SELECTED ISSUES OF TELEOLOGICAL AND HOLISTIC PERSPECTIVE OF MORPHOGENETIC AND BEHAVIORAL PHENOMENA OF LIVING BEINGS

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ABSTRACT: *Wholeness of vital processes in both, internal and external dimension is manifested, according to Aristotle's terminology, by a substantial living form and is a condition of a purposeful behavior.*

Authors claim that, empirical data concerning animals tool use, and data concerning regulating processes, inside every living organism, cognitively force us to place them within teleological-holistic conceptual frames.

According to the authors, teleology requires a renewed revision and specific defining. Although, from one hand, some researchers think that it is an adequate tool used to describe biological purposeful processes, from the other hand it has often been weeded out and replaced by physical concept of function. Biological functionality intuitively links with the concept of wholeness and purposefulness. It should be emphasized, however, that not always simply physical concept of function may coincide with the concept of function in a biological sense, in spite of the fact that some relations observed within a living organism might by expressed thanks to a physical concept alone.

KEYWORDS: *entelechy, purposefulness, wholeness, teleology, tool making, tool use*

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Introduction

The aim of this article is the attempt to analyze selected research materials which highlight the validity of perceiving morphogenetic, regulatory and behavioral processes and phenomena of all living beings as teleological and holistic. The authors emphasize the meaning and development of individual (teleological and holistic) concepts which either adequately constitute the description of teleological processes or are the source of arguments and misunderstandings in the field of science and philosophy. The authors also understand that this paper only makes a foundation for an in-depth and detailed analysis which, in turn, should consider the extended research material in this area.

1. Psychologist conceptual exaggerations in Aristotelian idea of "vegetative souls", purposefulness or wholeness?

The first ever thinker and researcher who systematically addressed the problematic aspect of the creation of organism was Aristotle of Stagira (4th century B.C.). He based his statement concerning biological research on the concept of a vegetative soul, accepted by him in order to systematize, organize and causally explain the data that come from direct life observation. More specifically, Aristotle advocated the existence of the so-called "vegetative soul" – an indivisible and unquantifiable factor that would possess the ability to transform the "elements" (air, water, fire and earth) into a "perfect" figure that would correspond to our form of reproduction. According to Aristotle, all living creatures that have the ability to develop biologically, that is plants, animals and humans would have a vegetative soul. In the case of plants, this soul would be something independent whereas as far as humans and animals are concerned it would only be an unquantifiable and not spatial part of dynamically richer factor which would explain the creation of sensory and intellectual experience's phenomena. Accordingly, Aristotle's vegetative soul was not a driving force for a machinery of the body, but a factor guiding the process of forming this machinery out of this chaotic and relatively homogeneous elements of matter (Lenartowicz 1984, p.164).

While making independent observations of animals' development, Aristotle clearly noticed an e p i g e n e t i c nature of those phenomena: complex organs are created one after another (*De gen. An.*, II, 1, 734 a 25-30). He also noticed a transparent psychologistic analogy between these mentioned processes, that is, their structural similarity to those, which are typical for human actions. By observing the process of organisms' development and by comparing it to an obvious perfection of the adult form, an ancient philosopher noticed that this process is similar to the actions of human, who models the matter into the form of bricks or hewn stones from which the structure of a house is being built.

Reporting this notion of similarity, which is completely shallow and not related to the essence of theoretical statement of Aristotle, significantly influenced the further development of research in this field, because it obscured the actual and peculiar nature of the process of development, that is its w h o l e n e s s, which Aristotle seemed to fully notice:

> Aristotle was […] aware of the wholeness of the process of development. Influenced, however, by the abovementioned analogy between an organism and a builder, instead of using a term directly placed in empiricism, namely "wholeness", used the term "purposefulness" which unavoidably suggested the aspect of consciousness. As a result the aspect of cognition was associated with the concept of vegetative souls, which Aristotle did not intend at all. This unfortunate terminological lapse lead, through the course of history, to further misunderstandings but, in particular, to understand the reasons for development as vis a forte, that is, as a temperamental action reaching from yet non-existent future to just popping out present (Lenartowicz 1984, p.165).

As Lenartowicz's research has shown, the purposefulness mentioned by Aristotle – consists in wholeness of action similar to the one that is present in the group of various human actions leading to the creation of some functional structure. Thus, it was the development of an organism's wholeness that Aristotle had in mind, not metaphysical psychologism.

The concept of a vegetative soul was then the attempt to explain the wholeness of internally complex, epigenetic process of development, and simultaneously the attempt to explain why are significant damages of material and spatial structure of an organism being created not able to cause the division of this process into parts. Vegetative soul did not have anything in common with consciousness, cognition, even a sensory one, even though its actual action could have been noticed (as a whole) only by human's intellect.

In our further considerations we will show, that similar research attitude in the area of wholeness of organizational processes at the end of the 19th and at the beginning of the 20th century was characteristic of Hans Driesch. Undoubtedly, the reason for this was Aristotelian concept of a vegetative soul, as well as his concept of biological life in general, which turned out to be a uniquely durable concept in the history of science and philosophy through thousands of years.

Unfortunately, it sometimes occurs that theoretical and scientific ideas also somehow "wear out". During such long-lasting periods of time various simplifications of those ideas take place. Sometimes they are even put to positions which are opposite to those primarily occupied, that is, the ones accepted at baseline of a given theoretical concept. The same situation, in fact, occurred in the case of Aristotle's epigenetic concept:

Unavoidable blurring of the awareness of facts resulted in stiffness and fossilization then based on the experience of abstract explanatory speculations. Finally, the period dominated by one sided and exclusive interest in the last stage of life cycle came out. It led to associating an organism with reproductive form and to ignoring those data, which laid the foundation for Aristotelian concept of a vegetative soul. Organism was recognized as ready machinery made of prefabricated parts and epigenesis and totipotentiality remained the terms known only to those, who were able to oppose the common blindness of the age of enlightenment. In the history of

embryology this period has been called "a period of preformation theory's reign"[3] (Lenartowicz 1984, p. 167–168).

Such dialectics of opposites in the development of theoretical and philosophical knowledge about life is not just a pure invention. It is actually something that became a fact lasting for many ages. This opposition is precisely the foundation for Hans Driesch's neo-vitalistic concept.

2. Hans Driesch – epigenetic view of morphogenesis. Formation of telelological and holistic concepts

Directed and epigenetic holistic specificities inspired Driesch, a philosophizing biologist, to precise a conceptual framework, essential for an adequate description of phenomena observed by him.

About epigenetic processes he wrote:

> Morphogenesis, we have learned, is „epigenesis" not only in the descriptive but also in the theoretical sense: manifoldness in space is produced where no manifoldness was (Driesch 1908, p. 144).

This is the reason why do Hans Driesch's methods of scientific research (inspired by vitalism) in the morphogenetic field should be started with charting the beginnings of forming this individual conceptual machine on the basis of previously gathered embryological material and the experiments conducted, focusing mainly on sea urchin[4]. What definitely should be emphasized is his conceptualization occurring in a great number of his embryological details, which in a way conceptually "spot" holistic, directional and organizational aspects of those elementary organic phenomena. What is also very characteristic in this area is clearly observational genesis of the terms helping to describe more adequately the processes of morphogenesis, which emphasized qualitative nature of these terms in relation to non-organic phenomena. It was about perceiving organic processes as running purposely in order to create complex organization of the whole living organism, typical for each species.

Recognition of purposefulness of organic processes and their holistic development, on the basis of gathered biological material, directed the researcher towards searching for "something" that would lead the course of these phenomena.

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[3] An argument between the supporters of preformation and those of egigenesis broke out in the second half of the 18th century. Preformationists claimed that body parts of the adults exist in their lessened forms in very early stages of development. The supporters of epigenesis maintained that body parts, typical of adult creatures are the effects of development and do not appear in its initial stage. Epigenesis, in this sense, is a gradual shaping of homogeneous (tissues) and heterogeneous parts (particular organs). Aristotle was aware of that (De part. An., II, I, 643b, p. 5–8). In 1759 Caspar Friedrich Wolf showed faulsness of a performation theory and replaced it with the epigenesist theory (Mayr 1998, p. 25).

[4] We will not describe the experiments of Driesch in this article due to space limit. His experiments were extensively described in the "Biocosmology – Neo-Aristotelism", Vol. 4, Nos. 1&2, Winter/Spring 2014, p. 123–137.

> There must be something deeper to be discovered: we only have been on the surface of the phenomena, we now want to get to the very bottom of them. Why then occurs all that folding, and bending, and histogenesis, and all the other processes we have described? There must be something that drives them out, so to say (Driesch 1908, p. 50).

Therefore it should be strongly emphasized that that for Driesch the very description and comparison of the observed organic phenomena seem to be a starting point for a thorough consideration of holistic nature of these organic phenomena examined by him mostly the experimental method.

It was all an important starting point to working out his own philosophical and biological theory, based mostly on morphogenesis, thanks to which he tried to show that he "noticed" the working of a particular vitalist factor, holistic and integrative, natural for organic processes, dubbed by him later, after Aristotle, as entelechy.

> Let us then borrow our terminology from Aristotle, and let that factor in life phenomena which we have shown to be a factor of true autonomy be called *Entelechy*, though without identifying our doctrine with what Aristotle meant by the word entelechy. We shall use this word only as a sign of our admiration for his great genius; his word is to be a mould which we have filled and shall fill with new contents (Driesch 1908, p. 143, 144).

Noticed by Hans Driesch, strongly transparent collision between clearly epigenetic natures of morphogenesis and then widespread mechanistic prejudices made it apparent that then the conceptual machine of physicochemical research was totally inadequate as far as organic morphogenesis and the organic world as a whole is concerned. The content of mechanistic conceptual machine of physicochemical research conducted on the basis of then widespread "development mechanics" was stigmatized by static and machine. It did not correspond to clear dynamic-holistic properties of morphogenetic phenomena; even when they were observed first hand. Honest and neutral description of first-hand-observed morphogenetic phenomena questioned the mechanistic sense of the conceptual machine used in the "development mechanics".

Thus, the next phase of Driesch's research was to show the fundamental insufficiency and ultimate uselessness of mechanistically interpreted conceptual machine of physicochemical morphogenesis in terms of adequately including the holistic, dynamic and teleological character of those naturally organic phenomena when they were included on phenomenological level.

> Therefore there can be neither any sort of machine nor any sort of causality based upon constellation underlying the differentiation of *harmonious-equipotential systems* (Driesch 1908, p. 141).

On the basis of analytically designed experiments concerning organizational and holistic nature that are typical for morphogenetic processes, Driesch tried to outline

his theory of organic phenomena's nature as a theory of harmonic-equipotential systems. It was based exclusively on a rather narrow morphogenetic material, but the whole sense of this theory was – according to Driesch – general, because it was intended to concern the whole organic phenomena.

Our systems are equipotential to the extent that each of their elements may play every single part in the totality of what will occur in the whole system; it is to this single part that the term "function of the position" relates. We therefore might call our systems equipotential systems with single potencies; or, more shortly, singular-equipotential systems (Driesch 1908, p. 120, 121).

Elsewhere, Driesch wrote about peculiarity and uniqueness:

> Let us apply the term *equipotential ontogenetic system* to any ontogenetic totality which consists of cells with equal prospective potency, *i.e.* with an equal possible fate; then the blastula is, in short, an *equipotential system* (Driesch 1914, p. 13).

The harmonic-equipotential systems (together with prospective powers), that is, according to Driesch, all animals and plants had a directed ability to develop holistically, despite interfering their complex organization. Such attribute of those systems were demonstrated for instance by Driesch's experiments, which are not described in this article due to limited space.

Vitalistically inspired Diresch's research which concerned mainly teleology and other related processes directed towards an organized and functional whole, lead him to valuable discoveries as far as equipotentiality of particular processes of development, today associated with totipotentiality, is concerned[5]. These discoveries were the base for coining very important terms in the range of embryology, which are still valid. It is enough to mention the terms (above defined as prospective powers) that is: p r o s p e c t i v e m e a n i n g and p r o s p e c t i v e p o w e r[6], formulated by Driesch during his biological and philosophical research. It is also worth noticing that both these categories were used, without changing the meaning, by Hans Spemman (Ostrowski 1985, p.82)

Driesch's vitalist approach presenting holistic view of organic nature often was and has been criticized by most of contemporary researchers.

Ernest Nagel criticizes Driesch's vitalist approach with these words:

> Historians of philosophy are usually thinking that problems of Driesch' research and analyses are now of no scientific or philosophical interest any more. This may be taken, however, to be not so much an outcome of a

[5] The problem of totenpotentiality, or, more specifically, the problem of totipotential cells has still been valid and controversial.

[6] In both Driesch's and Spemman's cases prospective meaning of a particular embryo's area is what will be produced out of this area as a result of normal development, without any developmental disorders. Prospective power defines all possible developmental ways of a particular area of an embryo during normal development, pathology or experimental conditions.

> thorough methodological and philosophical criticism of his vitalism in all its dimensions, but rather as a consequence of a heuristic sterility of this standpoint in the course of the contemporary biological research, especially in comparison to such a fruitfulness characterizing disparate reductionistic conceptions of the research approach to living phenomena. This is just, for example, how Ernst Nagel argues (Nagel 1970, p. 369).

Speaking in the name of all philosophy historians, mostly its critics, Nagel writes about an unjustified emptiness of Driesch's vitalism. A question that arises here is why contemporary researchers mostly do not appreciate methodological value of Driesch's vitalism. We believe that it might be caused by the fact that those researchers do not distill the proper sense existing in biophilosophy of Driesch. Instead, they focus exclusively on the very entelechy in its clearly metaphysical sense. This issue, however, requires separate, fundamental research.

However, in my opinion, Driesch's methodological vitalism possesses positive value of the inspiring–heuristic character. It has been appearing in the course of scientific research carried out in embryology in general; it was so, beyond any doubt, at least in the course of Driesch's own scientific research. Some important scientific inspirations have been taken from his conceptual developments; also those concerning the specifically vitalistic notion of entelechy as a kind of a life-factor – a term taken over from philosophical tradition going back to Aristotle. Even tentatively determined concept of entelechy has greatly inspired Driesch's experimental research in the domain of the organic morphogenesis; the very primary intuitive content of this concept inspired Driesch, in his own scientific research, as concerns his concrete morphogenetic concept-construction, in planning and carrying out his morphogenetic experiments and observations, as well as in his theoretical generalizations aimed at showing off the qualitative specificity of living phenomena. Even a quick look at some of Driesch's scientific research and achievements illustrates beyond any doubt the cognitive fruitfulness of his vitalism.

In the second part of this article we will refer to behavioural purposefulness (and wholeness), which includes animal tool use, and also human behaviour. Such research perspective will allow us to show another important aspect of directivity, and as a result, wholeness of behaviour. Purposefulness of such type we will define as external purposefulness.

3. Ostensive view of external purposefulness. Selected examples

The most obvious and important characteristic of a tool use is the fact that they are undertaken with the intention to achieve a define result. Using teleological language, they are *par excellence* purposeful. "Purposefulness" of theirs has been noticed since the oldest of times. According to Aristotle, it consisted in wholeness of use, similar to the one, which characterizes a group of human activities leading to the creation of some functional structure. As Maryniarczyk notices:

> For Aristotle and the whole tradition of realistic philosophy it was obvious that it is impossible to explain the World movement, entities' operations,

> and organisms' development without referring to the purpose. Heteronomic parts of organisms are understandable only if they are related to their purpose. By omitting the philosophical and scientific explanation of a purposeful cause one condemns himself to the absurd. No wonder, then, that the purpose has always been defined as the cause of all causes. Only after discovering the purposeful cause and by relating to it we can understand all other causes (material, formal and efficient). Next important, if not the most important discovery, as a result of discovering the purposeful cause is realizing that purpose requires the existence of rational cause, which gives this purpose to things or makes some activity a purposeful one […] (Maryniarczyk 2008, p. 8).

Animal and human tool use is such activities in which purposefulness is undoubtedly noticeable. Purposefulness and wholeness of an activity is something "common" in biology and also a crucial condition and the essential feature of life. Tool use is always subordinated to the realization of some tendency and to achieving certain purpose. It should be remembered that tool use, which are integral parts of the defined behaviour, that is, a pursuit to achieving the exact purpose cannot be associated with this behaviour. It is behaviour that is the element of biological activity, which *hic et nunc* determines the way of using the tool. In other words, tool use is within behaviour, but is subordinated to the particular behaviour.

There is a cognitive error, namely "separating" the natural whole of animal behaviour into small pieces. As a result of this cognitive operation it has often been said only about making and using tools, without mentioning the ecological context of behaviour. There have also been many attempts to evaluate animals' cognitive abilities on the basis of the complexity of the very tool behaviour, omitting other animals' activities. Some elements of behaviour have been treated as separate reactions not connected with each other. Holt writes:

Often too materialistically-oriented biologist is afraid of encountering some deuce, "a soul", and as a result rushes into breaking down each case of behaviour into constituent reactions, without trying to observe it as a whole (Holt 1915, p.78)

Elsewhere in Holt's works we can read:

> Phenomena, which come from an integrated organism are not just a nerve stimuli, a muscle cramp or just a game of reactions elicited by stimuli. All of them are present and have a fundamental significance for phenomena described here, but now they are only components because they have been integrated. This integration of reflex arcs –including everything that adds up to them in a systematic, mutual dependence – has created something, which is not only an automatic action. Biological sciences have long been named this new and more advanced something and called it "a behaviour" (Holt 1915, p.155).

If we take a closer look in a purposeful action of humans and animals we will notice, that there are several aspects included here, such as: wholeness,

homogeneousness, orderliness, succession, etc. That is the aspects in which cognitive element is crucial.

Behaviour as a behaviour […] is purposeful and cognitive. These cognitive purposes and processes are direct descriptive features of its. Undoubtedly, it is specifically and totally dependent on various physical and chemical processes, which are its basis, but at the beginning, when trying to do the first identification, purpose and cognitive processes are characteristic of behaviour […] such purposes and cognitive processes are equally obvious in rat and human behaviour. Nevertheless, it should be emphasized at the end that purposes and cognitive processes, which are so directly and immanently rooted in behaviour, are completely objective when it comes to its definition (Tolman 1995, p.30)

4. Teleological nature of tool use

Teleological nature of tool use is *non est dubium* (beyond doubt). It is obvious in both animal and human tool use. Significantly, in case of tool use, there should be considered behavior involving the usage of biological tools, and modifying and using external materials.

Most generally speaking, tools are material structures manufactured by living beings in order to produce objects and phenomena necessary to perform a number of tendencies of these living beings. We can differentiate between the following:

1. Biological tools – organs, organelles, molecular machines or structures developed in the process of embryogenesis (individual developmental dynamics), such as hands, a heart, eyesight, ribosomes, digestive enzymes etc.
2. 'Artificial' ('technical') tools – structures formed outside the process of embryogenesis, but *thanks to* embryogenesis, such as a hammer, a plough, a crane, a fuel engine, a microscope etc.

The purpose of tool making is to produce objects and phenomena which are crucial for implementing various tendencies of living creatures – for example, the creation of massive beaks among parrots (in the process of embryogenesis), strong enough to cut, squash or crush tough objects, thanks to which the bird is able to cut through hard fruit pedicels, etc. Yet another example is provided by humans, who (this time outside the process of embryogenesis) manufacture pincers, strong enough to cut, squash or crush tough objects, thanks to which a person may cut through thick wires, crush wire ends, remove nails etc.

As Lenartowicz (2010) notices, trying to define prehistoric stone tools, a tool is an item, purposely shaped in a way which would make it easier for its creator to process materials (e.g. skin removal, tendon cut, drilling a hole in a shell or sabers of hunted predators, planing wood). Stone tools – similarly to teeth – are exceptionally robust to a destructive influence of surrounding and that is why they are a valuable trace of hominids' behavior that used to live millions of years ago.

Tools, just like teeth, "are designed to do something" but are not purposes themselves. The problem of purposefulness in their creation differs from the problem of purposefulness in their using. Tool use is something superior to its production. So, purposefulness of use contains purposefulness of production within itself. Both these

forms make indivisible series of selective actions, which may be called a tool use (Lenartowicz 2010, p.248).

5. Universality of tool use

In the world of nature we may observe a broad spectrum of tool use. Proper view of tool use must present animal behavior including both direct use of biological tools and making use of biological tools to use and modify certain items.

For example, the dynamics of building a spider web by a spider (*Araneus diadematus*) clearly shows the orientation, correlation and integrity of actions, which are elements of spider's manipulative behavior. Constructive actions of a spider could not be realized without proper biological structures and behavior. By using these biological tools, creates a material structure (internal to him). A spider acts in directed and structured way. Freedom of manipulation is strictly connected with orientation in numerous physical features and the surrounding's properties. Material used for making a spider web is produced in spider's body and then used in web's production (Witt 1963, Heiling & Herberstein 1999, 2000; Zschokke 1993, 1997, 1999, 2002; Zschokke & Vollrath 1995, 2000, Zschokke & Coslovsky 2009, Hansell 2007, Dawkins 1998).

An archerfish (*Toxotes jaculatrix*) uses water spray aimed towards its victims and shot up from its mouth in order to catch them. Thanks to its perfectly adapted organ (mouth) it is able to shape a water trickle in the way that may shoot down a victim that exists in a different environment. Behavior that concerns locating the victim, making a direct hit and – what completes the whole process – catching a shot-up victim requires orientation and numerous correlated actions from archerfish. A fish puts itself in such a position to make a "gunpoint" created by a tongue a sulcus on its palate aimed towards an insect. Wanting to hit a victim with this trickle, a fish has to take refraction occurring on the border between the two environments into consideration (Schuster 2007, Ben-Simon *et al.* 2009). What is very transparent n archerfish's tool use is acting with the use of biological organ (mouth) thanks to which a water trickle is formed.

Chimpanzees (*Pan troglodytes*) habitually use various natural elements of surrounding, they also modify the material – they have regional and local distinction in a way they form those tools (Whiten *et al.* 1999). Chimpanzees often modify leaves, grass straws, stalks, barks, branches, sticks and stones. Next, they use such modified or non-modified objects for various purposes, like probing, inserting, hitting, throwing or breaking. These actions are taken in order to, for instance, to extract various species of social insects, which could not be reached with fingers and teeth, or, what takes places during cracking nuts, to get into an edible core of a nut. Getting these food supplies, might have been impossible without having the ability of shaping objects (Scothern 2006, Morbeck, 1994).

The example of an advanced animal tool use, which currently electrified scientific environment and put the uniqueness of monkeys' tool use were observations of living in the wild New Caledonian crows (*Corvus moneduloides*). Hunt (1996) has said that, in contrast to already known birds' tool use which makes a

small material modification, New Caledonian crows produce and use two different types of hooked objects to get food: hooked branches and scalariformed, prickly leaves of pandanus.

During further research it has been observed that crows various items, which can be classified as one of the three main categories: straight sticks or stalks, hooked objects made of branches or ramblers and objects shaped from pandanus leaves (Hunt 1996, Hunt 2000a, Hunt 2000b, Hunt, Corballis, Gray 2001, Hunt, Gray 2002, Hunt, Gray 2003, Hunt, Gray 2004a, Hunt, Gray, 2004b (Suppl.), Rutledge, Hunt 2004, Hunt, Corballis, Gray 2006).

Conclusion

This article draws attention to how important holistic view of particular processes, both morphogenetic and behavioral in living natural reality is. Wholeness of vital processes was shown in two dimensions which are sometimes falsely separated from each other, or even put in opposition against each other. It is important for those two spheres – conceptually divided here in order to show rules that connect them – to be treated as an integral whole. In this matter big credit should go to Aristotle, who was undoubtedly an inspiration for many researchers as far as this important problem is concerned, not only in of biology but also, and mainly, in the field of philosophy.

Vitalist-inspired Driesch's research, indirectly taken from Aristotle's (a great vitalist[7]) research and a consideration of a whole and directness of organic processes, lead him to formulating basic biological and philosophical concepts (which are related to holistic and purposeful processes) which has still been valid in today's development's biology.

The same points we may relate to biological tools produced during the process of embryogenesis and then used, or items produced outside embryogenesis, but thanks to biological tools.

These issues are the elements of a particular whole, that is, a behavior of a given creature. Wholeness of vital processes in both, internal and external dimension is manifested, according to Aristotle's terminology, by a substantial living form and is a condition of a purposeful behavior.

It should be added that the authors omitted the intensive conceptual argument which has been about the attempts to explicitly define producing and using tool by animals (Beck 1980, Shumaker et al. 2011). Some arbitrary decisions, which do not include biological tools in animal's behavior, lead to false conclusion as far as the view of living creatures' activities is concerned.

According to the authors, teleology requires a renewed revision and specific defining. Although, from one hand, some researchers think that it is an adequate tool

[7] *Editor's note*. Due to the BCA disposition, Aristotle is rather a great Organicist (but not the vitalist) – the great scholar who had created the supersystem of rational (scholarly) knowledge, essentially of scientific Organicism (and that his Organicist, aetiologically Four-causal knowledge have been laid into the basis and formed the framework and matrix of the entire modern scientific edifice; indeed, Aristotle is recognized worldwide as "the Father of Science").

used to describe biological purposeful processes, from the other hand it has often been weeded out and replaced by physical concept of function (Nagel 1970, p. 346-369). Biological functionality intuitively links with the concept of wholeness and purposefulness (Lenartowicz 1984, p.210). It should be emphasizes, however, that not always simply physical concept of function may coincide with the concept of function in a biological sense in spite of the fact that some relations observed within a living organism might by expressed thanks to physical concept alone.

As it was stated, empirical data concerning animals' tool use cognitively force us to place them within teleological-holistic conceptual frames. It seems that because of the atomization of research and high level of specialization of nearly all disciplines of science, the ability to put some phenomena in the light of teleological and holistic concepts has been lost. Its restitution would probably bring a better understanding of vital processes (morphogenetic and behavioral) artificially separated from an organic whole.

References

Aristotle. *De Genertione Animalium.* Translated by W.D. Ross. Retrieved 15.05.2014, URL: https://archive.org/details/worksofaristotle512aris

Beck B. (1980) *Animal tool behavior: The use and manufacture of tools by animals*. Garland STPM Press, New York.

Ben-Simon A., Ben-Shahar O., Segev R. (2009) Measuring and tracking eye movements of a behaving archer fish by real-time stereo vision. *Journal of Neuroscience Methods*, 184: 235–243.

Dawkins R. (1998) *Wspinaczka na szczyty nieprawdopodobieństwa*. Wyd. Prószyński i S-ka, Warszawa.

Driesch H. (1894) *Analytische Theorie der organischen Entwicklung*, Leipzig.

Driesch H. (1914) *The Problem of Individuality*, London.

Driesch H. (1908) *The Science and Philosophy of the Organism*, London.

Hall T. S. (1970) A *Source book in animal biology*. Harvard Univ. Press, Cambridge Mass.

Hansell M. (2007) *Built by animals. The natural history of animal architecture*. Oxford University Press, New York.

Heiling A. M., Herberstein M. E. (1999) Asymmetry in spider orb-webs: a result of experience? *Anim. Cogn*., 2: 171–177.

Heiling A. M., Herberstein M. E. (2000) Interpretations of orb-web variability: A review of past and current ideas. *Ekologia-Bratislava*, 19: 97–106.

Holt E. B. (1915) *The Freudian Wish.* Henry Holt and Company, New York.

Hunt G. R. (2000a) Tool Use by the New Caledonian Crow Corvus moneduloides to obtain Cerambycidae from dead wood, "*EMU*", 100, pp. 109–114.

Hunt G. R. (2000b) Human-like, population-level specialization in the manufacture of pandanus tools by New Caledonian crows Corvus moneduloides. "*Proc. R. Soc. Lond. B*", 267, pp. 403–413.

Hunt G. R., Corballis M. C., Gray R. D. (2006) Design complexity and strength of laterality are correlated in New Caledonian crows' pandanus tool manufacture, "*Proc. R. Soc. B*", 273, pp. 1127–1133.
Hunt G. R., Corballis M. C., Gray R. D. (2001) Laterality in tool manufacture by crows, "*Nature*", 414, p. 707.
Hunt G. R., Gray R. D., (2004a) Direct observations of pandanus-tool manufacture and use by a New Caledonian crow (Corvus moneduloides), "*Animal Cognition*", 7, pp. 114–120.
Hunt G. R., Gray R. D. (2003) Diversification and cumulative evolution in tool manufacture by New Caledonian crows, "*Proc. R. Soc. Lond. B*", 270, pp. 867–874.
Hunt G. R., Gray R. D. (2002) Species-wide manufacture of stick-type tools by New Caledonian crows*, "EMU*", 102, pp. 349–353.
Hunt G. R., Gray R. D. (2004b) The crafting of hook tools by wild New Caledonian crows*, "Proc. R. Soc. Lond. B*", 271 (Suppl.), pp. 88–90.
Hunt G. R. (1996) Manufacture and use of hook-tools by New Caledonian crows, "*Nature*", 379, pp. 249–251.
Koszteyn J., Lenartowicz P. (2008) Struktura ontyczna bytu żywego w arystotelizmie, w: *Ewolucjonizm czy kreacjonizm*, red. P. Jaroszyński, ks. P. Tarasiewicz, I. Chłodna, M. Smoleń-Wawrzusiszyn, Fundacja „Lubelska Szkoła Filozofii Chrześcijańskiej", Lublin 2008, http://www.gilsonsociety.pl/philosophiaetcultura/przysz%C5%82o%C5%9B%C4%87-cywilizacji-zachodu-the-future-of-western-civilization/nr-6-ewolucjonizm-czy-kreacjonizm/
Lenartowicz P. (2010) *Ludy czy małpoludy. Problem genealogii człowieka.* Kraków.
Mayr E. (2002) *To jest biologia*, Warszawa (*This is Biology*).
Maryniarczyk A. Stępień K., Gondek P., (2008) *Spór o cel. Problematyka celu i celowościowego wyjaśniania. Zadania współczesnej metafizyki t. 10*. Pol. Tow. Tomasza z Akwinu, Lublin, pp. 17–34.
Morbeck M. E. (1994) Object manipulation, gestures, posture, and locomotion, red. D. Quiatt, I. J. Itani, *Hominid culture in primate perspective*, Niwot, pp. 117–135.
Nagel E. (1970) *The Structure of Science*, Warszawa.
Ostrowski K. (1985) *Embriologia człowieka*, Warszawa.
Rutledge R., Hunt G. R. (2004) Lateralized tool use in wild New Caledonian crows. *Animal Behaviour* 67, 327–332.
Schuster S. (2007) Archerfish. *Current Biology*, 17(13): 494–495.
Scothern N. *A Comparison of Tool Using Behaviour between Chimpanzees (Pan troglodytes) and Bonobos (Pan paniscus)*, http://www.biolog-e.leeds.ac.uk/Biolog e/uploads/Nicola_Scothern.pdf (12.10.2006)
Shumaker R. W., Walkup K. R., Beck B. B. (2011) *Animal tool behavior. The Use and Manufacture of Tools by Animals*. Johns Hopkins University Press.
Tolman E. C. (1995) *Zachowanie celowe u zwierząt i ludzi*, Warszawa, Wydawnictwo Naukowe PWN.

Whiten A., Goodall J., McGrew W. C., Nishida T., Reynolds V., Sugiyama Y., Tutin C. E. G., Wrangham R. W., Boesch C. (1999) *Cultures in chimpanzees*. "Nature", 399, pp. 682–685.

Witt P. N. (1963) Environment in relation to the behavior of spiders. *Arch. environm. Hlth*., 7: 4–12.

Zschokke S. (1993) The influence of the auxiliary spiral on the capture spiral in Araneus diadematus Clerck (Araneidae). *Bulletin of the British Arachnological Society*, 9: 169–173.

Zschokke S. (1996) Early stages of orb web construction in Araneus diadematus. *Clerck. Rev. Suisse Zool*., 2: 709–720.

Zschokke S. (1997) Factors influencing the size of the orb web in Araneus diadematus. [w:] Żabka M. (red.), *Proceedings of the 16th European Colloquium of Arachnology*. Wyższa Szkoła Rolniczo-Pedagogiczna, Siedlce, pp. 329–334.

Zschokke S. (1999) Nomenclature of the orb-web. *Journal of Arachnology*, 27: 542–546.

Zschokke S. (2002) Form and function of the orb web. [w:] Toft S., Scharff N. (red.), *European Arachnology 2000*. Aarhus University Press, Aarhus, Denmark, pp. 99–106.

Zschokke S. Coslovsky M. (2009) Asymmetry in orb-webs: an adaptation to web building costs? *Journal of Insect Behavior*, 22: 29–38.

Zschokke S. Vollrath F. (1995) Web construction patterns in a range of orb-weaving spiders (Araneae). *European Journal of Entomology*, 92(3): 523–541.

Zschokke S. Vollrath F. (2000) Planarity and size of orb-webs built by Araneus diadematus (Araneae: Araneidae) under natural and experimental conditions. *Ekologia*, 19 (Suppl. 3): 307–318.