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► **To cite this version:**

Adrianna Wozniak. Is the real world something more than the world of our experience? Relations between neodarwinism, transcendental philosophy and cognitive sciences.. 2006. hal-00095289

HAL Id: hal-00095289

<https://hal.science/hal-00095289>

Preprint submitted on 15 Sep 2006

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Is the real world something more than the world of our experience? Relations between neodarwinism, transcendental philosophy and cognitive sciences.

Aдриanna Wozniak

Institute for Cognitive Science, Lyon, France

wozniak@isc.cnrs.fr

The question I will deal with concerns the nature of the phylogenetically acquired knowledge and the assumptions of Biological Evolutionary Epistemology. EE constitutes a direct extension of the Synthetic Theory of Evolution and supposes, that (1) some external world exists and that; (2) knowledge about the external world has been shaped by the external world itself, i.e. through natural selection.

If Evolutionary Epistemology accepts the evolution as a fact and admits the influence of the natural selection on the formation of living organisms (among it their cognition), the speculations of constructivism and of subjective or transcendental idealism are not defensible.

The ontological status of logic and mathematics will be discussed from an evolutionary point of view as well.

Keywords: Biological Evolutionary Epistemology, Cognition, Realism, Constructivism, Mathematics

1. Introduction

The understanding of the living world that the Synthetic Theory of Evolution offers determines the assertions of Biological Evolutionary Epistemology¹ about the nature of phylogenetically acquired knowledge. The Modern Synthesis has monistic and materialistic assumptions and supposes that natural selection, based on evolutionary constraints (Gould and Lewontin 1994), shapes organical forms. The action of natural selection concerns inborn cognition as well. What kind of assertion, then, does the Biological Evolutionary Epistemology (EE) set forth about the nature of the knowledge, given that it aspires to agree with today's theory of evolution? First of all, EE treats organic cognition as corresponding to the external world. This is the case principally because natural selection, which is embodied by outside influences, shapes organic cognition. It implies directly that a given organism's cognitive abilities, which were formed in the phylogenetic past, constitute a response to the surrounding conditions of the organism, i.e., to the external world. Knowledge about the outside world comes into existence in the cognitive apparatus of living organisms, being shaped by the external world itself. Consequently, the external world is mirrored in organic knowledge. Obviously, for EE, some external world exists. Those assertions of EE naturally follow from the monistic and materialistic metaphysical suppositions of the Modern Synthesis, which is based on the conviction that natural selection has a direct influence on organic constitution.

There are tight connections between the way we consider the nature of the world and the nature of knowledge. This means that idealistic or constructivistic assertions make no sense from today's evolutionary theory perspective. Unless the constructivists succeed in proving that natural selection has no direct influence on living organisms' physical constitution (which is tantamount to contest the very fact of evolution), their thesis that cognitive features are free constructions of organisms themselves, and that cognitive forms do not depend on natural selection's brushwork, is not defensible. A similar idea appeared in the idealistic philosophical current. Although constructivism is a contemporary speculation and idealism (subjective idealism as well as transcendental idealism) goes back to eighteenth century, they

¹ I will discuss about Evolutionary Epistemology of Mechanisms and not about Evolutionary Epistemology of Theories (Bradie 1986).

have two assumptions in common. The first assumption stipulates that (1) there is no relation between the external world (the things which exist independently of the mind) and cognition (things which exist in the mind). The second assumption follows from the first. If (1) the evolution of cognition is not connected at all to the external world, then (2) even if our cognition tells something about the external world, we can only be sure that it tells something about our cognition. We have no right to extrapolate from what our cognition tells to the extra-subjective world and to pretend that it effectively tells something true about the outside world. Thus, cognition is valid only when is applied to the cognitive dimension. There is no justification to transcend it and extend it to what is beyond and belongs to the outside world. What is more, we don't even need to suppose the existence of the outside world. However, if Biological Evolutionary Epistemology accepts the evolution as a fact and admits the influence of natural selection on the formation of living organisms, it is not possible to defend constructivist conclusions.

2. The nature of the reality according to the Synthetic Theory of Evolution

2.1. Monism and materialism, continuity of living organisms

The Synthetic Theory of Evolution gives us an understanding of the living world, its dynamics and nature. The vision of the world that the Modern Synthesis offers, has the marks of metaphysical inquiry, of which the first aim is the most general investigation possible about the nature of reality. On the Modern Synthesis view, everything interacts with everything else, it is a kind of variabilism *à la* Heraclitos. This vision is monistic and rests on the metaphysical supposition of a single ultimate principle: matter². The Modern Synthesis postulates the unity and continuity of the living world. This continuity is underpinned by the homogeneity of living beings, based on the same material nature.

For instance, hereditary continuity rests on material, physical continuity. Genetic information exists in the sequence of nucleic acids and has no existence apart from its support, the vehicle which constitute it. Cellular information or signal means nothing more than chemical molecules and their action: this is the way that cells exist - detecting, converting and exchanging molecular components. This constant interaction and communication underpins the process of life³. Signal and information are physically transferred from the surface of a cell to its other parts. This ability to communicate, interact and exchange is what the cell actually is: if a cell could not receive or respond to signals from its environment, nothing would be left of it. Communication and exchange have allowed cells to evolve: if they had not existed, cells would have no *food*, could not *avoid predator*, i.e., would be unable to survive, especially since competing cells exist which can and do communicate -produce, recognize, interpret and answer to signals from the environment. Transduction of signal - i.e., of information - means that a message is converted from one form to another and its original content is retained⁴. Inter- and intracellular signalling, converting, communicating of molecules translate a signal into a cell behaviour. But the information or rather content itself is nothing but the components, which physically structure and vehicle it, and which are sort of building block constituents for information. There is no substantial existence beyond that.

² Two major tendencies in metaphysics are idealism (considering reality as spiritual or mental) and materialism (considering reality as material). They both propose a single ultimate principle, and both are monistic. Metaphysics → monism → idealism — Berkeley versus Materialism and Modern Synthesis.

³ Receptors respond to mechanical forces such as touch, pressure, vibration, to temperature changes, to chemical molecules, to painful stimuli which may be damaging to tissues, to light.

⁴ Let us take the famous example of a message sent by telephone: one person speaks into a transmitter which converts the sound into an electrical signal. Next, the electric signal is transmitted over distances and then is converted back into sound at its destination. The original content of the message is retained.

2.2. *Metaphysical unity of mind and body, of the knowing subject and the object of knowledge*

In the same way, the scientific view of the soul, mind (consciousness, free will etc.) conceives it as being a manifestation of the physiology of the brain and nervous system, an effect of physical reality, organic constitution. In 1994, Crick published his book, *The Astonishing Hypothesis: The Scientific Search for the Soul*. Francis Crick's (1994:3) Astonishing Hypothesis is that

a person's mental activities are entirely due to the behaviour of nerve cells, glial cells, and the atoms, ions, and molecules that make them up and influence them.[...] You, your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behaviour of a vast assembly of nerve cells and their associated molecules.

Mind and body are part of the same reality. The brain is not a seat for the soul, which would function independently of it and of the environment. The brain by its constitution is an organ of exchange, a big window for and from the world, among which the external environment (extra-subjective world) as well as the internal environment (body and senses). The Modern Synthesis withdraws from dualistic theses, inherited from Descartes' distinction (Descartes 1992) of the two ontological categories of which reality consists, namely the dichotomy of *res cogitans* (thinking things, mind, soul) and *res extensa* (extended things, body). Without making a distinction between cognitive subject, ego, mind, soul etc, and the external, real world, another apparent ontological distinction seems to be suppressed in the Modern Synthesis: the one between the knowing subject and the object of knowledge. Subjects and objects are defined in a conventional, arbitrary way.

3. A common starting point: what is perceived by our senses exists

The cognitive contents of a given perception have the same nature as its components: it is the same thing but seen at different levels of generalisation. We can say that the senses and their cognitive contents are a single thing taken from a single world. This is because perception is a constant flow and an exchange between every parts of an organism, and because there is a tight relation between senses, bodies, sense data and states of mind, impressions, imprints that the world makes through the senses. That is why it seems justified to assert that our senses inform us about the existence of the things from the outside of the perception of an organism. On one point, the Modern Synthesis would agree with George Berkeley's subjective idealism, namely that what is perceived exists, that what is in our senses exists. Nevertheless for the Modern Synthesis, as what is in our senses is the same thing as what is outside of the senses, then what exists in our senses exists as well as what is outside them.

4. Divergent conclusions

Berkeley's argument, if seen without dualistic suppositions, could prove materialism (not idealism) and the existence of the real world (and not only the existence of the soul and of God). Berkeley's argument is turned round here by the Modern Synthesis and used to prove the contradictory claim, that it was conceived for proving: namely, monism (if not materialism at once), and the existence of the real world.

We can concisely draw a parallel between Berkeley's argumentation and what follows from Modern Synthesis metaphysics:

G. Berkeley (and later constructivists)	Modern Synthesis → Biological Evolutionary Epistemology
Assumption: Dualism, distinction between body and mind.	Assumption: The content of perception has the same nature as the components of perception.
No relation between - things which exist independently of the mind and things which exist in the mind: - between bodies and our ideas about them, - between senses, external things and the soul, ego, - seat of impressions.	Perception is a constant flow and exchange between every parts of the organism and its environment.
<ul style="list-style-type: none"> ➤ Our senses inform us only about impressions, about what is being directly perceiving by senses ➔ and only about this, can we say that it exists (and that it exists only in senses, <i>esse est percipi</i>) ➤ Our senses do not inform us about the existence of the things independent of the mind ➔ We have no right to believe that things in themselves exist on the basis of sense data 	Our senses inform us about the existence of the things outside of the perception.
Trying to grasp the existence of the things in themselves, we conceive nothing but our own ideas. The existence of the world as existing independently of the mind is postulated through the rules of rational inference from sense data Conclusions: ➔ external things do not exist and because there is no necessary relation between bodies and our ideas about them, we don't need to suppose, that the external world exist ➔ subjective idealism	Conclusions: If what is perceived exists (<i>esse est percipi</i>) ➔ what is in our senses exists ➔ metaphysical realism: the outside world exists

Table 1. The subjective idealism of Berkeley (and later of constructivists) and Biological Evolutionary Epistemology, derived from neo-darwinism. The same starting point but different presuppositions that leads to the contradictory conclusions about the existence of the external world and its nature. For constructivists, as for Berkeley, there is no relation between the things in themselves and the representations of them ➔ we cannot (and we don't even need to) prove the existence of the external world nor the reliable relation between things in themselves and the contents of experience, representations or ideas.

The Modern Synthesis would agree with George Berkeley's subjective idealism that what is perceived exists, that what is in our senses exists, and this argues for materialism and for the existence of the real world. Thus, the Modern Synthesis presupposes metaphysical realism, while Berkeley postulated that external things do not exist.

The same type of reasoning but from the perspective of evolutionary time applies to the inborn cognitive representations acquired in the phylogenetic past of an organism:

- (1) There is a tight phylogenetic relation between stimuli from the surrounding environment and the form of their cognitive inborn representations.
- (2) Thus, our inborn cognition informs us about the external phylogenetic environment.

5. Pure forms, empty forms?

According to Berkeley (Berkeley 1991), as a representative of subjective idealism, in trying to seize the existence of the things in themselves, we conceive nothing but our own ideas. This argument was undermined by Berkeley's successor, Immanuel Kant: since the thing in itself is independent of our experience of it, we know absolutely nothing about the noumenal realm.

Nevertheless the appearance and the phenomena given in our experience imply that there must be something, which causes them. Even if this appearance does not give us access to the nature of the thing in itself, at least it guarantees that there is some thing in itself.

According to Kant, we know how the world appears to us, how the world looks to our cognitive system, but we don't know how the world is in itself. Kant's argument to prove transcendental idealism is that we cannot conceive of the properties of things in themselves before we conceive of the things in themselves, which those categories (properties) describe (Kant 1980). These categories which belong to things in themselves cannot be intuited prior to the things which they define. Nevertheless, these categories are intuited a priori. What's more, every cognitive act passes solely through these categories. That is why they can represent only the way that things appear to us, and not things as they are in themselves.

Kant argues that concepts of understanding are pure forms of intuition because they precede and structure all experience. Perception is always a judgement, which goes beyond what is directly given in experience. There is no direct relation between the input, data from the external world, and our representations of it. We do not perceive the things in themselves but sense-data: perception is mediated and is an indirect representation of the world. So can we assert that, on the basis of the apprehension of how things appear to be, on how they look (for example when we see them - on the basis of their visual appearance), we learn how things are in our immediate environment? Can we transcend our experience?

6. Do we know something beyond our own experience ?

EE claims that categories of cognition are embodied in physiological make-up and convert sensory data into perception. They are constant and invariant. Thanks to this, we perceive regularities. Our inborn cognitive categories, cognitive organic make-up, formed by natural selection in the evolutionary past, constitute the sensory input as well as the external stimuli and participate in modification of our representation. EE also claims that we perceive the world indirectly, in the sense that our cognitive apparatus converts the input from the external world. But for EE, *indirectly* means that the input passes by complex steps and levels, and not by some metaphysical gate to a qualitatively different existence.

Let us come back now to Berkeley's argument, that we have no right to infer the existence of the external world from sense data, because the only thing we can assert in a justified way is that there exists what is in our senses. This is the argument, which undermined realism, assuming that our statements go beyond the data. How then could EE defend realism? EE, derived from the Modern Synthesis, does not represent extreme realism, because here perception does not depend only on the structure of the external world. EE does not represent radical constructivism either, because perception involves the existence of the external world and needs its evaluation through natural selection.

7. Adaptation as a gain of knowledge

To live means to interact and to interact means to know, because some kind of knowledge is contained in organic structure. The gain of organic knowledge constitutes an adaptation, it means that certain dispositions, determined by the sequence of nucleic acids, increase the chances to acquire energy or reduce the risk to loose it. These dispositions are hereditary in nature and are originally generated by random mutations. What we call knowledge and adaptation is precisely the alterations introduced in the organic constitution and selected for (Lorenz 1975: 32).

Nevertheless, we shouldn't forget that the Modern Synthesis is not adaptationism. Not every trait of organism is considered as an adaptation

8. How does natural selection work and what is thus the nature of knowledge ?

The crucial point to understand is that natural selection eliminates only what is unfavourable and saves what is either beneficial or neutral. This has two major consequences

8.1. Truth means consistency with the surrounding world because it allows to avoid the sieve of natural selection

The cognitive phenotype is required to be true to the same degree as it is consistent. Truth and consistency are equivalent in the sense that if an organism lives, interacts in such a way that it can spread its genes, it means that the organism comes within the scope of what exists apart from it, outside of it. Since we admit that no organism lives in a void, truth becomes the minimal condition for being invisible and avoiding the sieve of natural selection.

8.2. Impossibility of entirely free constructions

In fact, part of our inborn cognition has evolved phylogenetically and has nothing to do with adaptation to the structure of the world. Thus, there is a considerable number of possible organic (cognitive) phenotypes, which are invisible for natural selection⁵. Nevertheless this number is not infinite. Our inborn epistemology could evolve in many, but not in every direction. Evolution has its narrowing constraints (Gould and Lewontin 1994) not every form is possible in evolution. Thus we cannot assert, like constructivists do, that what our cognition submits to us is the result of a process of entirely free construction.

9. Phylogenetically acquired cognition is constructed as much by organisms as by the environment

Organic knowledge is, on the one hand, an internal item, constructed, created and determined by the cognitive apparatus of a perceiver. On the other hand, the nature of the external world delimits and evaluates the possibility and quality of cognitive items. Cognition emerges from interaction with the environment: an organism itself influences its environment, and the environment influences it. Cognition is an active, dynamic process. The internal logos is not a static given. Organisms live, change and acquire new qualities and knowledge⁶.

Perception and cognition depend on both:

(1) on the one hand, the constitution of the organism, on its organic make-up. Potentially, in the same conditions and with the same selective pressures, a number of different forms and different representations is possible. Nevertheless this number is not infinite, as was said earlier (see point 8.2).

(2) on the other hand, on the evaluation of external world through selection. Cognitive forms which are favourable for their bearer are retained by natural selection and their number increases. Cognitive forms, which are neutral are retained or rather are not eliminated by the action of the natural selection. Cognitive forms which are unfavourable or detrimental for their bearers are eliminated.

Both factors - organisms themselves (as constructivists claim) as well as their environments (as realists assert) - equally determine the nature of cognition.

10. Back to the origin of the pure categories of knowledge

For constructivists (and idealists, like Berkeley), there is no relation between things in themselves and the representations of them (or the ideas in Berkeley's sense). We cannot and we don't need to prove the existence of the external world nor the reliable relation between

⁵ The lack of adaptation does not exclude the conservative action of natural selection. Natural selection does not equal adaptation.

⁶ It also is obvious that human cognition is greater than the knowledge of a bacteria and that the progress of phylogenetic acquired knowledge takes place in the evolutionary process, that there is a progress in organic evolution, in evolution of cognition.

things in themselves and the content of experience, of representations or ideas. However, as it has been shown, this argumentation is based on dualistic suppositions about an ontological difference between the knowing subject or mind and the object of knowledge or body, which is rejected by the monism of the Modern Synthesis. On this view, one question - that need not be asked for constructivists - should be reinstated. It is the question of origin: how did the Kantian synthetic a priori come into existence? How does the structure of the nature print itself on the internal structure of cognition of organisms? To use Heraclitos' terms: what is the relation between the universal logos and our own internal logos?

The sensitive point lies in the origin of these categories. Solipsists and constructivists meet again on Kant's point, that concepts of understanding are pure forms of intuition because they precede and structure all experience. Our forms of intuition, our categories of understanding, the forms of 'logical functions of judgment'⁷, the necessary conditions to conceive of any objects, which Kant defined as synthetic judgments a priori, are true and universally valid without being analytic or derived from experience.

11. The ontogenetic a priori is phylogenetic acquired knowledge

In the Modern Synthesis, the question of origin was clarified as follows: the ontogenetic a priori is phylogenetic acquired knowledge. It implies that a priori truths are not purely analytic but are full of empirical significance. For the Modern Synthesis, *the pure forms of intuition* are also prior and constitutive for any cognitive act, but they are neither necessary nor universally valid. They are innate, as they were for Kant, but today *innate* means innate in ontogenetic perspective, and acquired in phylogenetic perspective.

Our cognitive system is explained precisely as a product of the evolutionary process. Thus, cognition is considered as an adaptation - is claimed to fit the real world that cognitive structures reflect, is supposed to be isomorphic, homomorphic, conform, congruent, convergent, and at least partially correspondent with the outside world. We find in Konrad Lorenz's writings: "*the categories and modes of perception of man's cognitive apparatus are natural products of phylogeny and are adapted to the parameters of external reality in the same way, and for the same reasons, as the horse's hooves are adapted to the prairie, or the fish' fins to the water.*" (Lorenz 1975: 37)

12. If mathematics has an origin (it is just another object of the evolutionary process), they are not objective, absolutely universal, and mind-independent

The knowledge, and of logical knowledge as well, is not merely a product of adaptation: the laws of logic and mathematics are aspects of the law of adaptation itself, emerge naturally from evolutionary processes, where they are fully implicit. Logical laws are not just the product of historic evolutionary processes. They themselves are an intrinsic part of this process, they are constituents of this very process.

Organisms' reasoning is not just a product of the evolutionary processes. If so, we would be back to the old question of where the laws of logic come from, as for Plato, for whom some kind of rational heaven existed, which he called Pleroma, but never described in details. According to the Modern Synthesis, the laws of logic or mathematics are neither pre-existent nor independent. They are identified with the evolutionary processes themselves⁸. It is not just only that the evolutionary pressures shape an organism to pre-existent, independent, extra-subjective realm and that the organisms simply obey external logical conditions. They engender the rules of logic or mathematics: they are these rules. For Kant, the most basic laws of nature, for instance the truths of logic or mathematics represent the systematic structure of

⁷ According to Kant knowledge is always expressed in a judgment.

⁸ See William Cooper's thesis (Cooper 2001), that the principles of pure reason are propositions about the very evolutionary processes, indeed are evolutionary laws.

the world of our experience, they are true for the phenomena, but don't say anything about noumena. Nevertheless, for the Modern Synthesis, those rules of logic or mathematics are manifestations, expressions of the matter. Logic, mathematics and knowledge generally are nothing but the effect of the action of the matter and have no existence of their own, independently of their material vehicles.

According to the Modern Synthesis, the nature of knowledge is immanent, because knowledge is contained in a being and results from the very nature of that being. The nature of living beings is supposed to be materialistic, so knowledge could exist only with a materialistic support.

In this context, the phylogenetically acquired knowledge and, among it, the rules of reason, can be identified with the way it is manifested: i.e., with behaviour. What we can observe is that certain *external* (in relation to the subject) conditions interact with *internal* conditions of the organism himself. For unicellular organisms, like bacteria, the distinction between the inside and the outside is simply defined by a membrane (let us think of unicellular organisms). It has been said that some stimuli entail some specific response, some adapted behaviour. This is precisely the manifestation of logic; this is what is behind the notion of logic we use. As was mentioned about the ontological status of information, logic exists in the very organic structure, and can be identified with the physical constitution of which is made up.

Because we share a great proportion of genetic inheritance with the realm of animals and plants, to some degree logical and mathematical rules evolved commonly during the evolution of plant, animal as well as human cognition. Let us take into consideration the basic logical rule of inference, the basic law of thought : *modus ponens* (if the first, then the second; but the first; therefore the second). This principle can be associated with the basic processes of homeostasis generally observed in the living world, and among others in the earliest forms of life, namely feedback loop processes⁹. The latter describe information processing in nature and can be metaphorically considered as a kind of cognitive process, which means the acquisition of some information, of some objective knowledge¹⁰. It takes place even at the basic level, as in the case of simple stimulus-response relation.

So *modus ponens* and feedback loop processes can describe for instance how bacteria are able to manage in their mezzocosmos by responding to differences of stimulus intensity. The search for food and the avoidance of dangerous molecules of *Escherichia coli* consist of an alteration: run/tumble (Dusenbery 1996: 68). Thanks to just one sensor and the ability to change its position, *E. coli* can *infer* the concentration of some substance. The search strategy is the following: if conditions improve then move in some direction, keep going. If not, try a new direction through tumbling. When the concentration of glucose increases, *Escherichia coli* reduces the number of *tumbling*. If there is no glucose or in the presence of benzoate, which is a repellent, the rotations of the flagella are more frequent, which makes that the bacterium tumble and therefore it goes in a new random direction¹¹.

Knowledge, for instance logical knowledge, is immanent, intrinsic in relation to the matter with which it can be identified. There is no essence behind its laws. Since we know the evolutionary origin of universals, categories of cognition etc., we know their nature: not absolute, not necessary local optimizations. We also know their extension: they exist in

⁹ Feedback loop process — where the output of a system causes (positive or negative) changes to the system. If the output becomes too great, it acts through the feedback loop to reduce itself.

¹⁰ Konrad Lorenz's example of Paramecia, that its reaction to the stimulus from the outside and its movement means that this Paramecium possesses objective knowledge about the real world (Lorenz 1975: 12).

¹¹ We can multiply examples: when *Caulobacter* is in a wet environment, it is fixed to the ground. But if the weather is continually dry, the bacteria reproduce and develop a flagellum, which enables them to move to a wetter environment.

human, in animal, in every living organism, as we share genetic inheritance and organic cognition. So the laws of nature, the laws of logic and mathematics are what is invariant and constant in cognitive make-up. They are not objective, absolutely universal, mind-independent but specific to humans and other living forms on the Earth. Truth, in the classical Aristotelian sense, as a coincidence of a representation with reality, is impossible, because the representation exists in some organism. It is not external, objective, independent from how and in what it exists. Perceptual content is intrinsically an experience of some perceiving apparatus, is necessarily from some perspective, and is determined by the very organic organisation of given perceiving subject. Yet, reality still has its independent ontological status.

13. One constant of the Modern Synthesis: variability

The Modern Synthesis does not work in essentialist terms as substance and accidental attributes¹². This view is free of the search for an essence, for a first cause of everything. The accidental does not imply the necessity of existence of the essence. There is no need to search for the essence in what is accidental. The variability and temporality of what appears to our cognition is worth as much as the eternal and immutable essence, whose ontological status is uncertain. The ultimate basis of reality, the constant we would research in the principle, in the essence underlying the universe, is precisely in that incessant variability: this is the only constant. Nevertheless, it is incredibly astounding and stunning to replace the very notion of essence.

14. Conclusions

Thus, we can see that there are tight connections between the way that we consider the nature of evolution, the nature of the living world and the nature of knowledge, between Synthetic Theory of Evolution and Biological Evolutionary Epistemology. According to how we comprehend the nature of the natural selection and its role on modelling organic forms of cognition, Evolutionary Epistemology can go the way of metaphysical realism, or follow the trail of constructivist speculations. Nevertheless, as has been shown, if Evolutionary Epistemology claims to agree with the Synthetic Theory of Evolution, it cannot defend and follow the second way.

Acknowledgements

I would like to express my most profound respect and gratitude for my dear Professor Jerzy Krakowski. Tragically, his time is finished. But my memory of him is not.

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¹² (essence / accident - lat. *per se* / *per accidens*).

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