediscovered not sooner than 35 years later (in works of C.E. Correns, E.Tschermak and H. de Vries). Mendel's invaluable knowledge was finding out that "*...parental hereditary factors combine in zygote, and do not lose their identity but are rearranged in the following generation.*" (Mayer, 1967, 139) Mendel's work complemented the rising Darwinism (although Mendel himself objected against some of Darwin's theses).

German zoologist August Weismann had a huge impact on further development of evolutional ideas (predominantly Darwin's) already in the 20th century. Weismann emphasized the necessity of new synthesis in biology and following evolutional ideas, he combined Darwin's theory of selection with knowledge on genetics and cytology. Significant expansion of classical Darwinism is due to this constructive synthesis. *Neo–Darwinism* originated there, introducing the principle of selection and teaching on heredity at the cellular level of an organism. All aforementioned philosophers led by Darwin created a basic framework in their era for present evolution models. T. Dobzhansky, E. Mayer, B. Rensch, G. Simpson and J. Huxley should be mentioned from among Darwinism followers in the 20th and 21st centuries, whose evolutionism brought priceless results for science, especially for molecular biology and genetics. Evolution principles were applied in the sphere of biology at various levels of reality (cosmical, cultural, and spiritual).

Darwin's theory and the whole Darwinism later represented (and represents until now) an extraordinarily outrageous theory for several worldview platforms. The stumbling block was Darwin's idea of a random variation and its selection. Random variation cannot be understood in traditional late–scholastic approach, i.e. causally. Darwin's interpretation was opposed as if it had been

an interpretation in an "it was done itself" way. (Kratochvíl, 1994) Customary metaphysical perception of the world could not (and cannot) admit that nature itself can be active and can create qualitatively new. However, neither Darwin's interpretation of evolution nor its simplified school form attribute the nature its clear spontaneous activity. Under the impact of contemporary church opposition, Darwin's theory was shifted towards a more mechanistic and denaturalistic interpretation. It does not change anything about the fact that Darwin got into a conflict not only with religious fundamentalists as a result of his book Descent of Man in 1871. Including humans in the nature, he confronted with the Greek tradition and most of Latin thinking, where the human is understood as contrasting the natural. The human represents a value in the form of culture and religiosity, the natural acquires value only as a subject of human or divine activity. (Kratochvíl, 1994) Darwin's opposition interprets his understanding of human nature only through a caricature of an ape, from which the man evolved — such understood evolution is however copying or even a failure, not actual comprehension of successiveness. In relation to Darwinist creationist opposition, František Koukolík states a nice anecdote about how a wife of Anglican minister is anxiously waking her husband up, saying: "I hope Darwin's theory on how we evolved from apes isn't true. In case it is true, I hope no one learns about it." (Koukolík, 1997) One of arguments used by creationists (i.e. those persuaded about the fact that the world was created more or less not long ago in an act of creation) against the evolutionary theory is e.g. an objection — what would an unevolved eye serve for? How could something so complex and differentiated like an eye evolve gradually? It had to (according to creationists) be created at a time, as a miracle, in the form of a creation. However, this objection of creationists is wrong — as Koukolík states, eye is a multicellular organ and thus could evolve not sooner than with multicellular animals and had a billion of years for that; according to zoologists, eye was evolving independently for different species of invertebrates 40 — 60 times

in at least nine different ways. (Koukolík, 1997) Creationists create an illusion of respect and love to nature, while twisting scientific as well as religious fairness when the creation — "creation" is understood as production — "fabricatio". Everything was *fabricated, produced* according to a plan and did not appear randomly. (Kratochvíl, 1994)

According to Kratochvíl, such understanding of nature as a designed product is even more reductive than scientific reduction, even though the "creator" is god (of course, also reduced). (Kratochvíl, 1994)

Recommended Literature

DAWKINS, R.: *The Selfish Gene*. Oxford University Press, 1990.

CAPRA, F.: The Web of Life: A New Scientific Understanding of Living Systems.Anchor Books, New York 1996.

DARWIN, CH.: *On the Origin of Species by Means of Natural Selection.* London: Murray, 1967.

5. Present Evolutionary Theories

Keywords: *intelligent design, theory of emergence, theory of random*

5.1 Intelligent design

Over the last years, theory of "intelligent design" has attracted interest of the scientific world (the term "design" is usually translated as an objective, purpose, arrangement, design or structure. We also encounter the name IDM (Intelligent Design Movement), which simply means "ID movement"), theory of intelligent objective or intelligent design, marked as ID. This theory is maintained by renowned as well as less known scientists like Michael Behe, Charles B. Taxton, Jonathan Wells, Phillip E. Johnson, William A. Dembski, Stephen C. Meyer etc. Theory of Intelligent Design was originally supposed to be an alternative to Darwin's theory of evolution. Representatives of the Theory of Intelligent Design mainly focus on criticism of Darwin's theory in its original classical form and regarding less the development which the theory of evolution underwent over one and a half centuries after publishing of basic Darwin's theses. Representatives of ID theory agree on the opinion that reality and evolution cannot be explained on the basis of activity of random and blind forces. Arrangement and function of inanimate nature as well as living systems are a result of intelligent design. In their opinion, intelligent design requires an intelligent creator.

ID theory originates in the anthropic principle, pointing out a unique position of the Earth in space. Emphasis is also put on the fact that some of the parameters of our solar system are suitable for humans to be able to know the uniqueness of the Earth, observe and discover it. After adoption of the anthropic principle, further questioning regards effects of intelligent design in the processes on the Earth. In question *Where are life, organisms and humans from?*, ID theory almost exclusively resorts to criticism of Darwinist understanding of evolution. Representatives of ID focus their criticism on the issue of life creation. They question the possibility of its creation by a chemical evolution, as there has not been enough time since the creation of our planet for a random system of connection of atoms and molecules into complicated polymers of the first cells. "*There are plants and animals. And complex systems. All that had to get here somehow. If it had not been created according to Darwin's theory, then how? If something had not been created gradually it had to be created fast or even at once.*" (Behe, 2001)

According to the ID theory, biochemical systems were constructed not only under the impact of natural laws or effects of a coincidence and unavoidable circumstances. As Behe states, they were planned. The "designer" knew what the systems would look like after completion and started their construction. Life on earth in its fundamental form is a result of sophisticated, intelligent activity. According to Behe, the fact that life on earth is a result of intelligent activity is a finding naturally resulting from the facts themselves, not from a religious persuasion. Assuming that biochemical systems were designed by an intelligent creator, he states that he assumes in a standard way without using any new logical procedures or scientific disciplines. Behe considers "designed activity" to be a *purposeful arrangement of individual parts* in reality.

In the process of evolution after creation of the simplest cells, ID theory questions the Darwinist principle of natural selection as well as the principle of changeability. And natural selection only works based on changeability, which relates to hybridization, mutations and other genome changes. They arise as a result of changing impacts on the Earth but they often have an endogenous

origin, they are thus absolutely spontaneous. Natural selection then only prefers or maintains those changes of forms and processes in organisms which are adequate to changing conditions on the Earth. And possibility of survival, respectively further evolution of the population of organisms is thus ensured. The ID theory does neither explain how individual organisms were created nor their occurrence in geological layers gradually from the simplest ones in the deepest soil layers up to those most complex ones near the earth surface.

Instead, the ID theory points out a lack of transitional forms which should be known if evolution of species actually existed. This objection can be opposed by the fact that ID theory does not take into consideration a number of transitional forms which are known, precisely described and their number is still increasing in spite of the fact that they are very difficult to extract from fossil materials. ID theorists admit evolution but not uncontrolled. M. Behe does not agree with the view that life with its various forms was created as present evolutionary theory interprets — uncontrolled by an intelligent being.

Supporters of ID theory are persuaded that some phenomena like creation of eyes or transition of reptiles to birds could not have been random. Complex structures are called *irreducible complex system* (ICS) or "irreducible complex" by ID theory representatives (some ID theorists also use the expression *irreducible complexity*). According to him, a cell is full of "machines" working in its individual components, having their specific functions and generating specific substances. These machines cannot be created gradually, as they would (according to Darwin) be excluded in natural selection. That is to say that they have their meaning for a cell or organism not sooner than when they are complete, and they are sometimes indeed very complicated (multilevel), like a flagella of some one–cell organisms. However, we should not forget that most of the "machines" are actually original cells which reached eukaryotic cells through symbiogenesis, like mitochondria and plastids.

Model organ of ID — flagella, which is assumed to have been a spirochaeta originally, can also have such origin. Structural or functional changes inside of the originally host cell can occur in a symbiogenetic process. (Erdelská, 2006)

Some complicated organs like an eye can evolve gradually. The eye of evolutionally primitive animals only comprises several light–sensitive cells. Complexity and functionality of an eye increases with an increase of the overall structural and functional complexity of organisms. Natural selection facilitates enhancement of the eye and adaptation to changing life conditions.

These are arguments of evolutional biology, recording whole ranges of such created organs of gradually more complex and evolutionally advanced organisms. In order for *irreducible complex system* to work, it needs to comprise functionally all necessary components. If it lacks only one component, the system is not able to work. Behe used the expression irreducibly complex to say that it is an independent system comprising several well–interconnected components that participate in the basic function of the system, while elimination of any of the components would lead to actual failure of the system. According to ID theorists, ICS cannot be created at a time on the basis of small consecutive changes of the previous system, because any predecessor missing a component would not be functional. And if anything like ICS exists, according to the ID theory supporters it means that Darwin's evolutionary theory is easily questionable. With regard to the fact that natural selection can only be applied to the already existing and working systems then — if it is impossible for a biological system to evolve gradually — it would have to arise at a time as an integrated unit in order for natural selection to have somewhere to take place. Therefore, as we have mentioned before, natural selection is not able to prepare a complex system according to the ID theory supporters. A *mouse trap* can be provided as an example of ICS. It comprises several parts: a flat wooden platform, a metal hammer entrapping the mouse, springs with prolonged endings, a movable catch and a metal arrester.

Presence of each of these parts is necessary for the trap functioning. Based on that ID assumes that a complex system cannot develop by evolution. The only acceptable explanation for ID is the presence of an intelligent designer who planned such system and created it at a time. ID theorists do not specify God as a designer; they even state that ID does not deal with the *question of who the designer is*, as this question is under the competence of theology.

Objections appeared in response to ID theory principles, pointing out natural phenomena rather demonstrating a "non–intelligent intention" of the creator. They include remains of organs which do not have any function anymore, or seemingly useless, respectively chaotic parts of genomes as well as suffering in the world. The ID theory does not insist on literal interpretation of Genesis, however does not admit evolution where natural selection is a control selecting the most suitable out of a number of evolving forms. The ID theory supporters are further reproached for reevaluating evidence collected from observation and in experiments in order to show that evolutionary scientific concept is not sustainable. This approach is actually not new; it is only a more sophisticated revival of two hundred–year old Paley theory. (Moreland, Reynolds, 2001)

The ID theorists response that their Theory of Intelligent Design of creation includes a broad spectrum of arguments to support this design (e.g. hypothesis on the best interpretation and arguments on the level of probability), while Paley only derived a standard argument analogically. The ID supporters further defend themselves by the fact that they bring new types of evidence (e.g. information theory, correct reconditioning of space, etc.). One more argument used by the ID theory opponents can be mentioned, although there are much more of them and the discourse on ID will probably never end. The argument is that ID defenders ground their assumptions on an intelligent designer only upon arguments on ignorance, i.e. upon the fact that contemporary science cannot explain something. As a result, ID assumes that the

designer needs to be asked to provide an explanation. The ID theorists get in a dispute with the scientific community when they insist on the opinion that their theory is a scientific theory. They are also in a dispute with the community of philosophers and theologists when they range in the question of definition of the designer.

Further broadly discussed are *Emergence (E)* and *Random design (RD)* theories.

5.2 Emergence Theory

The main representative of the Emergence Theory, P. Clayton states three features characterising this theory:

Primacy of the process: reality is unstable, it is under constant changes, and it is still evolving.

Evolution in progress is producing new features.

In the course of evolution, various levels of reality appear (emerge). Reality does not only comprise elementary particles and forces. We distinguish various levels, mutually interconnected, while each of them represents a whole and various forms of influence. (Clayton, 2006). E thus seeks a bottom–up view of reality, which enables to observe qualitative changes in creation of bigger units. H. Rolstone, another E representative, characterises emergence mechanisms as follows: Each emergence step is 'super' to the previous one, thus exceeding principles and processes known before. When life appears, the organic transforms the anorganic. Materials acquire qualities not observed before the change (famine, illnesses and others). From the viewpoint of physical and chemical categories, these phenomena are supernatural, i.e. superphysical. They exceed previous ontological levels. (Rolstone, 2006)

5.3 Random Design

This theory neither introduces new features foreign to science (intelligent designer, ID) in its system, nor postulates top–down

influence without a deeper scientific justification (E). Representatives of this theory include e.g. J. Krempaský and R. G. Colling, the author of the book *Random Designer: Created from Chaos to Connect with the Creator.* RD predominantly focuses on the spheres of mathematical physics, avoiding strict determinism. It is a theory of chaos or a physics of dynamic systems far from thermodynamic equilibrium, as well as quantum mechanics, particularly Heisenberg's uncertainty principle. Systems in chaotic condition are characterised by the fact that even small changes of initial conditions can cause unforeseeable effects. An example is the weather forecast where also small differences in clouds in a certain location lead to extensive changes of weather, which disallows a forecast of its result. According to the RD supporters, the tendency to disorder is important in creating order in a way which ensures a great variety in space. According to the RD representatives, two basic processes work in space — activator and blocker. Activator represents a tendency of physical and chemical processes towards disorder, which is necessary in creating of order, which according to Colling and Krempaský handles directing in the world as a necessary condition of development. The second process creates blocks as building features of new structures. RD theorists neither want to generate scientific concepts nor formulate new laws, their ambition is to introduce in an authentic way empirical data of the modern world of science and enhance belief in the existence of the Creator. They agree with the ID theorists regarding this issue, although they comprehend the role of designer differently. RD attributes the designer whole creation process; ID attributes him the role of gap filler in scientific description of space.

To conclude, we can say that the given three theories are quite popular in contemporary discourse, however they cannot be said to "shuffle the cards" like, for example, Neo–Darwinism.

Recommended Literature

BEHE, J.M.: *Darwin's Black Box: The Biochemical Challenge to Evolution.* Free Press, 2006.

BEHE, J.M.: *The Edge of Evolution: The Search for the Limits of Darwinism.* Free Press, 2008.

6. Evolution Natural (Bioevolution) and Artificial (Cultural)

Keywords: *Bioevolution, cultural evolution, culture*

6.1 The Notion of Culture

The following chapter will deal with two types of evolution — natural evolution and cultural evolution. Many only comprehend evolution as the evolution of nature, not taking into consideration that the product of humans — the culture also has its evolution analysed by various scientific disciplines. The notion of culture according to the British literary critic R. H. Williams is one of the most complex notions, which is mainly due to the fact that it is used in various disciplines and contexts. (Williams, 1976)

The Latin root of the word culture is created by verb *colere*, which can be translated as to cultivate, inhabit, invoke, protect. The term inhabit resulted from *colonus*. Colere was also related to *cultus* (well–groomed, educated, neat, decorated, refined). The notion of culture was first used by Marcus Tulius Cicero in Tusculan Disputations in the meaning of cultivation, active enhancement of the spirit. The basis of understanding of culture as human education can be found here. (Soukup, 2011)

The notion of culture is very broad in various evolutional social sciences. We provide at least several definitions:

Human ethology defines culture as a *"situation when a behavioural variant spreads in a group where it is passed from one generation to another and when the group follows it only as an acquired behavioural feature."* (Beer, Immelmann, 1992, 65). Some human ethologists assume that various cultures behave similarly to biological species. (Eibl– Eibesfeldt, 1991)

Sociobiology defines culture as one of our most significant adaptations. Culture is as natural for us as prickles for a porcupine. (Barash, 1981) Culture includes all aspects of "*...complex, symolical, societal, linguistic and technological activity.*" (Barash, 1981) Edward O. Wilson defined culture as a summary of all artefacts, behaviour, institutions and mental concepts transmitted among members of the society through learning. (Lumsden, Wilson, 1981)

Coevolution of genes and culture presents culture as information having an impact on behaviour of individuals through learning, imitation and other ways of social transmission.

Evolutional psychology defines culture as any mentally, behaviourally or materially common characteristics shared among individuals (Tooby, Cosmides, 1992)

6.2 Cultural Evolution

As nature is a subject of evolutionary process, also culture has its evolution which is *partially* examined by various social sciences (cultural anthropology, ethnology, cognitive anthropology, human ethology, memetics, evolutional psychology, philosophy, etc.)

As we have already mentioned above, the "topic of the day" in contemporary evolutional philosophy should be an analysis of the conflict between culture and nature, which is thematised by Josef Šmajs. Šmajs noticed that a great theoretical attention was paid to examination of nature and natural evolution in history; interest of scientists in culture was significantly lower. (Šmajs, 2013) The reason is predominantly seen in the absence of onthological concept of culture. He himself tries to create such concept (see in more detail works of ŠMAJS, J.: *Ohrožená kultura. Od evoluční ontologie k ekologické politice*. Brno: "Special edition" 1995, Slovak translation ŠMAJS, J.: *Ohrozená kultúra. Od evolučnej ontológie*

k ekologicej politike. Banská Bystrica: PRO Banská Bystrica, 2006; ŠMAJS, J.: *Evoluční ontologie kultury a problém podnikání,* Brno: Doplněk, 2013, p. 54–77)

Šmajs characterises cultural (artificial) evolution as a collective product of purposeful activity of humans. (Šmajs, 2013, 54–55) In cultural evolution, behavioural patterns are not transferred genetically (like in natural evolution) but through learning, imitation or symbolical signs (symbolical speech, writing). Qualities and behavioural patterns created through biological evolution are recorded and transferred as genes or gene groups. Analogically, the name "meme" was introduced for information conditioning a sign passed in a cultural way (memes will be discussed in more details in the following chapter). In biological evolution, individual gene variants (alleles) compete between themselves for which of them will be more effectively transferred to further generations. (Flegr, 2005) Artificial evolution cannot be considered as a continuance of natural evolution: constitutive element of culture is not a spontaneous activity of the whole range of natural forces, activity which incorporates, optimalizes and reactively multiple corrects each new evolutional form, but only a specific human activity insufficiently controlled by nature. (Šmajs, 2008)

Cultural evolution, only in progress within an older natural evolution was initiated by the human by generating of any earthly being not created in natural evolution. (Šmajs, 2013) But ontic creativity of culture "*...organizes earthly being not only by a different activity and according to different rules but also purposefully, restrictively and temporarily. The existence of cultural evolution is conditioned by physical and mental activity of the human as a biological species.*" (Šmajs, 2013, 54) Cultural evolution is selfish to natural evolution, and suppresses nature artfully. The conflict between both types of evolution occurs as a result of too fast growth of artificially arranged structures which spread to where originally climax ecosystems were. We have been experiencing the greatest existential crisis in culture so far (the public, mostly not

only laic but also professional does not perceive this crisis, does not thematise, and even if the conflict between nature and culture gets attention, *nature* gets out as the weaker and more disposed to the crisis although it is vice versa) related to the extinction of irreplaceable natural being. Culture "still consumes more and more what it did not create itself, and creates what the planet does not need." (Šmajs, 2013, 55)

As Josef Šmajs suggests, destruction of natural arrangement of the Earth is not only a side but global and key result of spatial expansion of culture, which implies that it is necessary to assess seriously *philosophically* not only what culture brings to humans in an intellectual sense but also what it brings in a prospective somatic and psychical view by changing too radically the Earth, natural ecosystems and the way of human life in culture. (Šmajs, 2008)

6.3 Creation of Culture

How did the culture originate and how is it still created?

Culture is created in a process of purposeful and spontaneous informative activity of people. As Šmajs states, human activity produces cultural structures in either an *indirect* or *direct* way. (Šmajs, 2013)

Indirect way of culture creation: dominated before the industrial revolution, and it corresponds to a careful growth of culture. A form of culture as information unspecified in advance was being created in the indirect way. According to Šmajs, this is how, for example, organised groups of hunters and collectors, ethnical language, mythical awareness, Neolithic settlement, Medieval town, market and later institutions of liberal society are created. (Šmajs, 2013)

Direct way of culture creation: as Šmajs states, it produces cultural structures specified in advance, information–structured, e.g. "...tools, technology, useful objects, structures..." (Šmajs, 2013, 60) These information–specified features of culture remain open for

new information, contrary to organisms. Besides, only a smaller part of spiritual culture — productively oriented knowledge is materialised in these features according to Šmajs. (Šmajs, 2013) The boom of direct activity of cultural evolution was initiated by industrial revolution, whose basis was the process of transformation of manufactures to factories using machines. As Šmajs states, inanimate natural forces were more and more involved in the production process and mainly the energy of fossil fuels initiated the industrial revolution. *"An operation started here in which antinatural culture continues and its intensity dangerously gradates: at its end, there is not only a highly differentiated global abiotic technosphere but also a damaged and polluted planet, deforested country built–up in vain, dried soil, simplified, contaminated and destabilised biosphere.*" (Šmajs, 2013, 64)

Until recently, we were persuaded in history (it also applies to the history of philosophy) that culture is anthropologically more important than nature. It was understood as the world of something higher, as the world of art, morals, freedom, justice, while nature was only interpreted as a necessary "background" of culture, as the world of laws. However, culture as an especially fast and strong predator is not only the world of "high creation" but it is also a world leading not only a war with nature lost in advance, but also includes permanent internal wars and conflicts among people, ethnic groups, states and civilisations. (Šmajs, 2013)

Humans cannot ignore tradition, cultural heritage, they have to socialise and thus adapt. On one hand, the human is a catalyser of cultural evolution and manages to free themselves with its help whether socially or technologically; but on the other hand, they are more and more dependent on supraindividual system of the whole culture and thus forced to adapt to changes of cultural system. Adaptation to new conditions resulting from constant cultural evolution implies a spiritual change of people, however in correspondence with what our a priori ontogenetic programme enables and allows them. Josef Šmajs captured it metaphorically: nature created our so far perfect 'hardware', while culture into which each person socialises in course of their ontogenesis only creates and changes their 'software'. (Šmajs, 2000)

Recommended Literature

CLAYTON, P.: *Science and Theology News.* Roč. 6, č. 7, 2006, s. 21–22.
DEMENY, P.: *Population.* In:B. L. Turner, et al. (eds.), *The Earth as Transformed by Human Action.* New York: Cambridge University Press, 1991.

7. Evolution from the Viewpoint of Meme Theory

Keywords: *gene, cultural evolution, meme*

This chapter will deal with basic characteristics of cultural evolution. This type of evolution will be examined from a certain specific viewpoint. It will be based on the concept of the *meme* as a replicator analogical to gene in some most general characteristics. This viewpoint is based on certain scientific knowledge on cultural transfer as well as on some approaches of philosophers like Daniel Dennett, Richard Dawkins and Susan Blackmore.

One of the first authors talking about social heredity was James M. Baldwin. The so–called ontogenetic adaptations are also said to be reproduced in the following generations, however they are not physically hereditary. (Baldwin, 1896) We would nowadays say that it does not concern *genetically* hereditary adaptations. This is one of key specific features of cultural evolution: heredity is not carried out through *genes*.

This type of evolution is mainly characteristic of the human. However, it also occurs in a certain extent in other animals. Animals show not only purposeful traits and behaviour patterns due to *biological* evolution but also those created in *cultural* evolution (Flegr, 2005). The best known examples of traits created in organisms in cultural evolution include bird singing or various hunting habits and abilities of raptors (Flegr, 2005). It means that particular forms of bird singing or particular hunting habits of raptors are not recorded in their genes but are transferred from a generation

to another *not genetically*. The ability to learn itself is conditioned by genes; however particular content an organism learns is not. But this content is also limited by abilities whose creation is also dependent on genes.

7.1 Basic Conditions of Evolution

As the meme will be understood as analogical to the gene in a certain general meaning, also cultural evolution will be understood as analogical to biological evolution at a certain level of abstraction. In order for cultural evolution to be evolution it has to fulfil certain basic general conditions. For example, according to Dannett, evolution occurs anytime after fulfilment of the following conditions:

(1) *variation*: permanent abundance of various traits exists
(2) *heredity (replication)*: these traits have an ability to create copies (replicas) of themselves
(3) *various "ability"*: the number of copies of a trait created at a given time changes depending on interactions between characteristics of such trait and characteristics of environment it endures in (Dennett, 1995).

As we can see, such definition is actually only general and includes many different processes. As Dennett emphasizes, this definition does not deal with organic molecules, food receiving or life. It is an abstract definition of *evolution of natural selection* and was formulated in many approximately equivalent versions (Dennett, 1995).

7.2 Cultural Evolution — Basic Terms

In biological (genetic) evolution, hereditary information is transferred through genes. They replicate and have to be considered as entities "heading" towards their own endurance. Similarly in case of cultural evolution, there is something which replicates and is "focused" on its endurance. Such entity is called **meme**. The meme

is analogical to the gene to a certain extent: similarly to traits and behaviour patterns created in biological evolution which are recorded and transferred as genes or gene groups, traits and behaviour patterns created in cultural evolution are transferred through memes or meme groups. The name "meme" was introduced by Richard Dawkins in his book *Selfish Gene*, where he mentions as examples of memes for example tunes, ideas, known phrases, fashions in clothing or ways of pottery production. As genes are spread in gene pools by transferring from a body to another body through a sperm or ovum, memes spread in meme pools by transferring from a brain to another brain through a process which can be called imitation in a broader sense (Dawkins, 2006).

However, memes cannot exist on their own. Like genes, they need a physical **bearer**. As D. Dennett points out, memes depend on a physical medium, however they can skip from one medium to another (Dennett, 2003). Among various bearer types, we distinguish the so–called **natural bearer**. In case of genes, nucleic acid is the natural bearer (unnatural one is e.g. computer hard disc), in case of memes, natural meme bearers are memory traces in brains of animals (Flegr, 2005). DNA of organisms creating a population is a bearer of various genes; similarly, brains of these organisms can be understood as bearers of various memes. As a new gene variant can be created through mutation in transcription of genetic information, a "mutation" of a meme can also occur in case of memes when a meme change occurs in its bearer within its transmission or existence. Various genes and gene variants and analogically also various memes and meme variants have a different ability to spread — in case of genes in a gene pool, in case of memes in a **meme pool**. According to the described view of cultural evolution, the process of creation, spreading and development of memes fulfils basic conditions of the process of *evolution*:

(1) variation: a number of various memes exists;

(2) heredity (replication): memes have an ability to create copies (replicas) of themselves;

(3) various "ability": the number of copies of the given meme created at a given time changes depending on interactions between characteristics of such meme and characteristics of environment it endures in, i.e. various memes have a various ability to spread within a meme pool.

The fact that a replicator other than a gene can exist is not surprising when we realise that conditions of evolution can be fulfilled by a great number of various processes independently of a medium serving as a replicator bearer, and independently of a replicator type. Important is only the fact that the given process fulfils the aforementioned conditions. Dawkins therefore says that a unit of natural selection is any replicator copied with a certain occurrence of copying errors and which can have a certain impact on probability with which its copies are created. He suggests that genetic natural selection is only a special case of a much more universal process, denoting *as universal Darwinism*(Dawkins, 1999, p. 19).

Also Susan Blackmore points out that we need to distinguish between general evolutionary theory, describing evolutional algorithm in its weakest form and including all particular evolutional processes on one hand, and theories describing particular types of evolution on the other hand (Blackmore, 1999). Biological / genetical evolution is only one case included under general evolutionary theory. Cultural evolution is a different case. In less general characteristics, both evolution types differ, however in spite of these differences, all evolutional processes have to include a replicator defined in its most abstract form by three conditions specified above. Each process fulfilling these conditions is an evolutional process and each entity represented in such process as the replicated entity, is a replicator and a subject of such evolutionary development.

We need to remember that individual evolution types can differ in all other characteristics. Therefore, we should not consider any analogy exceeding the framework of general evolutionary theory as guaranteed. It is always necessary to examine closely whether such analogy can be recorded among the given evolution types.

7.3 Cultural Evolution in Nature

Cultural transmission, which represents a non–genetic heredity of *adaptive* features, i.e. traits and behaviour patterns which are *purposeful*, does not occur only in the human but also in many other biological species. Latest studies imply that processes essential for cultural transmission are spread and significant for animals more than it was assumed until recently (Whitten, Hinde, et al., 2011). How do we know that these traits and behaviour patterns of animals were hereditary in a way different than through genes? We know that in many cases genetic consanguinity of populations does not correlate with the similarity of behaviour patterns which are transmitted in the given group of animals through imitation, i.e. cultural transmission. For example in individual groups of chimpanzee populations (a similar phenomena was also observed with orang–utans) observed in the long term in their natural environment, many behaviour patterns were observed, specific only for populations found at a certain territory. It showed that thanks to these differencies, groups of shimpanzee populations create certain cultural groups reminding human nations, while similarity of cultures related little to genetic consanguinity of their bearers. It implies that these cultural traits were transmitted independently of gene flow (Flegr, 2005) and thus could not be transmitted through genes.

However, share of traits occurred and fixed through cultural evolution is not big for biological species according to Flegr, which, as he suggests, does not apply to the human (Flegr, 2005). In the same way Ernst Mayr suggests a certain exceptionality of the human in this sphere. According to him, the amount of information most of animal species can transmit through the system of non–genetic transmission is quite limited. However, transmission of cultural information became the main contents of life for the human (Mayr, 2004). We can say that the share of traits transmitted through cultural transmission is extremely high for the human.

However, it does not mean that non–genetic transmission of adaptive traits does not exist for other biological species. Knowledge transmission in a non–genetic way was also recorded for birds (while behaviour, one of phenotypic features of animals, is also conditioned by their knowledge). One of the best known examples of cultural evolution is the following case of adaptation of English titmice. Around 1921, blue tits in Swaythling area in England learnt to peck wax lids of milk bottles and get cream from them. This habit gradually spread to further areas of England also among other bird species, while individual birds used different techniques to open the bottle lids. That implies that only information on the fact that cream could be reached by opening the bottle was spread culturally, not the technique of bottle opening itself. (Flegr, 2005)

According to Susan Blackmore, this case and similar cases do not represent imitation, as animals did not copy an entirely new type of behaviour from other animals (Blackmore, 1999, p. 72–73). Such cases only represent individual learning or types of social learning. Blackmore understands imitation as learning of behaviour through observing of others, while she sees social learning as learning about an environment through observing of others (Blackmore, 1999). According to Blackmore, English titmice only learnt into what they should peck but they did not learn the ability to peck itself, because they had had it long before. She also argues that birds opened bottles in different ways, which means that what they acquired from others was not an ability to do an activity but only information on environment (information that there was cream in bottles). As according to Blackmore, imitation in its broader meaning represents the only way how memes can spread, we cannot talk about memes spreading in this case. Memes transmission among biological species other than the human is very rare according to her. Exceptions are e.g. songbirds and maybe dolphins. Also chimpanzees and gorillas raised in human families can imitate in a way not occurring in relation to chimpanzees and gorillas living in wilderness (Blackmore, 1999). According to her,

imitation, spreading of memes and cultural evolution are therefore specific features of the human. A universal or general ability to spread memes is observed about the human. Extent of memes which can spread among people and which primarily occur in the human brain is very broad and might even be unlimited. There is a difference between the human and other biological species: songbirds imitate singing but will never learn to imitate construction of planes, rockets, computers, etc. Neither a transmission of scientific theories nor an ability to transmit almost any type of activity have been observed about them. On the other hand, a person can learn from other person basically any technological procedure or other type of activity. Therefore, according to her, human species (species belonging to *Homo* genus) crossed the critical boundary behind which a new type of replicator — meme started to be applied more and more significantly beside genes.

7.4 What are Memes?

In order to understand what memes are, it is useful to realize that memes have to exist in their bearer at least for as long as to be able to copy into another bearer. Therefore, not all contents of our minds are memes. Only those able to copy into other minds can be called memes. If memes want to endure in the long term and spread, they need to have the ability to copy.

However, mind depends on the brain, existing only for a relatively short time. Memes thus use a similar strategy to genes which are preserved and spread through bodies of organisms. They only exist for a limited time, too. Genes thus have to have the ability to spread into new bodies after a new individual comes into existence and acquires them. Otherwise, genes could not endure in the long term and spread in the long term. Similarly to genes transferring from one body to another, memes are transferred from one brain to another.

Of course, memes do not have mind, intentions or will — similarly to genes. A way of speech presupposing anything like that is

only used metaphorically as a useful shortcut. It would be more precise to say that only memes able to transfer from a medium to another one endure in the long term and can spread in the long term. If we say that memes "try to spread", that "they aim at their own survival", that they are "selfish" in this sense, it only means that only memes good at spreading will probably spread in the long term and will endure. After all, there will be a great number of such memes, as those not disposing of such traits will extinct fast, while the population of those good at their own replication will either increase or will at least be sustained.

It is good to realise in this relation that memes in the ultimate meaning do not have a "higher goal" than their own replication. Similarly to genes, memes are not there for us after all. They are there because they have a good ability to survive and spread in the long term.

In spite of the fact that memes are not necessarily there for our benefit, some of them can be useful for us. And on the contrary, some memes can be harmful for us. Others can be neutral from the viewpoint of our benefit. D. Dennett points that out accurately when he compares memes to organisms living in our bodies, while he divides them into three types: 1. *parasites* whose presence lowers the ability of their bearer; 2. "*messmates*", whose presence is neutral (they live in our bodies, "share a common table with us" but neither lower nor increase our ability); 3. and *mutualists*, whose presence increases our ability and which are beneficial for us (Dennett, 2003). However, it should be said that memes can be divided into such three categories with regard to various criteria. When talking about our ability we should talk about harmfulness, neutrality and usefulness of memes for our genes (!), not necessarily for us. On the other hand, we could talk about harmfulness, neutrality and usefulness of memes for us, while in this case, their usefulness and harmfulness could be related with regard to objectives of the given individual or society. However, these objectives can be different for different people or societies.

7.5 Specific Features of Cultural Evolution

Genes can only spread from parents to offspring within sexually reproducing organisms. However, not only *vertical* spreading of memes from parents to offspring is possible in cultural transmission but also *horizontal* spreading among non–related individuals (Flegr, 2005). It is obvious that learning — whether social learning with help from other organism or imitation — is not limited to learning from parents, but that it is also possible to learn from completely unrelated individuals. Generally, we can say that memes do not spread genetically.

Further difference between biological evolution and cultural evolution is that biological evolution can only progress slowly in very small steps, although from the viewpoint of geological time, some periods can seem as leaps. It is due to the fact that mutation, which is basically an error in copying of genetical information, is normally not big. Copying is very reliable in case of DNA. It means that an error in copying is normally very small and the overall amount of errors in relation to the volume of copied information is also small. The second, practically impassable restriction for jump evolution is that a big change in genetical information — since mutation is random — would lead to the fact that the given organism would not survive. Genotype created by such big mutation would not encode anything vital, i.e. something able to evolve in mother's body and survive in natural environment. Biological evolution is thus referred to gradual accumulation of small changes.

However, cultural evolution is different in this relation. To clarify this fact, it will be appropriate to use a useful theoretical tool, which is the idea of **adaptive land**. This concept was introduced by the American biologist Sewall Wright (Wright, 1931). This idea will first be described within biological evolution.

Adaptive land is an abstract model of either environment and individual organisms or environment and populations of organisms. In the first case, we can picture evolution of organisms in an environment as a three–dimensional topographic map, where coordinates *x* and *y* correspond to two traits of a hypothetical organism, e.g. body weight and maximum speed of movement (Flegr, 2005). Coordinate *z* of a point (*x*, *y*, *z*) located on adaptive land corresponds to biological ability of an organism with traits *x* and *y*. The fact that land is not flat means that not all *x* and *y* traits combinations are equally advantageous from the viewpoint of survival. A higher *z* corresponds more to more advantageous combinations of *x* and *y* traits than less advantageous combinations. It is necessary to realise that from the long–term point of view, only upward shifts, i.e. shifts toward a higher *z*, toward greater ability, can occur through natural selection on the given adaptive land. A shift is to be understood as a change of traits of organisms in the process of succession of individual generations in time. Thanks to mutation, offspring can shift with regard to *x* and *y* coordinates of their ancestors at positions corresponding to a higher ability. As Flegr states, organisms gradually climb peaks of individual mountains in biological evolution. Of course, it does not apply unnecessarily. If for instance external factors cause extinction of a whole population, such shift will not occur.

The fact that biological evolution pushes projections of organisms upwards to mountain peaks however does not imply that organisms should occupy all peaks or that they should climb the highest peaks. If there is a valley between two peaks, organisms cannot get from one peak to another. If a new individual of the following generation gets at a position with lower ability, it is either eliminated in natural selection or its offspring climbs back at the nearest peak after some time. There can be situations when there are several free and maybe higher peaks close to an occupied one which organisms will never climb. Flegr summarizes it by stating that **evolution does not optimize** but only **enhances** (Flegr, 2005). In order to be able to optimize, it would have to be able to overcome valleys in the adaptive land.

To understand why cultural evolution differs from biological evolution in that leaps are possible in it, including leaps through

valleys in the adaptive land, it is necessary to realise that functioning and activity of meme bearers play an important role in the process of cultural evolution. One of the ways how very different variants and even new memes are created based on leaps is also human thinking. Even complex structures like our scientific theories were created in the process of cultural evolution. The example of scientific theories can illustrate the fact that many meme mutations are *targeted* mutations. For instance, the theory of relativity was not created by accumulation of millions of small changes but each "brain" added much to the resulting product (as if a leap occurred), moreover, in a not random but targeted way. The theory of relativity was not created by a small modification of Newton's theory. A significant intellectual performance was necessary, in which also other memes as the tools of thinking certainly had a share. Such leap would not be possible with genes; however it is possible with memes. It shows that *optimisation*, unavailable in biological evolution, is possible in cultural evolution at least to a certain extent. This optimisation is also possible thanks to intelligent activity shown by human beings in creation of new memes. That is one of the reasons why leaps over valleys in the adaptive land are possible in cultural evolution.

As genes are tested by natural selection through the phenotype, i.e. a set of all traits of their biological bearer, memes also have to take a certain "test". In order to be able to copy into another brain they have to be shown somehow. They also have to find a way how to "force" the new bearer to spread them, for which they can use different ways. A substantial activity necessary in meme transmission is human thinking. Activity of a human being in transmission, spreading, modification or creation of memes is necessary, as it also corresponds to our experience with culture. We are thus getting to further specific feature of cultural evolution, distinguishing it from biological evolution. According to Darwinist model, new purposeful traits can be created in biological evolution exclusively by random mutation. However, new memes in cultural evolution can

also be created by targeted and purposeful activity of an individual (Flegr, 2005). New genes are created through processes which are unconscious. There is no rational mind which could propose a new variant subsequently tested in natural selection. New is created without any intention. Design is due to natural selection. It is a reason why, genes genetically conditioning individuals with a sufficient amount of adaptive traits, i.e. individuals sufficiently adapted to environment they live in will endure in the long–term perspective.

However, cultural evolution partially differs from biological evolution in this regard, since in the point where new variants are created in biological evolution, a new type of their creation is *possible* in cultural evolution. Besides unconscious processes which are still possible and present in a great extent, also more or less *conscious* processes are possible in cultural evolution. Design carried out by conscious rational beings with intentions can come up. That is how human activity, thinking, creation, judgement and thus also more or less conscious and purposeful design come up.

To put it differently, variability of memes is ensured in various ways. Some of these ways are unconscious and without an intention, e.g. common imperfection in transmitting of the given meme or imperfection of our memory, etc. Others are conscious and intended in a certain extent. A human can also create a new meme *consciously*. For instance, they can create a new, significantly modified version of a theory or a brand new theory through their intellect, consideration and thinking. This process and its results can be denoted as "ingenious" in some cases.

A human is thus able to create new meme variants and even new memes purposefully and intentionally. Design can be applied already at the moment of creation of new memes or new meme variants. It is then not *only* a result of a long–term process of natural selection of variants preferred to others. *Such cases* concern — if we can borrow the expression — a more less "intelligent design". It comes up not sooner than in cultural evolution, not in

biological one anymore, as the supporters of so–called intelligent design assume. That is a substantial difference not to be disregarded. Not only the creation of a new meme but also its receiving itself by a new potential bearer itself (i.e. its replication) *can* be at least partially determined by intelligent activity of this potential bearer. In other words, whether a new meme creates its replica in a brain and whether this replica endures in it, and whether and in what extent it will replicate itself is also dependent on such processes like thinking, judgement, etc.

Another difference between biological and cultural evolution lies in the fact that if branches of the tree of life are separated they cannot be reconnected again later (this only applies to sexually reproducing organisms). Since a biological species is defined as a group of populations of organisms which can multiply and are reproductively separated from other populations (Mayr, 2004), it is practically impossible after separation of a species that any of these populations gets in a condition, following gradual evolution, that its members can multiply again with the offspring of a different species, creating a different branch of the tree of life. That is why the tree of life is a tree. The tree metaphor however does not apply to cultural evolution. Combining of different memes into new memes, or blending of its different parts often occurs in it. The meme can be affected by accepting a part of a different meme. Reconnection of lines is therefore possible in cultural evolution.

Eventually, we would like to discuss the issue of preferential creation and heredity of purposeful traits, related to Lamarck. Flegr argues that cultural evolution can take place not only through the mechanism of Darwinist evolution but also the mechanism of *Lamarckian* evolution, i.e. preferential creation and preferential heredity of purposeful memes (Flegr, 2005). However, Blackmore points out that if we use the term "Lamarckian" for cultural evolution at present, we only understand the presence of one of the aspects of Lamarck's theory in this evolution: heredity of acquired traits (Blackmore, 1999). However, Lamarck's original theory

presupposed many other characteristics, confirmed neither in biological nor in cultural evolution. The necessity of progress in evolution or efforts in self–improvement of organisms can be used as examples. Therefore, what is nowadays denoted as "Lamarckian" is something much narrower than what Lamarck would have denoted by it. That is the first key point.

Secondly, it is necessary to realise that heredity of acquired traits in Lamarckian meaning is based on differentiation between a genotype and phenotype. Also in case of genes, heredity of all acquired changes of genes themselves exists. What does not exist in biological evolution is the transmission of acquired traits at the level of a phenotype to a genotype. That means that the genotype does not inherit acquired changes of the phenotype, however it obviously inherits all acquired changes of the genotype occurred within individual generations. Of course, that only happens if an individual inherits the given gene variants from the given parent, not their other variants from the second parent.

Asking whether a process occurs in a Lamarckian way thus has a meaning only where a difference between a genotype and phenotype exists, as only in such case is it meaningful to ask whether changes acquired by the phenotype were inherited by any subsequent genotype. However, unless genotype and phenotype can be distinguished, this question is meaningless. And this is a problem in case of memes to a certain extent. Therefore, in case of meme transmission, Blackmore prefers distinction between *copying of a manual* and *copying of a product*, while her conclusion of the whole discourse on Lamarck is that we do not have to bother by the issue of Lamarckian nature of cultural evolution. According to her, this question is meaningful only in biology and only in case of sexually reproducing organisms. With regard to cultural evolution, it would only be meaningful, if we managed to define a precise analogy between genes and memes. However, she assumes that it is meaningless to create such precise analogy (Blackmore, 1999). Why? Because analogy between these two replicators is only

guaranteed to the extent that they are replicators in the evolutionary process defined in the aforementioned abstract and general meaning. Anything more is a separate question which needs to be examined separately. For instance, analogy of a genotype and a phenotype in cultural evolution is not automatic, and therefore cannot be *a priori* presupposed. This question cannot only be decided on the grounds of the fact that both processes (biological as well as cultural evolution) are included in general evolutionary theory (and thus in universal Darwinism) and that both replicators are replicators in the evolutionary process.

7.6 Possible Problems of Memetic Approach

According to present defined view of cultural evolution, cultural evolution is an evolution in the general meaning defined by general evolutionary theory, i.e. it fulfils conditions of *1. variation* (memes mutually differ), *2. heredity* (memes are able to create their copies) and *3. different ability* of memes (different memes, respectively their different variants have a different ability to spread). Meme is thus a replicator in the process of evolution.

However, this view also has certain problematic features. We can, for instance, consider the problem of preciseness of meme replication. If the preciseness of meme replication was too small (i.e. the extent of "mutation" would be too big), evolution could not take place. If each newly–created meme differed too much from its parent all adaptive traits would be lost faster than the new adaptive traits could be created by "mutation". The reason is that mutation, since it is random, is much more often useless for ability (i.e. not adaptive) than useful. Precision of copying is therefore so important in biological evolution. Thanks to it, what has already been achieved from the viewpoint of adaptability is maintained. Natural selection subsequently removes bad mutations. However, if big mutations occurred in all or most of cases, natural selection would remove almost all entities already in one generation and after

several generations, all of them would disappear. If memes were always too different from their parents, natural selection would remove almost all of them with their bearers, *unless* their bearers were kept alive by *genes*, copying very precisely, thanks to their adaptive function. In such case, meme bearers would not cease to exist but memes would be "thinned down" randomly from the long–term viewpoint. In case of too imprecise copying, each meme would cease to exist after a certain rather small number of generations regardless of its adaptive function. It would thus not concern natural selection. We would rather examine certain "modes" or temporary "epidemics" but not long–term evolution. As a result, the original information would inevitably be disorganized and cease to exist after a rather small number of generations regardless of how it would affect traits and behaviour of its bearer.

Such idea brings us to question whether all culturally transmitted entities are copied precisely enough, or whether at least some of them are copied precisely. Probably only those copied with a great precision have a prospect of development, and it would be interesting to examine which cultural entities are of this kind. For instance, it seems that development is most obvious in the sphere of technology. A reason might be the fact that cultural information coding technology is copied very precisely. On the other hand, various belief systems not related to technology seem to be spreading rather epidemically and seem to be similar to temporary fashions. A period of hundreds or thousands of years is a short period from the viewpoint of evolution. As if it was not development taking place in this case but only a fast initial spreading and then several centuries of gradual change, while at the end, we have a different belief system which can become a subject of further fast spreading of another such system. On the contrary, tools like results of technical procedures have been used for a long time during which development is already possible, and seems to be actually present in this sphere. It is similar in case of creation and development of technologies in general. Status of science and scientific theories

could be questionable, since the science has only existed for a short time. On the other hand, scientific theories are copied very precisely, which gives us hope that evolutional development could exist in this sphere.

Recommended Literature

DENNETT, D. C.: *Darwin's Dangerous Idea*. London: Allen Lane The Penguin Press, 1995. s. 335–369.
GOULD. S. J.: *Ever since Darwin*. New York: W. W. Norton & Company, 1977.

8. Information

Keywords: *information, cultural information, natural information*

8.1 Discovery of Information

Element making mechanisms of cultural and natural evolution clearer is *information*. As Slavkovský states, etymologically the term information has *„a Latin stem and comprises two parts: "in" and "form". "In" is a prefix suggesting inward direction, "form" expresses form, shape. To inform then means to give a shape to something shapeless , to give a form to a deformed pile ."* (Slavkovský, 2013,) The aforementioned J. G. Mendel can be considered as the discoverer of inward information of living systems. In his paper *Versuche über Pflanzenhybriden*, (1866) he selected seven pairs of traits of seeds and plants of peas which could be well distinguished:

— round, rounded or irregularly angular shape of seeds
— colour of seeds: while, yellow or orange
— colour of seed coat: white, grey or brown in connection with white or purple colour of flowers
— shape of ripe legume, simply arched or very narrowed
— light to dark green or yellow colour of unripe legume
— position of flowers on the axis or along the axis
— length of the axis: 1.9 — 2.2 mm or 0.24 — 0.46 (Mendel, 1965)

Mendel observed distribution of the aforementioned traits for individual generations of crossbreeds. In all seven pairs of traits, he proved the ratio 3:1 in segregation of parental traits in

hybrid offspring. (Soukup, 2011). Besides, he introduced symbols for marking of recessive and dominant traits, which are used up to now. A stable dominant trait was marked as A, variable as aA, recessive stable was marked as *a*, variable as *aa*.

8.2 Natural and Cultural Information

Information will be understood in the context of this textbook as "*...the most important creation of evolution.*" (Šmajs, 2003, 46) Information as a product of evolution not only integrates living and culturally open non–linear systems but differentiates reality ontically at the same time (Šmajs, 2013, 34).

Similarly to Šmajs's distinction of evolution as natural and cultural, also information is understood as natural and cultural. „The significance of this distinction is related to the fact that information not only *ontically unifies but also ontically differentiates the reality*." (Šmajs, 2013, 34) According to him, information should be an ontological category; culture itself, endangered by destabilised nature, calls for it: *"Information not only as a message transmitted, received or processed by the system, but also as a condensed abstract structure of the system (its memory in a narrower meaning), or as orderliness comprehended in the structure (memory in a broader meaning) exists objectively, and the category of information is even more important for ontological understanding of the world than significantly uncertain categories of motion, space or time."* (Šmajs, 2000, 110)

Natural information — memory in the narrower meaning of the word, an anti–entropic barrier between anorganic and organic systems actually helps sustain a systemic orderliness of living systems reached in evolution. (Šmajs, 2000)

Cultural information — a genome of culture can be created by e.g. myths, ideologies, values or technological knowledge, etc. It makes culture possible and was created by modification of natural information. Šmajs sees the necessity of its existence in the fact that artificial structures beneficial for humans need to be fulfilled by an artificial cultural way (work, cooperation, ...), and all cultural institutions and features are dependent on systemic integrity of a community and on spiritual consistence of individuals. (Šmajs, 2000) (More on the category of information can be found in e.g. ŠMAJS, J.: *Evoluční ontologie kultury a problém podnikání,* Brno: Doplněk, 2013, s. 34–46)

8.3 Other Concepts of Information

Over the last fifty years, economically developed countries have gradually changed to the so–called *information society*. Futurologist Alvin Toffler called this transition the *third wave*, suggesting that the change would be equally significant to the previous two — transition from societies of hunters and gatherers to agricultural societies and from these to industrial ones. (Fukuyama, 2000)

The task of cultural information and intelligence embodied in us as well as in more and more intelligent machines starts penetrating into all spheres, and brain work is gradually substituting manual work. (Fukuyama, 2000)

Information also plays a significant role in other evolutionary ontologies, e.g. in creation and evolutionary ontology of C. Tresmontant. In his concept, since it is a concept of creation and evolutionary ontology, a creator is necessary for the creation of information. *"In no moment of its history can space explain the creation of new information, procreating new beings in it. And since this new genetical information cannot come from nothing — as nothingness is sterile and cannot create anything — it implies that new genetical information, constantly enriching space in its history, originates from a source X and it is not important how we call this source."* (Tresmontant, 2002, 140)

Until the human appeared in the evolutionary line, only genetical information was present in space according to Tresmontant. *"We have observed that until the occurrence of the human, all*

creation in the history of space and nature was carried out through transmission of a message, delivery of information. Newly occurred zoological genus first of all means an establishment of new genetical information, which is subsequently transmitted. Information is at the initiation of each new creation. Information was with God." (Tresmontant, 2002, 140)

After the occurrence of the human, information is not transmitted only to their genes but, as Tresmontant states, also to their thinking, mind, spirit and free will. Even though Tresmontant does not explicitly speak about natural and cultural information, we can say that the analogy with Šmajs's distinction is present. Information produced and reproduced by human thinking, their spirit and freedom can be called cultural information. On the other hand, creation information, existing in the nature long before the human, is actually natural information.

Recommended Literature

ROLSTONE, H.: *Science and religion. A critical survey. III.* Philadelphia and London: Templaton Foundation Press, 2006.

TOOBY, J., COSMIDES, L.: *The psychological foundations of culture.* In J. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture.* New York: Oxford University Press, 1992.

9. Evolutionary Epistemology. Cognition of Evolution. Evolution of Cognition

Keywords: *Cognition, evolutionary epistemology, theory of autopoiesis*

9.1 Evolutionary Epistemology

The following chapter will connect to the previous one — the phenomenon of information. That is closely related to recognition and cognition. Cognition in evolutionary epistemology is understood as a strategy of "*any system to survive effectively in its environment, mainly through mapping of relevant characteristics of the environment and searching for efficient mechanisms of its endurance.*" (Démuth, 2013) Cognition in the context of evolutionary gnoseology could be characterised by the words of Josef Šmajs as a "*physiological process through which systems able to cognite acquire information from an external environment."* (Šmajs, 2008, 33)

Evolutionary epistemology is an interdisciplinary approach to cognition, resulting from knowledge and methods of various (predominantly natural) sciences and emphasizes natural selection. Attention is drawn to selection at two levels:

— selection as a generator and "maintainer" of our senses and cognitive mechanisms, and at the same time a connection between these mechanisms and the world
— selection within evolution of scientific theories

Origination of evolutionary epistemology directly relates to the creation of evolutionary theory of Darwinism. Evolutionary

approach to cognition was first applied by pragmatists (Dewey). The human (with his cognition) is comprehended as a result of evolutionary activity, and is thus obviously ranked among natural beings. In spite of the fact that Dewey postulated cognition as a result of evolutionary process, he did not call his concept *evolutionary epistemology*. This term was introduced by Donald Campbell in the 1970s.

9.2 Why Do We Recognise?

Most of the aforementioned authors probably agree on the fact that cognition actually represents an *existential need*: "*As gathering of relevant information from external environment represents an existential need for all these systems: it is the only way they can flexibly adapt to active, structured and changeable environment, it is the only way they can effectively gather agents, energy and information for their reproduction.*" (Šmajs, 2008, 41)

What is the position of the human in recognition of environment with regard to other animate systems? We can say in a simplified way that the human recognises in a way similar to other living systems. (Šmajs, 2008) As Šmajs suggests, the human recognises a fact verbally as well as non–verbally, and like the rest of the living systems, they recognise at two levels: the first level is *"biologically fundamental... it is an indirect but most objective recognition and it is recorded in the language of nucleic acids..."* (Šmajs, 2008, 43) The second, highly selective, recognition level is well visible mainly with multicellular animals with receptor and neuronal regulation of behaviour. It is recorded in the central nervous system of the respective biological species but is not further transmitted to any external common signals. (Šmajs, 2008) However, as Šmajs points out, besides the two mentioned recognition levels, we can find a third one with the human, encoded in an ethnic language. This conceptually encoded recognition is an empirical form of cognition, or in other words — grasping of reality in a human language thanks to the great capacity of human CNS. It concerns a social and cultural interpretation of reality whose primary task is not to help adaptation of the human to external environment. (Smajs, 2008 45–46) *"Gathering, storing and functions of neuronal social and cultural information partially resemble mechanisms existing in the biosphere before the human. However, this generationally discontinuous information which is affected by the species with regard to the structure of environment will be applied in the culture in a new way: not only behaviourally, i.e. biologically adaptively and communicatively but also theoretically interpretationally, and therefore also structurally constitutively — ontically."* (Smajs, 2013, 46) By contrast to the first level of cognition, this third level does not define any binding order of steps to spontaneous molecule activity for creating an organism. Information gathered from the third level is determined in two ways of creating of cultural system — either technical designing or social communication and worldview orientation of people. (Šmajs, 2008) In spite of the fact that this type of information is the latest (it is only several ten thousands of years old) it dominates semantically over the first and second cognition levels (as Josef Šmajs suggests, philosophy almost never discusses the first two "floors" — for more details, see e.g. ŠMAJS, J.: Potřebujeme filosofii přežití?, 2008). The third cognition level is a basis of cultural evolution. We cognize in order to live, survive and above that — live more quality lives; not directly in natural ecosystems anymore, only biologically, but more and more often through the cultural system.

9.3 Theory of Autopoiesis

Evolutionary gnoseology deals with philosophical problems of cognition and recognition through the prism of evolution, while the basic thesis is that "all living systems cognize". This idea is based on the theory of Humberto Maturana and Francisco Varela (so–called Santiago theory), dealing with examination of biological

preconditions of (not only human) cognition: “Living systems are cognitive systems and life as a process is the cognitive process. This thesis is valid for all organisms, whether with a nervous system or without it.” (Capra, 1996)

Varela and Maturana became famous by (probably the only globally spread) theory contradicting the existence of information. In a nutshell, we can say that their theory, which they called autopoiesis, follows Prigogine’s understanding of the world as a set of structures regulating themselves. The term autopoiesis is a compound of two Greek terms — “auto”, meaning own, self, and “poiesis”, which can be translated as creation. (Capra, 2004). Autopoietic system thus could be translated as a self–creating system. The authors themselves define it as a dynamic entity materialised in the form of a closed network constantly producing its components. Thanks to their mutual interactions in the process of creation and disintegration, the network which produced them is constantly being reopened, and the extent of the network is determined at the same time. (Maturana, 2006)

Self–creating system in the autopoiesis theory cannot only be understood as a summary of mutually interacting features which create it. The given theory does not deal with individual components. It rather searches for a structure (network), created by mutual relationships within the system. Maturana got to the issue of recognition of environment through examination of perception of colours. His conclusion was that there is no way how to define a colour objectively. There is no guarantee that what we see as a certain colour has anything in common with what this colour actually looks like. Maturana (in cooperation with his student Varela) supported his theory by the already mentioned autopoiesis theory. One of the key activities in the process of self–creation and self–maintenance is cognition, according to them. They also applied this observation to defining of living systems, which put them in a position against anthropocentrism, and they also consider structures with not highly evolved nervous system as living.

According to them, the cognition process is an inevitable accompaniment of life.

The preceding thoughts about autopoiesis imply that each living system is related to its environment and is energetically dependent on it. According to Maturana and Varela, something like a selection process accompanies living systems in reactions to changes. The system selects itself which of the changes the process initiates and thus decides in a certain way to what it will or will not react. Therefore, according to the cognition theory of Maturana and Varela, we do not understand cognition as a representation of the objective world existing out there. The world of each living system is created on the grounds of its interactions with its surroundings, taking place as a part of efforts of the system to keep it alive.

Constant changes in the arrangement of the structure of living systems, which are a result of reactions to physical impulses coming from the surroundings, actually represent cognition according to the given theory. It is not a synonym of the term leading; cognition according to Maturana and Varela is a process of adaptation in which representation of objectively existing world “outside” does not occur. Information on the state of reality out there does not enter into a living system, instead, a photon, or a chemical substance or other living organism, etc. enters into the system and the living system reacts by reestablishment of relationships between its components in order to incorporate the change in its arrangement. Accordingly, we divide organisms at various levels of complexity depending on how many components they are able to process. It does not imply for Maturana and Varela that more complex systems are superior to simpler ones. All systems are created in a way most beneficial for the environment they operate in and for the function they have in the ecosystem. Thin ice of the cognition theory of Varela and Maturana is that not each process is understood as cognition. For instance, accidents (a fox bites a bear, a giraffe gnaws tree bark, etc), i.e. changes which the system did not undergo voluntarily through cognition do not exist. And this is

where we perceive a problem. Where do the accidents finish? How to define them generally? Is it an accident when we for example get wet? It seems so, since no living system chooses when, how and where it gets wet. However, our task is not to solve unanswered questions but rather to motivate the reader to ask them. Therefore, we further deal with the evolutionary gnoseology.

9.4 Popper's Evolutionary Gnoseology

Another significant project in the sphere of evolutionary gnoseology was a contribution by K. R. Popper, who besides other issues dealt with the philosophy of science and cognition growth in his philosophical concept. In one of his last papers — Life is a Solution of Problems, he introduced an idea that life is a solution of problems, and applied it to the history of science. He proposed the following three–level scheme which is experienced by each living system from bacteria to a genius: 1. a problem – it arises when a mistake occurs, which means a violation of inherent expectations 2. Attempts at a solution — attempts to solve the problem, which can, for instance, be new scientific hypotheses. 3. Elimination — exclusion of unsuccessful solution attempts.

It is obvious that in the world of nature, elimination is cruel and relentless — an inappropriate attempt for solution often ends in death. Popper applies this process to science, which originated from the pre–scientific cognition as a development of the way how the human brain, which represents a development of animal cognition, cognizes.

Science is therefore a biological phenomenon for Popper. (Popper, 1997) In spite of the fact that science as a part of life is also "only" a solution of problems, it is unique in that it disposes of the critical method. Pre–scientific cognition of animals or the human is dogmatic — in case of prescientific solution of problems, it eliminates attempts at solution of environment. Science attempts at a critical approach and elimination of mistakes thus results from

itself. A scientist can ruin a hypothesis without his own death. Popper applied the level scheme for scientific cognition as follows: 1. an older problem, 2. attempts to create theories, 3. elimination attempts through a critical discussion and experiments, 4. new problems resulting from the critical discussion.

Science for Popper is dynamic and never anything ready; there is no point in which it would definitely find its objective. (Popper, 1997) Evolution of cognition is thus for Popper a result of a process resembling Darwinist natural selection and he calls it *natural selection of hypotheses. Our cognition comprises at each moment those hypotheses demonstrating their adequateness by their survival in the struggle for existence up to now; in a competitive struggle eliminating those hypotheses which are inadequate.* (Popper, 1972)

Recommended Literature

POPPER, K. R.: *Objective Knowledge. An Evolutionary Approach.* Oxford: Oxford University press, 1972.

CAPRA, F.: *The Web of Life: A New Scientific Understanding of Living Systems.*Anchor Books, New York 1996

10. Evolution of Language

Keywords: *language, evolutional psychology, hypothesis of gossip, hypothesis of social contract, Scheherazade's effect*

Language is usually considered as the only ability distinguishing the human from other living organisms. It is mainly due to the fact that language enables us to exchange information and thus to have an impact on the way of thinking of our surroundings. Language also played a significant role in the creation of culture. Tracing of the origin of human language is an important key to understanding of how we have become so unique. It is the language thanks to which we can communicate much more effectively than animals. (Diamond, 2004)

Advancement, the creation of culture, art, technology etc. was possible thanks to verbal language, which evolved differently than the speech of animals. Origin of the human speech has remained an impulsive and probably also irresolvable evolutionary issue since Darwin's time. How did the human overcome the abyss between themselves and animals? If we accept the generally spread hypothesis that we have evolved from animals, which lack the ability of human speech, then our speech had to be evolved with the human skull, pelvis, tools, etc. First, there had to be some transition phases of speech, connecting ape sounds and Shakespeare's sonnets. (Diamond, 2004)

Experience of scientists suggests that explanation of the origin of our speech has proved to be much more difficult than tracing the origin of the skull, pelvis or first tools (they all could be preserved, discovered, dated, but spoken word disappears instantly). The most elaborated animal language is used by African ape — *macaque*. Due to understandable reasons, a free–living macaque — like other species of animals is constantly forced to solve situations in which communication is necessary. Macaque has to distinguish a Martial Eagle (the biggest predator of Guenon) from White–backed Vulture, feeding from carcasses of animals and not representing a threat for a living Guenon. Obviously, when an eagle appears it is necessary to react correctly and notify the others. "When you do not recognise an eagle on time, you die, if you do not manage to tell your relatives, it is their end — and also an end of a part of your genes, and when you think you have noticed an eagle, while it was a vulture having flown above your head, you are losing time by a useless protection, while the other members of the group are gathering food." (Diamond, 2004, 143)

Communication and language are also related to the size of the social group of primates. As Dunbar (1996) points out, the number of members in a social group of primates is determined by several ecological, demographic and cognitive variables — Dunbar and Hill (2003) presumed 60 members of Australopithecus group, 80 members of Homo habilis group, 100 members of Homo erectus group and 150 members of a group of modern people. In present society of developed countries, this number (100 — 150) corresponds to approximately the number of people an individual can ask for a service and expect a positive response.

Observations of evolutionary psychologists suggest that free–living primates spend approximately 20 % of the time of day by mutual care about their fur — so–called grooming. If modern people dealt with such grooming in a group of 150 individuals it would take 43 % of their daily schedule. However, the human spends time in conversation, representing 20 % of the time of day, i.e. an equal share than non–human primates spend grooming. (Dunbar, 2010)

Several evolutionary psychologists argue that it suggests that language evolved as a means of further development of social

grooming. Our language enables grooming of more than one member of a group at a time, other activities can be carried out at the same time, and it enables an exchange of social information on events in our social network which took place during our absence. (Koukolík, 2006) One of the most interesting problems related to the examination of the origin of language is a question to what extent is language an inherited, and thus evolutionally given phenomenon. Several scientific theories provide answers. Authors persuaded about the fact that language was evolving gradually assume that this evolution took several thousands of years. Fully evolved language, according to estimates of several scientists, appeared already fifty thousand years ago, at a time close to the appearance of symbolic art.

The theory of inherited language basis is also confirmed by a research of deaf–mute children from Nicaragua, raised at home before 1970. Many of them created their own family sign language, a system of gestures through which children communicated. Older children were teaching the younger ones, and this language (NSL — Nicaraguan Sign Language) is currently spoken by approximately 800 people in the age ranging from 4 to 45. NSL development started by children dividing complex events into basic elements, and later creating more complex expressions. Younger children enriched this procedure and changed the sign language into a language system. (Koukolík, 2007)

If we consider the inheritance of language, we predominantly mean inherited basic features — language predispositions. These predispositions develop quite fast as a result of the impact of external environment — communication, and on the contrary — if children at the age of approximately 2 — 5 are not spoken to at all they will never learn to speak. It is confirmed by for instance Indian girls Kamala and Amala, who were found in a wolf's den, or a case of Laotian girl Mai, closed and isolated in a cage for several years, because a superstitious family was afraid that she was rabid. (more details can be found in e.g. Douglas Keith Candland: Feral Children and Clever Animals: Reflections on Human Nature, Oxford University Press, 1995).

The given examples imply a double conditionality of language competence acquisition — on one hand, language is a result of neurobiological predisposition of specific brain centres of the human, and on the other hand, it is a result of cultural impact of a human communicating community. Both conditions — specific nervous apparatus as well as early experience with the language practice are necessary preconditions of the language competence.

If language is a certain form of mutual remote care, maintaining a unity of big groups, the question why we need syntax remains unanswered; if it only concerned maintaining of a group together, non–verbal communication would be sufficient, as Barett, Lycett and Dunbar (2007) pointed out. There are three different hypotheses on the assumption that content of conversation can efficiently influence the unity of big social groups.

Hypothesis of gossip — according to Dunbar, the key factor of the unity of big groups was an exchange of information on present and future states of the given social network — gossip in the broadest meaning of the word (for more details see Dunbar, 1993, 1996)

Hypothesis of social contract — according to Deacon, language evolved in order to facilitate the coordination of social contracts (e.g. marriage); (for more details see Deacon, 1997)

Scheherazade's effect — according to Miller, language evolved by sexual selection in relation to searching for a partner. (for more detail see Miller, 2000).

There are still many questions emerging in relation to language and evolution. We do not know (and will probably never learn) what the first human words were and why they uttered them. This chapter only offered selected most popular hypotheses.

Recommended Literature

MILLER, G.: *The Mating Mind: How Sexual Choice Shaped the Evolution of Human Nature.* Anchor, 2001.

DOUGLAS, K.C.: *Feral Children and Clever Animals: Reflections on Human Nature.* Oxford University Press, 1995.

DUNBAR, R.: *Grooming, Gossip and the Evolution of Language.* Hardvard University Press, 1996.

11. Evolutionary Ontology

Keywords: *ontology, evolutionary ontology, creative and evolutionary ontology, Teilhard de Chardin, Henri Bergson, Josef Šmajs*

11.1 The Term *Ontology*

The following chapter will deal with evolutionary ontology. Etymologically, the term *ontology* originated from the Greek *on* (to be), respectively from the present participle *ontos* and the word *logos* (speech, science, discourse). The term *ontology* was introduced in philosophy by the German Protestant Scholastic Rudolf Göckel (Rudolphus Goclenius) in his *Lexicon Philosophicum* (1613), and was paralelly used with expressions *ontosophia* and *philosophia entis.* (Letz, 1993) Ontology is defined as a philosophical teaching on being. Aristotle and Scholastics still matched ontology to metaphysics, i.e. the first philosophy. At the time when ontology started to be slowly establishing as a separate philosophical discipline, it was closely connected to philosophical teaching on God, i.e. theodicy. Systematic defining of ontology in form of a science, i.e. in relation to the most general teachings on being, can be found in work of Christian Wolff (18th century) *Ontology*.

11.2 History of Evolutionary Ontology

As we mentioned in the chapter on understanding of evolution in history, the process of evolution was already anticipated by Ancient

philosophers in a certain way (Anaximander, Heraclitus, Democritus, Aristotle, Lucretius and others). Christian Middle Ages also heralded the issue of evolution (e.g. in the discourse of nominalism and realism). Ideas of evolutionary ontology were more explicitly profiling in the 18th century, though some records can also be found in the 17th century (e.g. Leibniz and his concept of the history of the Earth, explaining its creation by evolution, considering as probable that also species of animals were changing during their evolution). Goethe's basis in idealistic morphology in searching for animal prehistoric types got to the issue of evolution, probably suggesting a certain historical change in the sense of phylogenesis when he claims that organisms can be derived from prehistoric forms of life. These Goethe's ideas agreed with Herder, who considers animals as older brothers of humans in his work *Ideas upon Philosophy and the History of Mankind* (Herder, 1941). Evolutionary thinking also spread among materialists in the 18th century (e.g. J. O. de Lamettrie emphasizes a biological affinity of humans and animals, mainly with apes; P. H. D. Holbach supported the idea that living organisms are able to change in their evolution; D. Diderot, Montesquieu, etc.).

All the given philosophers (including many others like H. Spencer, C. Bernard, A. A. Cournot, etc.) heralded the presence of evolution in reality; however we cannot say that they elaborated an integrated concept of evolutionary ontology. That took place not sooner than in the 20th century with the appearance of *great* system concepts of H. Bergson and P. T. de Chardin. These will be dealt with in more detail later; therefore, the historical overview will more closely examine their followers. A follower of both philosophers was E. Le Roy. *"Le Roy recognises the internal aspect of evolution (approaching Bergson) as an ascending flow of reality as well as the external aspect of evolution (approaching P. Teilhard de Chardin) as a process taking place in cosmos and particularly in the biosphere."* (Letz, 1993)

Le Roy's objective was to unify both aspects of evolution, while he discovered the *global law of evolution*, according to which

evolution is a continuous, ascendant and orthotropic motion towards fuller and fuller being. The motive force of evolution according to Le Roy is Bergson's élan vital, concentrating spirituality. A follower and continuator of the ontology by Bergson, Le Roy and Teilhard was also M. Barthélemy — Madaule, who assumes that the biggest impact of the given concepts is in the fact that they managed to maintain the basic status of being. The concept of participation of becoming in being did not make these philosophers' being disappear in a pure processuality, as it did with, for instance, Whitehead.

Teilhard's primary followers were C. Tresmontant, A. Gosztonyi and G. Straniero. Tresmontant positions himself strictly against each ontology not assuming a creation of a being in a direct creation. According to him, revelation is a continuation of creation, thanks to which evolution can continue in the human and reach its completion.

The best known representative of the process philosophy, which shares some common characteristics with evolutionary ontology (it understands being as dynamic), A. N. Whitehead, states that *"nature is a process."* (Whitehead, 1964, 274) Manifestation of the process in nature according to him is the fact that each duration (Whitehead uses Bergson's term duratio) exists, it is happening and will end. The process of nature can also be called the *passage of nature*, as Whitehead uses it. Whitehead's passage of nature is immeasurable. It interconnects nature and primary metaphysical reality. According to Whitehead, each current being can only be understood in terms of the process, becoming and finiteness. Whitehead can be considered as one of a few philosophers who pointed out not only the meaning of creation but also the meaning of extinction. *"Philosophers paid insufficient attention to the term of extinction. The term of extinction appears as a sort of offense."* (Whitehead, 1970, 40) Reality for Whitehead is a stage of forces where everything affects everything. The basis of his ontology is *creativity*, which he also calls *causa sui,* i.e. basis and cause of the

existence of everything. Everything in reality is materialised due to creativity. Whitehaed's concept reminds Bergson's concept of élan vital, where dynamic creativity is also constantly present.

Critical ontology of N. Hartmann is more–less stationary in its character, and shares a few common features with evolutionary ontology. Hartmann pointed out a lack of sense in natural science of the dynamic dimension of reality. Hartmann's grasping of ontology approaches grasping of processual philosophy in the emphasis on ontological meaning of time and changeability.

11.3 Characteristics of Evolutionary Ontology

1. Evolutionary ontology understands the world in evolutional dynamics, following the philosophical tradition of Heraclitus
2. Subject of evolutionary ontology is not only abstract being but also nature and dependent culture
3. Evolutionary ontology is currently immediately reflecting the issue of global ecological crisis. *"...ontology cannot only concern the traditional question of what being is anymore but also a much more complicated problem regarding what being is created in the cultural evolutionary process, to what being we, the humans, can adapt as living beings, and what being we need in order to live in it in correspondence with our own conservative human nature."* (Šmajs, Krob, 2003, 112)
4. *Recording of principled dependence of culture on nature leads evolutionary ontology to acceptance of philosophically deepened responsibility for the fate of humans.* Evolutionary ontology is currently not only trying to explain the structure of the world but, in an effort to prevent ecological catastrophes, it is trying to create an ontological minimum which would help initiate a change of cultural strategy and support philosophically deepened ethics, axiology and politics. (Šmajs, 2013, 19)
5. Evolutionary ontology cannot follow traditional ontologies, considering the world as fixedly given forever.
6. *Evolutionary ontology represents a philosophical basis for constitution of other fundamental philosophical disciplines (also philosophy as a whole) comprehended as evolutional.* It thus represents a philosophical basis for evolutionary gnoseology, evolutionary anthropology, evolutionary cosmology, evolutionary ethics, evolutionary axiology, etc.
7. Evolutionary ontology defines the human materially, and aims at being non–anthropocentric (Šmajs, 2013)

The given characteristics predominantly result from the concept of the contemporary Czech author Josef Šmajs; they are only partially or implicitly present in individual systems of other evolutionary ontologists.

Contemporary evolutionary ontology mainly results from efforts to provide environmental ethics with ontological basis, while its objective is to consider the basis of ontology from evolutionary perspective. Needless to say, it has higher ambition than to supplement traditional philosophical framework of ontology with a natural scientific experience of evolution. "Evolutionisation" of ontology comprises establishment of new ontology on evolutionary and biological grounds. As Peter Sýkora suggests, it means to consider the phenomenon of evolution not only as one of many pieces of the overall mosaic of reality but to comprehend evolution as a fundamental feature of this whole mosaic. (Sýkora, 2005)

One of the crucial subjects of evolutionary ontology at present is the analysis of ontic conflict between culture and nature (outlined in Chapter 6) with philosophical consequences for ethics and axiology. Ontology in evolutionary ontology is on one hand comprehended traditionally as the highest level of philosophical abstraction, examining the whole of a reality, contrary to special sciences only examining individual spheres of reality. On the other hand, ontology is grasped by authors of evolutionary ontology as the only intellectual means able to reflect adequately the central ontological problem of present times — the mentioned conflict between cultural and natural beings. (Sýkora, 2005)

The sphere of examining of contemporary evolutionary ontology also includes the sphere which was not included in traditional ontological examination — sociocultural being. When evolutionary ontology examines sociocultural being, it actually examines culture, respectively a summary of human activities and their products.

The following part of the chapter on evolutionary ontology will present selected types of evolutionary ontology — ontology of P. Teilhard de Chardin, H. Bergson and J. Šmajs.

11.4 Creative and Evolutionary Ontology of P. Teilhard de Chardin

Pierre Teilhard de Chardin's original thinking suggested the concept of creative and evolutionary ontology. It considers space as internally unified in spite of its plurality and heterogeneity. This unity and consistency are constantly reflected in evolution, which Teilhard de Chardin considers as the key attribute of space. His concept of evolutionary ontology can be presented through the following characteristics:

a) Space as a whole and each of its spheres is a subject of evolution, if it changes, while not each change can be considered as an evolutionary process. He assumed that importance of the problem of creation does not lie in the original (involutional) phase but in the present phase (evolutionary). (Teihard de Chardin, 1961)

Teilhard admits that a hundred years ago, evolution could be considered as a "local hypothesis" which was necessary to answer questions on the origin of species. However, since then, *"...evolution has flooded and dominated all our experience. Primary Darwinism and transformism have only become historical terms. We can see nowadays that nothing in the nature — from the most imperceptible and non–persistent core elements to the most evolved living creatures — is conceivable from the scientific viewpoint in a way other than as a part of a single huge process of corpusculisation and complexification in which what we call mass (although we do not know what it is) passes through phases of gradual and irreversible interiorisation (realisation)."* (Teilhard de Chardin, 1997)

b) Changes in space are carried out in a certain spatial and time framework; we are thus witnesses of the history of evolutionary process comprising phases corresponding to certain levels of development. What is the origin of multiplicity of the most various species? Biological revolution caused by the occurrence of humans can be explained by a certain explosion of consciousness; and this explosion can be explained by the fact that one privileged direction, 'corpusculisation' — one zoological phylum — has crossed so far impermeable boundary separating the sphere of direct psychology from reflected psychology. (Teilhard de Chardin, 1997)

The mankind was evolving as a species similarly to any other zoological phylum. However, it manifests four features different from other species:

— extraordinarily intense expanding
— fast differentiation
— remarkable preservation of germinative ability
— ability of connection between branches of the same bond.

c) Changes in space lead to superior forms, characterised by increased elaborateness, complexity and corresponding level of consciousness. A wave of complexity and consciousness passed through the phylum of anthropoids into the sphere of reflexion during humanisation. This wave was completely new in space.

It started to spread through psychically convergent environment and manifest a significant tendency towards mutual approximation. According to Teilhard, the basic trait of expanded mass is reflected in socialisation. Human socialisation proceeded at full and on the whole Earth. This homogeneous cover interlaced by various bonds represents a sphere which Teilhard calls *noosphere,* i.e. the sphere of thinking. Etymologically, the meaning of the word noosphere is derived from the Greek *nous*, meaning *reason, mind, and soul* and word *sphaire*, denoting a certain sphere, environment.

It thus concerns the sphere of human reason, thinking, sphere created by individuals, societies, nations, races or various cultures. (Teilhard de Chardin, 1993)

According to Teilhard, noosphere is created due to three key traits of the mankind: reflexion (the ability of thinking and self–awareness), creative invention (ingenuity) and the ability of "conspiration" (meant as co–thinking, co–reflexion).

d) Creative evolutionary process has a convergent character. The human is a core of spiral winding and convergence. Cosmic substance, die Weltstoff, respectively proto–energy is a unifying ontological basis. According to Teilhard, space has neither material nor spiritual character; its basis is proto–energy. With regard to comprehension of proto–energy, Teilhard adopts an understanding different from monistic or dualistic theories. Die Weltstoff is the most proper content of the existence of space; its forms include mass and spirit. Ontological basis of cosmos thus is neither mass (like in materialism) nor spirit (like in spiritualism), but original energy.

If the mankind is to reach its final objective, two types of conditions, external and internal, have to be fulfilled.

External conditions according to Teilhard are mainly reserves (of time, mineral raw materials, food, people) necessary for life on the Earth not to finish. *Internal conditions* according to Teilhard are related to human freedom. The mankind has to *"want to maintain endurance and not be discouraged by boredom, weak mind or fear."* (Teilhard de Chardin, 1993)

Teilhard himself was not too worried about fulfilment of the first, external conditions. Much bigger risks were seen in relation to the appearance of *reflected freedom*. On one hand, reflected freedom is necessary for life to flourish, however, on the other hand, it is also a dangerous source of emancipation without any order. (Teilhard de Chardin, 1993)

Teilhard sees the risk of planetary evolution of consciousness reaching its objective also in what he himself calls "internal

polarization", i.e. desire to live, reasons to live, desire for improvement. If the mankind loses "internal polarization", according to Teilhard, it will also lose the ability to advance and develop, it will "disappear". Therefore, the mankind needs to be interested in the motion forcing it forward.

e) The final objective of evolution is Omega Point. If current astronomy counts with the existence of an initial "prehistoric atom", Teilhard puts the hypothesis of a *universal focus*, Omega Point, which is a *focus of psychical internalisation*, in place of the hypothesis of physical primary "atom". Omega Point is a point which the earth's noosphere, focused by getting complex, should reach within several million years. Omega Point according to Teilhard is beyond the boundaries of experience, and if we are to reach it, time and space need to be left. In spite of the fact that this point is transcendental, it has certain particular and formulable qualities. *Reality* is another of its qualities. Omega Point is real but, as Teilhard assumes, from the evolutional viewpoint, it only shows us a half of itself. As the last member of the line, it is also located off it. Omega thus has four attributes: reality, irreversibility, separateness and transcendence. (Teilhard de Chardin, 1993)

In his concept, Teilhard reached three universal laws: law of complexity and consciousness, law of tangential and radial energy and law of convergence. The first law deals with a gradual evolutional growth of organic complexity and proportionally, psychical internalisation or spiritualisation. Validity of the law of complexity and consciousness is universal; we can record it from initial moments of the existence of cosmic energy effects through evolution of individual phyla to the last centre of evolution, Omega Point.

The second law expresses connection between tangential and radial energies. Tangential energy corresponds to material effects of reality in space and radial one to psychical and spiritual effects of the reality of space. "Tangential energy approximates the given element to all other elements of the same class (i.e. the same complexity and 'centrality') in space and radial energy approximates it

to still more complex and centralised state, forwards." (Teilhard de Chardin, 1990)

The most important for evolution in space is the activity of radial energy, leading to complexification and centrification of psychical and spiritual energies. The third law says that from spiritual aspect, everything converges to a single point where everything binds, from which all consistency and unity originates, everything converges around the Omega Point.

Teilhard's concept had an impact on several evolutionally oriented ontologists — C. Tresmontant, G. Straniero, A. Aliotta, A. Gosztonyi. This creative and evolutionary concept also found its followers in Slovakia (e.g. J. Letz, Z. Plašienková). (Letz, 1993)

11.5 Evolutionism of H. Bergson

One of the first philosophers who dealt with evolution in the philosophical context was Henri Bergson. Bergson's thinking was at first significantly inspired and influenced by H. Spencer, who basically introduced the term of evolution in philosophy. Bergson comprehends evolution neither from the viewpoint of finalism nor mechanism. He puts creativity, vitality and dynamics against mechanism and static nature. Nature has its order, however it is not a fixed and automatic arrangement, it has a meaning, however not in the sense of plan and objective defined in advance. It is a creative, free order. (Bergson, 1970) Bergson criticises radical finalism as well as radical mechanicism, since as he states, neither the first nor the latter wants to see any unforeseeable creation in the cycle of life evolution; mechanicism only sees in reality the aspect of similarity or repetition and is controlled by the law stating that there is only the same, reproducing the same in nature. (Bergson, 1919)

Teaching of finalism means that everything in nature, including the nature itself, follows a permanently determined programme. It is assumed that everything is given in advance. Bergson refuses such radical finalism. He distinguishes *internal* and *external*, respectively *immanent* and *transcendental* finality. Due to external finality, living beings are mutually arranged for each other (a plant was created for a cow, a lamb was created for a wolf, etc.). Internal finality on the contrary means that each being is created for itself, all its components agree for the greatest benefit of the whole and organise themselves with understanding for this aim. (Bergson, 1919)

Bergson argues that organism comprises tissues, while each of them works autonomously. Cells, which are a basis of tissues, also have their independence. For instance phagocytes are independent to such an extent that they attack the organism that nourishes them. According to Bergson, life is neither following of a programme determined in advance nor gathering of random adaptations, even though he does not deny their presence in nature. Individual adaptations thus represent not only acceptance of a form as a result of external influence but a solution of a problem. (Markoš, 2003)

For Bergson, evolution is a characteristic feature of life which includes actual setting of the past by the presence, duration which is a linking line. (Bergson, 1919) In order to understand Bergson's ideas, it is important to point out that he does not understand life in which evolution is constantly present as an abstraction. Bergson criticised thinking based on abstraction in general. In this criticism of abstract ideas, he follows Berkeley, who suggests in A Treatise Concerning the Principles of Human Knowledge that nothing like an abstract idea exists. We cannot imagine a triangle in general; it will always be a precise and particular triangle. Bergson's criticism of abstract ideas only differs from Berkeley's criticism terminologically.

Bergson understands life as a *flow, fluency, continuity*. Life is a development of *aggrandizement* from its inception. Having discussed Teilhard's concept, we mentioned that he understands evolution as a convergent development. It is the opposite with Bergson. *"...evolution we discuss never takes place in the sense of gathering but dissociation, never in the sense of concurrence but parallelity of forces."* (Bergson, 1919)

According to Bergson, evolution does not represent a simple notion easy to determine a direction to (life would have to circumscribe a line similar to the one circumscribed by a cannon ball fired from a cannon). However, we rather reckon with a grenade exploded into particles which were further exploding into particles, those were again exploding, etc. for a very long time. According to Bergson, two factors had a big role in fragmentation of the original aggrandizement into species and individuals: resistance to life by dead matter and explosive power borne by life. This originates from an unstable balance of efforts. Life first had to circumvent the obstacle of dead matter. *"It seems that life managed with humility itself, by cringing very much and jinking with physical and chemical forces, and even agreed to go with them along a part of the way, like a railway turnout, for a few moments, he accepts the direction of rails from which he wants to divert."* (Bergson, 1919) Bergson pictured the matter as a mass of protoplasmic jelly like with amoeba; it can be variously deformed and is therefore vaguely conscious. (Bergson, 1970) The matter had two choices: a way of motion and activity, or a way of passive acceptance, thus attenuation. Where life pulled the dead matter down by impelling and motion the first occurred forms were revived, though they were still very simple. According to Bergson, it most probably concerned clusters of protoplasm which can be compared to amoebas in terms of appearance. According to him, these first protoplasms were full of internal impelling which was to elevate them to the highest forms of life.

However, impelling forced the first organisms to grow in the greatest possible extent; the matter thus rather started splitting than outgrowing a certain point. Life forced a great number of elements, which originally wanted to split, to merge. But actual reasons of splitting were borne by life itself. *"Because life is an effort (tendency), and the essence of a tendency is to develop like a sheaf, and thus create unparallel directions, on which its zeal will be divided, only by the fact of its growth."* (Bergson, 1919) Life, original aggrandizement, is a deep reason for evolutional variations, which, according to Bergson, is a logical result of its constant need of creation. Obviously, aggrandizement can be fully creative, as it finds an uncreative static matter, i.e. an opposite tendency. But when it takes control of it, it establishes as much freedom and variation as possible.

When the original aggrandizement splits, three qualities were created from it: torpeur, intelligence, instinct. *Torpeur* is translated as stiffness, hartlessness, obtundity, lassitude, malaise, total passivity. Webster's dictionary translates torpeur as an apathy, dulness, lethargy. The Czech, Laichter's edition of Creative Evolution uses torpeur as *tupost*. We will use this translation, although lethargy or dullness may be semantically closer.

These qualities are present in a different relation in four evolutional parts (original unity, flora, fauna, mankind) — instinct is the closest to original unity. Flora originated from a flow of vital force which abandoned in torpeur — it is alive but as if not enough. Flows enriched by one of the two remaining qualities prevailed with fauna, and a flow enriched by intellect worked with the human. (Markoš, 2003)

According to Bergson, flora is thus closest to torpeur, lethargy. Plants do not evolve in a conscious activity, they are unconscious. Bergson likes the parallel between movability and consciousness; a plant is therefore definitely less conscious than an animal. For Bergson, consciousness represents a cause as well as an effect. A cause when its task is to manage movement from a place to another, an effect in the meaning that it is a movement which maintains consciousness and as soon as this activity disappears, consciousness shrinks.

However, we should be careful about generalisations, which Bergson resolutely refuses. We cannot say that each plant is unconscious and each animal is conscious. If consciousness shrinks in an animal degenerated to a passive and not moving parasite, it cannot be described as conscious. On the other hand, if consciousness occurs with a plant after it acquired movement, we cannot say that it is still unconscious.

According to Bergson, there were two unparallel evolutions: animals evolved towards free exertion of discontinuous energy, plants rather enhanced its evolution in place. At first, plants also had to be borne by the same original expansion which also actuated animals. That is what Bergson also applies to the tendency of plants to advance towards growing complexity. The tendency, i.e. tension, actuation is characteristic of fauna, however plants left to *lethargy* also represent the same tendency according to Bergson, as they accepted the same impulse at the beginning. Plants are therefore able to vary in various ways as soon as a period of "mutation" starts, while animals have to vary in much more definite ways. Evolution of fauna took place in two lines, one of which lead towards instinct, the other one towards intellect. *"The basic mistake inherited from the time of Aristotle, which has spoilt most of natural philosophies is that we perceive three gradual levels of the same developing tendency in the life of flora, in instinctive life and reasonable life, however they are three unparallel directions and activities which split as they were developing."* (Bergson, 1919) Bergson sees the difference between them neither in intensity nor a level but in their essence. They are not activities of which one is greater than the other; they are not the issues of the same order, they did not follow one another, they cannot be attributed a chronological order.

For Bergson, the human is a boundary and an objective of evolution in a sense, however without a plan or project. Saying that, Bergson does not mean that nature was modified according to the human, that everything was adapted to the evolution of human. The human is struggling in evolution in the same extent as other species; if the original enthusiasm had been distributed differently, the mankind would be physically as well as mentally different from what it has become. It would, therefore, be a mistake, according to Bergson, to consider the mankind as pre–created in evolution, nor does he claim that the whole evolution results in the mankind. Evolution took place in several unparallel lines, and the

fact that the human is at the end of one of them means that other species at the ends of others were overrun. Only in this sense does Bergson consider the human as raison d' etre of evolution. When life appeared as a huge wave spreading from a centre, the obstacle was removed only at one point, and the impulse came freely only in one direction. Bergson attributes freedom to the human form. Consciousness was driven into an impasse everywhere but with the human; it further observed its way only with the human. (Bergson, 1919) Everything was taking place as if the human was trying to self–fulfil himself by giving up some of its elements in the evolution. The fact, whether a mass or spirit, is a constant happening; it is never something finished. If we only use intellect in a discourse on the nature of reality we only perceive what is finished and fixed. We lose the ability to see evolution, radical happening. Bergson reproaches static ontological concepts for defining the timeless being in a mathematical or logical character. According to him, that intrudes on us only a static comprehension of reality. The main characteristic feature of Bergson's comprehension of being thus is that being endures, it is happening, it is dynamic and creative. Bergson's ontology was followed (later critically) by Edouard Le Roy, M. Barthélemy–Madaule, J. CH. Smuts and others. (Letz, 1993)

11.6 Šmajs's Concept of Evolutionary Ontology

The Czech philosopher Jozef Šmajs criticises past ontologies for excessive anthropocentrism, and that attention focused on the human was not accompanied by an adequate interest in other living systems and care about the ecosystem. Ontology as well as ethics, politics, etc. transform and are looking for a different guarantee than common evolutionary inheritance not sooner than after the beginning of ecological crisis. According to him, philosophy cannot *"...be silent about the fact that only the humans are responsible for what we started for our own benefit at some time and what nowadays exceeds average human possibilities of understanding and*

intended remedy — for elemental evolution of anti–natural culture. The role of the key motive for philosophizing, which was astonishment in Ancient times, humility in Middle Ages and doubt in modern times has been for the first time replaced by the feeling of anxiety, responsibility and guilt." (Šmajs, 2006)

Šmajs states that philosophy has not acquired in its history (probably meant as ontological systems occurred until the first half of the 20th century) an experience in ecological issues. Unfortunately, it is impossible to disagree with this statement. Taking a detailed look at the history of philosophy, we find evolutionary process ontologies, however without thematising of ecological crisis. Therefore, Šmajs warns philosophy that if it trivializes the ecocrisis it can happen that it will only be a particular sociocultural science without an impact on the destiny of culture. He therefore puts emphasis on *responsibility* for the destiny of our culture in his philosophical system. He leaves the anthropological viewpoint and places the human in nature.

Šmajs's evolutionary ontology points out that already first cultures were alien subsystems in nature and gradual economic, technological and cultural integration of individual cultures in the global civilisation will not exist forever, since global culture cannot grow extensively. Balance with earthly conditions has to be maintained. Šmajs manifests in his ontology that the truth needs to be searched for in reality itself. According to him, the time of big anthropocentric ontologies is over. (Šmajs, 2006) In the interpretation of reality, its plurality and diversity should not be forgotten.

Ontology should have a basis not only in the history of philosophy but also in the results of special sciences. Šmajs tries to elaborate on it in order for it to be acceptable not only for science but also for the laic public. The essence and function of his evolutionary ontology in relation to nature and the human can be expressed by the following characteristics:

Evolutionary ontology cannot follow the traditional (mostly stationary) ontology. The latter is grounded on the anthropocentric approach, resolutely refused by Šmajs. Even if the traditional ontology acknowledges a change it prefers stability and structure in it. It misses the emphasis on evolution, spontaneous ontic creativity, creation and extinction.

Šmajs's evolutionary ontology tries to be *non–anthroponcentric* and not to prefer the human to reality, nature. It examines not only the approach of the human to the world but mainly the approach of the world to us, how nature created us, how it includes us, predetermines, restricts us. According to Šmajs, traditional anthropocentric ontologies, however they try to overcome the focus of the human on himself, consider the surrounding world as the world of humans for humans. (Šmajs, 2006) In such ontologies, the human misses humility and natural respect for nature, greatness and power of space.

His evolutionary ontology defines the human *materially* and without the value feature. We sympathize with the fact that Šmajs does not make the human a master of space, however we rather prefer, for instance, Teilhard's concept, in which the human is thematized materially but is attributed a unique ontological status.

In his ontology, Šmajs creates a new ontological statute of nature. Nature is introduced as a self–organising system with natural internal information, as an ontologically dependent evolutionary process, spontaneously creating all natural preconditions of culture. He tries to "retrieve" nature ontologically. The human belongs in it and is evolutionally adapted to it.

He tries to create an ontological statute of culture. He unifies material and spiritual cultures in a single system with constitutive information in form of spiritual culture. He contradicts tradition, which considered culture as an artificial and learnt behaviour of people whose result is cultivation of nature. On the contrary, Šmajs points out that culture is in opposition to nature, it is expansive and aggressive. *"Culture — due to different constitutive information — is an anti–natural subsystem of the biosphere, which seemingly enhances nature locally, but actually, as it has appeared in full*

extent nowadays, it has been reducing, damaging and suppressing it since the beginning." (Šmajs, 2006)

In his concept, Šmajs recognises two ontic orders — original, older, i.e. spatial order, and derived, younger, partial order, which is artificial, thus revealing a separate creative ability of anti–natural system of culture. As we have mentioned, he thematizes the issue of *information* — natural and cultural.

Realisation of dependence of culture on nature should encourage evolutionary ontology (and philosophy as such) to accept an adequate philosophical responsibility for advancement and destiny of our culture. It should initiate a radical change of cultural strategy (education as well as learning). (more on the issue of evolutionary ontology can be found in ŠMAJS, J.: *Evoluční ontologie kultury a problém podnikání,* Brno: Doplněk, 2013, p. 1–21)

The basic categories of Šmajs's ontology include: activity, evolution, order, orderliness, memory, system and information. (Šmajs, 2013)

To conclude the interpretation of Šmajs's evolutionary ontology, we must add that according to him, ontology is losing its traditional academic meaning nowadays, while acquiring a more important, practical meaning — cultural and self–preserving. That radically changes the mission of philosophy. *"A part of theoretical philosophy is becoming a 'practical' philosophy; traditional speculative ontology of being is becoming a theoretical analysis of ecologically endangered culture — a precondition of reality of global ecological policy."* (Šmajs, 2006)

Recommended Literature

BARASH, D.: *Sociobiology: The whisperings within.* London: Fontana, 1981.

LUMSDEN, CH.J., WILSON, E.O.: *Genes, Mind and Culture. The Coevolutionary Process.* Cambridge: Hardvard University Press, 1981.

TEILHARD de CHARDIN, P.: *Genése d'une pensée.* Paríž: Bernard Grasset Éditeur, 1961.

12. Conclusion

We have come to an end of the textbook on the philosophy of evolution. The reader had a chance to become familiarised with basic terms related to the phenomenon of evolution (Can you still remember what *microevolution* is? Or what *memes* are?), they further learnt about the formation of evolutionary ideas from Ancient times until now (What is the *Theory of Intelligent Design*? What are differences between Lamarckism and Darwinism?). We outlined the key problems in evolutionary ontology and gnoseology (Can you remember the theory of autopoiesis? Who were Teilhard de Chardin and Henri Bergson? What are key characteristics of evolutionary ontology according to Josef Šmajs?). We briefly dealt with information, evolution of language and Darwinist opposition. A greater room was left for the meme theory (with regard to great popularity of this theory in current scientific and philosophical discourse). Of course, the number of topics related to evolutionary activity has not been exhausted. The reader has not learnt anything about the brain evolution, inter–species examinations, time factor in evolution and a number of other interesting issues, which would exceed not only the extent of the textbook but also the field of the philosophy of evolution.

We assume that the task of philosophy of evolution is mainly to point out constantly an alarming situation of self–destructive activity of the mankind. An increasing number of people on the Earth and more and more enhanced technologies damage biodiversity (variety of the kinds of life), many species have already

been extinct, and others are endangered, which will not be without consequences according to ecologists. David Tilman (current prominent American ecologist) and his team at the University of Minnesota carried out an interesting experiment. They selected 147 squares in the local prairie with dimensions 3 x 3 m, and with similar soil composition. Subsequently, according to the table of random numbers, they sowed 1, 2, 4, 6, 8, 12 and 24 kinds of local plants in the squares, and the result was distinct — the more variable in kinds, the more fertile the field was and the better it economized nitrogen. (Koukolík, 1997)

Of course, there are also people who disparage the aforementioned statements and oppose that kinds of life have always been becoming distinct, and we do not know how many of them actually exist on the Earth, therefore, we cannot estimate what the ratio between the number of disappearing and existing species is. The readers themselves create a picture of the appropriateness of arguments of both; we support the opinion that current philosophy of evolution, evolutionary ontology as well as gnoseology should point out the present ecological crisis and thematize it in their examinations. Culture primarily will benefit from it, as it mocks this crisis itself, thus digging its own grave.

At present (at the end of 2012), the Earth has 6.9 billion people, and this number is constantly increasing. As a consequence, energy consumption increases and, as the economist and expert on population policy Paul Demeny summarized — soil erosion, desert expansion, water intoxication, ocean pollution, loss of various living species, exhaustion of oil and mineral resources reserves, soil carrying in rivers, outgrowing of arable land by human dwellings, decrease of underground water surface, decreasing area of untouched nature, global warming, acid rain, radioactive wastes. (Demeny, 1991) What are our possibilities to do anything about it? In democratic political systems, one of ways is to vote for politicians offering not only an ecological programme but also a guarantee of its observation. As Koukolík states, there is little time, and experience from the past should be a clear warning (e.g. extinction of Mayan civilisation, which probably took place for two reasons — relationships within human groups and change of environment, which is independent of relationships). (Koukolík, 1997)

References

BALDWIN, J. M.: *A new factor in evolution.* In: American naturalist, č. 30, 1896, s. 441–451, 536–553.

BARASH, D.: *Sociobiology: The whisperings within.* London: Fontana, 1981.

BARRETT L., DUNBAR R., LYCETT, J.: *Evoluční psychologie člověka.* Praha: Portál, 2007.

BEER, C., IMMELMANN, K.: *A Dictionary of Ethology.* Cambridge: Harvard University Press, 1992.

BEHE, M.J.: *Darwinova černá skřínka.* Praha: Návrat domú, 2001.

BERGSON, H.: *Myšlení a pohyb.* Praha: Mladá Fronta, 2003.

BERGSON, H.: *Vývoj tvorivý.* Praha: Vydavatelství Jana Laichtera, 1919.

BLACKMOREOVÁ, S.: *Teorie memů.* Praha: Portál, 1999.

CAPRA, F.: The Web of Life: A New Scientific Understanding of Living Systems.Anchor Books, New York 1996.

CAPRA, F.: *Tkáň života : Nová sysntéza mysli a hmoty.* Praha : Academia, 2004.

CLAYTON, P.: *Science and Theology News.* Roč. 6, č. 7, 2006, s. 21–22.

DARWIN, CH.: *On the Origin of Species by Means of Natural Selection.* London: Murray, 1967.

DAWKINS, R.: *Předmluva Richarda Dawkinse.* In: BLACKMOREOVÁ, S.: *Teorie memů.* Praha: Portál, 1999, s. 9–19.

DAWKINS, R.: *The Selfish Gene.* New York: Oxford University Press Inc., 2006.

DEACON, T.W.: *The Symbolic Species: The Co–Evolution of Language and the Brain.* Norton, 1997.

DEMENY, P.: *Population.* In:B. L. Turner, et al. (eds.), *The Earth as Transformed by Human Action.* New York: Cambridge University Press, 1991.

DÉMUTH, A.: *Teórie percepcie.* Trnava: FFTU, 2013.

DENNETT, D. C.: *Darwin's Dangerous Idea.* London: Allen Lane The Penguin Press, 1995.

DENNETT, D. C.: *Freedom Evolves.* London: Allen Lane The Penguin Press, 2003.

DIAMOND, J.: *Třetí šimpanz.* Praha: Paseka, 2004.

DOUGLAS, K.C.: *Feral Children and Clever Animals: Reflections on Human Nature.* Oxford University Press, 1995.

DUNBAR, R.: *Grooming, Gossip and the Evolution of Language.* Hardvard University Press, 1996.

EIBL–EIBESFELDT, I.: *Liebe und Hass: Zur Naturgeschichte elementarer Verhaltensweisen.* Zurich: Pipen, 1991.

ERDELSKÁ, O.: *Inteligentný zámer (design).*
http://www.uski.sk/frames_files/ran/2006/ran–2006–2–04.htm

FLEGR, J.: *Evoluční biologie.* Praha: Academia, 2005.

GOULD. S. J.: *Ever since Darwin.* New York: W. W. Norton & Company, 1977.

GOULD, S. J.: *Pandin palec.* Praha: Mladá fronta, 1988.

FUKUYAMA, F. : *Veľký rozvrat.* Bratislava: Vydavateľstvo Agora s. r. o., 2000.

HERDER, J.G.: *Vývoj lidskosti.* Praha: Jan Laichter, 1941.

KOUKOLÍK, F.: *Mravenec a vesmír.* Praha: Vyšehrad, 1997.

KOUKOLÍK, F.: *Proč se Dostojevskij mýlil.* Praha: Galén, 2007.

KRATOCHVÍL, Z.: *Filosofie živé přírody.* Praha: Herrman a synové, 1994.

KROB,J., ŠMAJS, J.: *Úvod do ontologie.* Brno: Masarykova univerzita, fakulta filozofická, 1991.

LETZ, J.: *Metafyzika a ontológia.* Bratislava: ÚSKI, 1993.

LUMSDEN, CH.J., WILSON, E.O.: *Genes, Mind and Culture. The Coevolutionary Process.* Cambridge: Hardvard University Press, 1981.

MARGULISOVÁ, L.: *Symbiotická planeta.* Praha: Academia, 2004.

MARKOŠ, A.: *Přírodní zákony a evoluce.* In: *Filosofie Henri Bergsona.* Praha: OIKOYMENH, 2003.

MATURANA, H.: *Autopiesis, Structural Coupling and Cognition* (online).
Dostupný z www.<http://www.isss.org/maturana.htm>.

MAYR, E.: *Čo je to evolúcia.* Bratislava: Kalligram, 2004.

MENDEL, G.: *Pokusy s rostlinnými hybridy.* In: OREL, V.Gregor Mendel, zakladatel genetiky. Brno: Blok, 1965.

MILLER, G.: *The Mating Mind: How Sexual Choice Shaped the Evolution of Human Nature.* Anchor, 2001.

MORELAND, J.P, REYNOLDS,J.M.: *Třikrát evoluce versus stvoření.* Praha: Návrat domů, 2004.

PATOČKA, J.: *Aristoteles a jeho předchudci a dědicové.* Praha: Nakladatelství ČSAV, 1964.

PLAŠIENKOVÁ, Z., KULISZ, J.: *Na ceste s Teilhardom de Chardin.* Trnava: Dobrá kniha, 2004.

POPPER, K. R., ECCLES, J. C.: *The self and Its Brain.* New York: Springer — Verlag New York Inc., 1977.

POPPER, K. R.: *Objective knowledge. An Evolutionary Approach.* Oxford: Oxford University press, 1972.

POPPER, K. R. *Život je řešení problémů. – O poznání, dějinách a politice.* Praha: Mladá fronta, 1997.

ROLSTONE, H.: *Science and religion. A critical survey. III.* Philadelphia and London: Templaton Foundation Press, 2006.
SLAVKOVSKÝ, A.: *Informácia v kontexte filozofie a kognitívnych vied.* 2013.
SOUKUP, M.: *Kultura. Biokulturologická perspektiva.* Pavel Mervart, 2011.
SÝKORA, P.: *Alchýmia života.* Bratislava: Smena, 1989.
SÝKORA, P.: *Evolučná ontológia: Gigantomachia peri tés úsias.* In: „K otázkam dalšího rozvoje evoluční ontologie." Masarykova universita, Brno, 2004.
SÝKORA, P.: *Evolučná ontológia a biometafyzika: prieniky a rozdiely.* In: J. Krob a E. Višňovský (eds.). Človek–príroda–kultúra. Masarykova universita, Brno, 2005.
ŠMAJS, J., KROB, J: Evoluční ontologie. Brno: Masarykova univerzita, 2003.
ŠMAJS, J.: *Drama evoluce.* Praha: Nakladatelství Hynek, 2000.
ŠMAJS, J.: *Ohrozená kultúra.* Banská Bystrica: PRO Banská Bystrica, 2006.
ŠMAJS, J.: *Příroda a kultura.* Praha: Nakladatelství Svoboda, 1990.
SMAJS, J.: *Evoluční ontologie kultury a problém podnikání,* Brno: Doplněk, 2013.
SMAJS, J.: *Potřebujeme filosofii přežití?* Brno: Doplněk, 2008.
TEILHARD de CHARDIN, P.: *Genése d'une pensée.* Paríž: Bernard Grasset Éditeur, 1961.
TEILHARD de CHARDIN, P.: *Jak věřím.* Praha: Vyšehrad, 1997.
TEILHARD de CHARDIN, P.: *Místo člověka v přírode.* Praha: Svoboda–Libertas, 1993.
TEILHARD de CHARDIN, P.: *Vesmír a lidsvo.* Praha: Vyšehrad, 1990.
TRESMONTANT, C.: *Dějiny vesmíru a smysl stvoření.* Praha: Academia, 2002.
TOOBY, J., COSMIDES, L.: *The psychological foundations of culture.* In J. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture.* New York: Oxford University Press, 1992.
WHITEHEAD, A..: *Concept of nature.* Cambridge: Cambridge University Press, 1964.
WHITEHEAD, A.N.: *Adventures of Ideas.* Cambridge: Cambridge University Press, 1964.
WHITEN, A., HINDE, R. A., et al.: Culture evolves. Introduction. In: Philosophical transactions of the Royal society. Biological sciences. roč. 366, 2011, č. 1567, s. 935–1187.
WILLIAMS, R.: Keywords: a Vocabulary of Culture and Society. Glasgow: Fontana, 1976.
WRIGHT, S.: Evolution in Mendelian populations. In: Genetics, č. 16, 1931, s. 97–159.
WUKETITS, F.M.: *Základy evolučnej teorie.* Bratislava: Iris, 1997.

Mgr. Renáta Kišoňová, Ph.D.
Mgr. Ing. Michal Kutáš, Ph.D.

Philosophy of Evolution

Firs edition

Peer reviewers
Doc. Mgr. et Mgr. Andrej Démuth, Ph.D.
RNDr. Mgr. Reginald A. Slavkovský OP, Ph.D.

Proofreading · Mgr. Bc. Michal Zvarík, PhD.
Graphic © Ladislav Tkáčik

fftu

Publisher
Faculty of Philosophy and Arts · Trnava University in Trnava
Hornopotočná 23 · 918 43 Trnava
filozofia@truni.sk · Http://fff.truni.sk

in cooperation with

Towarzystwo Słowaków w Polsce
ul. św. Filipa 7 · 31–150 Kraków
zg@tsp.org.pl · Http://www.tsp.org.pl

ISBN 978–83–7490–600–5