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Chapter 22
From Konrad Lorenz's "Phylogenetic Apriorism" to the Birth of Evolutionary Epistemology

Marco Celentano

Abstract This paper discusses the role that Konrad Lorenz, already known as the founding father of comparative ethology, played from the 1940s in the birth and development of a new research area, important for its philosophical and scientific fallout: Evolutionary Epistemology (EE). The first and second sections examine the auroral phase of this process: the successful collaboration between the young Lorenz and the philosopher E. Baumgarten; their attempt to rework the Kantian doctrine of knowledge in the light of the Darwinian theory of selection and evolution; the landing of Lorenz to a first formulation of his "phylogenetic apriorism" with the essay *Kant's Doctrine of the* A Priori *in the Light of Contemporary Biology* (Lorenz in Kant's doctrine of the a priori in light of contemporary biology 1941). In this paper, Lorenz elaborated the theoretical core of an original synthesis between Darwinism and Kantism, and between ethology and theory of knowledge, which later, in *Behind the Mirror*, led him to conceive the anatomical, morphological and behavioral differentiation of the species as a "process of acquisition of knowledge" (Lorenz in Behind the Mirror. A Search for a Natural History of Human Knowledge. Meuthen& Co, London, 1973). The following sections examine the development of EE from the 1970s to the 2000s. In the early 1970s Lorenz's "Search for a Natural History of Human Knowledge" seemed to converge with the reflections independently developed by the philosopher K. Popper and the psychologist D. Campbell. From the dialogue between the three scholars stemmed the first program of Evolutionary Epistemology (EE): an "integrated theory" that aimed at clarifying both the continuities and differences between biological evolution and human socio-cultural development. The analysis shows how, apart from some common general assumptions, a number of fundamental divergences emerged among the EE's founding fathers, specifically regarding their explanation of the internal organization of living beings and of the human social, cultural and scientific evolution, which, notwithstanding their efforts, turned out to be impossible to reconcile. The penultimate section provides a concise chronology of EE developments. The last section outlines, in the form of a work in progress which needs

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further development, the profile of an *ethology of knowledge* which, starting from Lorenz, should take into account the development of contemporary ethological, epigenetic and evolutionary research.

Keywords Philogenetic Apriorism · Natural History of Knowledge
Evolutionary Epistemology · Ethology of Knowledge · Self-regulating activity

22.1 Introduction

This chapter synthetically reconstructs the historical and theoretical context in which Konrad Lorenz's phylogenetic apriorism, his "Naturgeschichte menschlichen Erkennens", and Evolutionary Epistemology (EE) had their genesis. I conclude by showing some points of divergence and open issues that persisted in the early formulations of EE, due to the contributions of its three founding fathers: K. Lorenz, K. Popper and D. Campbell.

Konrad Lorenz is known for various academic achievements. He is considered to be one of the founding fathers of comparative ethology, and a first promoter of Evolutionary Epistemology (EE). In 1973 he was awarded the Nobel Prize for Physiology and Medicine, jointly with Karl von Frisch and Nikolaas Tinbergen. Nevertheless, he also was one of the most controversial scientists of the twentieth century.

I consider that Lorenz contributed more than any of his contemporaries to introduce the study of animal behavior, and the discovery of the "selective" and "cognitive" dimension behind it, in the scientific and cultural community. By laying the foundations of a historical and phylogenetic approach to the study of animal behavior, Lorenz's work, maybe not less than those of Darwin, Freud, or Nietzsche, paved the way to a deeper understanding of the human feelings and actions. For these reasons, in the second half of the twentieth century, many people saw in him the naturalist who brought to maturity one of the most important aspects of the Darwinian revolution.

However, as a result of his adhesion to National Socialism in the late 1930s, of the importance he attributed to the hereditary components of behavior, of his mechanistic explanation of aggression and his unfounded concern about an alleged "genetic deterioration" of human species, another part of the public opinion and intellectual community started to perceive Lorenz as a leading figure only in biological determinism and social biologism.

Since the beginning of the new millennium, studies such as those of his former collaborator Norbert Bischof (1991), of the ethologist and primatologist F. de Waal (2001), of the authors of the collected book *Konrad Lorenz und seine verhaltensbiologischen Konzepte aus heutige Siche* (2001), edited by K. Kotrschal, G. Müller, and H. Winkler, introduced more balanced pronouncements on the role that Lorenz played in the history of the behavioral sciences and about his scientific legacy.

Over the past twenty-five years I have been involved in generating a critical discussion on both the theoretical limits and the ideological implications of Lorenz's positions, as well as on the innovative aspects of his research (Celentano 2000; Celentano 2011; Celentano and Stanzione 2005). One of the purposes of my research is in fact to facilitate the further investigation of Lorenz's fertile insights which still have not been adequately explored from an empirical and theoretical perspective.

22.2 Biology and Philosophy: The Meeting Between Lorenz and Baumgarten (1940)

On September 2nd of 1940, Konrad Lorenz arrived in Königsberg, Immanuel Kant's hometown. He had been offered the chair of Comparative Psychology at the Albertus Universität, where the great illuminist philosopher had taught for almost fifty years. Lorenz's major sponsor in that place was Eduard Baumgarten, full professor of Kantian Philosophy and thinker pragmatically oriented, follower of John Dewey and expert in the work of Ralph Waldo Emerson, Nietzsche, and Max Weber. He was interested in a critical interpretation of the Kantian philosophy and went looking for "a second teacher with gnoseological interests, but at the same time endowed with a solid biological background" (Wuketits 1990: 60). In Königsberg, he "brought together for evening discussions very bright scientists and men of letters, with the ambition of paving the way to a theoretical and methodological synthesis of the two fields" (ibid.), and in the Institute he co-directed with Lorenz, "philosophical anthropology was combined with comparative behavioral research" (Lorenz 1992: 75). At that time, they both were active members of the *Kant Gesellschaft Königsberg*, and promoted within it heated debates.

Lorenz remained in Königsberg only thirteen months, after which he enlisted in the army.[1] In this brief time, however, he sketched with Baumgarten a *phylogenetic and "non-transcendental" interpretation of Kant's theory of knowledge* which would become, in the second half of the twentieth century, the first pillar of Evolutionary Epistemology. Lorenz summarized this theoretical position in the essay *Kants Lehre vom Apriorischen im Lichte gegenwärtiger Biologie* (1941), published in the *Blätter für deutsche Philosophie*.[2]

As Donald Campbell remarked, in writing *Kant's Doctrine of the* A Priori *in the Light of Contemporary Biology*, "the young Lorenz creatively solved a major epistemological puzzle" (Campbell 1975: 96). Lorenz remarked later that this puzzle had already been evidenced by Kant himself: "§ 11 of the *Prolegomena to*

[1]Lorenz went to Königsberg on September 2nd, 1940, and joined the army on October 10th, 1941.

[2]The work was first translated in on Bertalanffy, L., Rapoport, A. (Eds.) *General Systems, Yearbook of the Society for General Systems Research*, vol. III, 1962: 23–35,, and later reprinted in Evans, R. I. (1975): 181–217.

Any Future Metaphysics: 'If one were to entertain the slightest doubt that space and time did not relate to the *Ding an sich* but merely to its relationship to sensuous reality, I cannot see how one can possibly affect to know, a priori and in advance of any empirical knowledge of things, i.e. before they are set before us, how we shall have to visualize them as we do in the case of space and time'. Kant was obviously convinced that finding an answer to this question in terms of natural science was impossible. The fact that our forms of ideation and categories of thought, in contrast with what Hume and other empiricists claimed, are not the products of individual experience, Kant found clear proof that they are logically necessary—a priori, and therefore cannot have 'evolved'" (Lorenz 1973: 9).[3] Building on Kantian premises, i.e. on a pluralistic realism acknowledging the reciprocally independent existence of "external" entities and of a "subjectivity" that experienced them, and on a theory of knowledge founded on the acknowledgment of "a priori forms of sensibility" as *conditions of possibility of experience*, Lorenz intended to demonstrate that a consistent response to Kant's problem *was made possible by the Darwinian theory* or, better, by a specific interpretation of it. He wrote:

> The system of sense organs and nerves that enables living things to survive and orientate themselves in the outer world has evolved phylogenetically through confrontation with an adaptation to that form of reality which we experience in phenomenal space. This system thus exists a priori to the extent that it is present before the individual experiences anything, and must be present if experience is to be possible (ibid.).[4]

In other words, organisms are pre-adapted, already from birth, to the interaction with a given environment and human mind itself is pre-adapted to this interaction, but this condition is an a priori *only for the individual, not for the species.*

22.3 "Phylogenetic Apriorism": The First Lorenz's Synthesis Between Darwin and Kant (1941)

As noted by Franz M. Wuketits, Lorenz was attempting "a synthesis between Kant's theory of knowledge and Darwin's theory of evolution" (Wuketits 1990: 83). A deep understanding of anatomy and behavior of organisms enabled him to provide new empirical foundations for a concept already given philosophical clarity

[3]The quotation of Kant, contained in the chapeter 11 of *Prolegomena to the* Critique of Pure Reason (1783), is quoted from the English edition of Lorenz 1973 mentioned in the References.

[4]Lorenz's formula "what is a priori for the individual is a posteriori for the species" was not an absolute novelty in the post-Darwinian epistemological debate. In a 1876 anthology of earlier journal articles, St. George Mivart wrote, criticizing Scottish sensism: "in this way Mr. Spencer conceives that what is a priori to the individual is but a posteriori to the race and he thus claims to have reconciled the two schools of thought, namely, those who assert and those who deny the derivation of our ideas exclusively from sensation and experience." "As it is manifest, however, he went on: "He gives the substantial victory entirely to the sensists, and denies to all ideas any higher origin than mere incipient sentiency" (Mivart 1876: 425).

by Nietzsche: the true possibility of experience is not to be found in a (non-existent) transcendental structure of reason, immutable and free from historical and empirical influences, as maintained by the Kantians. The real subject of experience is the human body, as a product of natural, social and individual history (Nietzsche 1882).

According to some, this conception was already present in the confutation of Idealism attempted by Kant in the second edition of *Critique of the Pure Reason* (1781; 1787). As Aldo Masullo remarked, Kant's transcendental idealism was primarily aimed at undermining the "immaterialism" and "spiritualism" upheld by Berkeley and Descartes. It was meant to overcome that form of idealism which frames the subject into an incorporeal dimension, and defines the object as "mere subjective representation". In this sense, "if never explicitly [...] the theme of corporeality of subjects constitutes the unifying focus of Kantian theoretical thought" (Masullo 1986: 34).

Kant's failure to make this theme completely explicit, however, had important theoretical consequences, highlighted by Lorenz in his 1941 essay: "The only thing we can assert about the thing-in-itself, according to Kant, is the reality of its existence. The relationship which exists between it and the form, in which it affects our senses and appears in our world of experience [...] is determined by the ideal forms and categories of intuition" (Lorenz in Evans 1975: 182) which cannot be related "to the laws inherent in the «thing-in-itself» by abstraction or any other means" (ibid.).

Hence a radical dualism, according to which the value of a priori forms of reason is considered "in principle independent from the laws of real nature, based only on the faculties of the subject, while the thing in itself appears in principle unknowable". For Lorenz, this interpretation generates some questions that biologists have to "ask [...] of Kant":

> Is not human reason with all its categories and forms of intuition something that has organically evolved in a continuous cause-effect relationship with the laws of the immediate nature? [Can an organ] ...that has evolved in the process of continuous coping with the laws of nature have remained so uninfluenced that the theory of appearances can be pursued independently of the thing in itself, as the two were totally independent from each other? (1975: 183).

Lorenz's second step was to translate the Kantian concept of "a priori form of sensible intuition" in that of an *historical state of pre-adaptation of the organs*, produced by selection and heredity (the "experience of the species"), which is the *necessary condition for both existence and experience for each and every individual*. To Lorenz, the conception of the "a priori" as an organic function "means the destruction of the concept: something that has evolved in evolutionary adaptation to the laws of the natural external world has evolved a posteriori in a certain sense" (ibid.).

The third theoretical step, in the final section of the essay, consists in the attempt to demonstrate how some categories, or some central conceptual nexuses such as causal relation, may have originated from genetically and physiologically based learning programs, i.e. the conditioned reflex. To Lorenz, human understanding

"does not prescribe the laws of nature" (1975: 186): quite like the horse's hoof, it continually stumbles over "unforeseen changes in its task, highlighting the inadequacy of its hypotheses":

> [...] the fundamentals of pure reason are just as imperfect and down to earth as the band saw, but also just as real. Our working hypothesis should read as follows: everything is a working hypothesis. This holds true not only for the natural laws, which we gain through individual abstraction a posterior from the facts of our experience, but also for the laws of pure reason. The faculty of understanding does not in itself constitute an explanation of phenomena, but the fact that it projects phenomena for us in a practically usable form onto the projection screen of our experiencing, is due to the formulation of working hypotheses; developed in evolution and tested through millions of years! (1975: 199).

Precisely the fact that human beings, since they exist, have had to interact with beings and phenomena that do not passively submit to their efforts to "shape" them, precisely the experience of these "resistances" from the external environment, accumulated in the biological and cultural patrimony of our species, ensure, within limits, that we can actually rely on the capabilities we possess.

Despite the unbridgeable gap introduced by these theoretical shifts, Lorenz did not ignore many points of substantial convergence between Kant's transcendental idealism and his own genealogical materialism. Like Kant, he opted for a "critical realism", while distancing himself from any form of "naïve realism":

> [...] we are perfectly aware that what exists in itself will never be completely at hand, except within the limits imposed even to theoretically higher living forms by the categorical forms of our thought, [...and] even if we as natural scientists are in a certain sense naïve realists, we still do not take the appearance for the thing in itself, nor the experienced reality for the absolutely existent! (1975: 191).

Compared to the Kantian model, Lorenz's approach both strengthened and weakened human pretensions in the cognitive field. Whereas Kant's transcendental idealism stated the impossibility of a positive knowledge of real aspects or features of things, according to Lorenz's hypothetical-critical realism "evolutionary success does not entail that all our innate hypotheses be true, but only that they cannot be completely false" (Vollmer 1984: 49). As Riedl later remarked, no organism could survive if its sensory organs and relational modalities did not put it in the condition of detecting *any real feature* of the elements it *really* deals with in its own environment (Riedl 1980: 56). In this perspective, the very fact that organisms can interact with other entities in a way functional to their survival demonstrates *a positive knowability of real entities or processes and an actual capacity of knowing*, present in different forms and degrees in every living being. It shows that the relation "between the real within and the real outside ourselves" is "explorable in principle" but always and only indirectly through an understanding that is constantly put to test *vis à vis* everyday acting and living which is not absolutely true or false, but rather more or less useful to face the needs, the circumstances and perils of life.

22.4 *Behind the Mirror*: The Attempt a "Natural History of Human Knowledge" (1973)

It was only a quarter of century later, with *Behind the mirror* (1973), that Lorenz tackled again the question of the genesis of animal and human forms of knowledge.[5] In this work, the genealogical approach to the theory of knowledge was recast in a model comprising, besides the phylogenetic version of apriorism, a critical interpretation of *Darwinism and neo-Darwinism*: a re-formulation of the problem of understanding, but also of the theory on the origin and transformation of the species. In the "Epistemological Prolegomena" which opened the work, Lorenz subtly criticized the position expressed a few years earlier by Jacques Monod in *Chance and Necessity* (1970) by observing how "it is undeniably true, yet at the same time misleading, to say that living organisms are at the mercy of purely random changes and that evolution only takes place through the elimination of the unfit" (Lorenz 1973: 27). In his polite rebuttal of Monod's claims, Lorenz was actually marking his own distance from a specific interpretation of the neo-Darwinian canon, springing from contemporary advancements in molecular biology. In a nutshell, the interpretation consists in the idea that evolution is essentially based on the interaction between two factors: *chance*, embodied in the favorable genetic mutations, and *necessity*, embodied in external selection. Lorenz, instead, stressed a third factor, namely, the "extremely active" care of their living conditions which all the organisms manifested through their behavior and physiology.

In other words, his interpretation implied that living beings search in an "eminently active" way and tend to accumulate "both a fund of energy and a stock of knowledge, the possession of the one being instrumental to the acquisition of the other" (ibid.). According to Lorenz the lack of appreciation for this "exploratory" aspect of behavior makes it impossible to account for two fundamental features of the evolutionary process, its "speed" and its "directness", without resorting to metaphysical and finalistic hypotheses. If evolution "depended simply on the random elimination of the unfit, then the period of a few thousand million years which has been calculated by physicists, on the base of the rate of decay of radioactive substances, to be the age of our planet would hardly be long enough for man to have evolved from the most primitive organisms" (1973: 28). By the same token, the appearance of beings endowed with a growing degree of organic complexity and behavioral capacities, which he considered an established fact, can be explained, without resorting to teleology and ultimately to theology, only by acknowledging that life is at the same time a process of acquisition of information.

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[5]Important intermediate steps were two of Lorenz's writings on which I cannot dwell here: Die angeborenen Formenmöglicher Erfahrung (1943; *Zeitschriftfür Tierpsychologie*, 5: 235–409) and *Die Naturwissenschaftvom Menschen*. (posthumous 1992; Engl. Transl. 1995: *The Natural Science of the Human Species*. Cambridge Mass. and London: Mit Press).

The history of living systems can be described as a process of knowledge acquisition, meaning that organisms, in order to survive and reproduce, have had to learn to distinguish the things that have an impact on their physiological condition and their chances of life, in order to exploit or avoid them. This means organisms have turned their own living conditions and the factors influencing them, into *objects of knowledge*, however indirect, without this process implying any form of predestination. Organic evolution "does not follow a predetermined plan" but derives its direction from the *reciprocal selection among organisms*, from their attitude to explore both the external environment and their behavioral capabilities, from their active search for a construction of specific internal and external conditions.

This is why, following Lorenz, organic history can be understood without reference to any kind of determinism, be it finalistic, genetic or environmental. In *Behind the mirror*, the ethologist was therefore proposing a general reinterpretation of Darwinism, in which *differentiation and preservation of living species are conceived as effects of a "process of acquisition of knowledge"* in the sense of an *increase, selection, and differentiation of "information"* actually embodied and potentially embeddable in organisms themselves, and usable to the survival of individuals and species.

From this perspective the living organism, whatever its level of internal complexity may be, can never be considered an entity simply *undergoing* an external selection: it must be considered, at the same time, as a *selecting agent.*

The behavior of organisms is therefore to be analyzed as both a *product* of phylogenetic, social and individual history and as one of the main selecting factors orienting phylogeny itself and, along with it, the history of the species.

22.5 The Bird of Evolutionary Epistemology and the Problematic Companionship Between Lorenz, Popper and Campbell (1974)

The earliest version of EE sprang from the integration of three independently developed approaches: those of K. Lorenz, K. Popper and D. Campbell. The latter, then less known than the others, was a psychologist interested both in the theoretical aspects of Lorenz's approach and in the evolutionary reinterpretation of the falsificationism propounded by Karl Popper since the 1960s; it is to him that we owe the invention of the formula "Evolutionary Epistemology" (EE) (Campbell 1974). Campbell conceived EE as a research program targeted to an "integrated theory", task of which was to identify analogies and differences between biological and socio-cultural human evolution, biological adaptation and scientific progress. In the perspective of its founders, EE implied first of all "the hypothesis that biological evolution in itself represents a cognitive process, independent from the appearance of the human species" (Somenzi 1996: 238) and the conviction that the human condition is a "product of biological and social evolution" (Campbell 1974: 413).

The common denominator among processes of such diverging order, complexity and origin, is to be found, according to EE, in the process based on "trials" and selective preservation of efficient solutions, which underlies both natural selection and individual associative learning. This process would have its most meaningful precedent and *functional* analogue (not teleologically oriented and not responding to any conscious immanent or transcendent design) in the "positive" interaction between genetic variance and environmental selection, which neo-Darwinism took as the moving force of biological evolution. The process of natural selection, favoring in terms of differential reproduction the organisms best fitted to their environments, *produces effects analogous to a learning process, unrolling through trials and errors*. In other words, natural selection and descent, without being pre-oriented in any direction, have de facto triggered a process leading to the elimination of errors, seen as inefficient solutions to the problems of survival and reproduction, and to their replacement with more efficient forms of behavior and internal organization. According to Lorenz, Campbell and Popper, from this first form of "learning of the species", in the course of phylogeny, all individual learning configurations, from the simplest to the most complex, have developed and differentiated.

But despite these important points of convergence, and Campbell's attempt to mediate them, Lorenz and Popper's theoretical positions presented irreducible differences. Popper's approach to Evolutionary Epistemology was founded on the "genetic dualism", a theoretical formulation admittedly very close to "a mind-body dualism". It presupposes the possibility to identify, already in "very simple organisms" and *a fortiori* in the more complex ones, an organization based on "two distinct parts: roughly speaking a behavior-controlling part like the central nervous system of the higher animals, and an executive part like the sense organs and the limbs, together with their sustaining structures" (Popper 1972: 273). Each organism, then, would be divided into a "aim-structure" and a "skill-structure" and, according to Popper, in the course of phylogeny the development of teleological structures has preceded and favored that of the performative structures, so endowing evolution with a course ever less subject to chance and progressively characterized by *orthogenetic* developments. "Once a new aim or tendency or disposition, or a new skill, or a new way of behaving, has evolved in the central propensity structure, this fact will influence the effects of natural selection" and this, to Popper, meant "that the evolution of the executive organs will become directed by that tendency or aim, and thus 'goal-directed'" (1972: 278).[6]

[6]In a later work, titled "Clouds and Clocks" (originally the 1965 *Arthur Holly Compton Memorial Lecture* delivered at Washington University), Popper further articulated this model, defining evolution as "development of a hierarchical system of plastic controls, embodied in animal organisms and developed also *esosomatically* by the human species". In this context, Popper claimed that animal knowledge is actually capable of solving a set of real problems and of selective activities functional to self-preservation. This capacity, however, does not necessarily imply a "conscious counterpart". Despite this display of awareness, he later kept framing all cognitive activities in the dualistic model proposed in 1961, in which cognition is idealistically conceived as a rigid succession of mental representation of the aim and consequent material action.

Lorenz's mastery of comparative anatomy made him well aware that this hypothesis was untenable in the case of "lower" organisms, devoid of a centralized nervous system. Popper's dualism arbitrarily extends to all or almost all living organisms a model, derived from the neurophysiologic organization of 'higher' animals, endowed with a central nervous system (a level of organization arising only in a very advanced phase of phylogeny). Cognitive performances of some complexity are, instead, observable in the protozoans or lower metazoans, whose physiological organization shows no trace of the division between two different mechanisms devoted to central coordination and executive performances, adumbrated by Popper.[7] But in fact, according to Lorenz, even for "higher" organisms Popper's dualistic model was valid only in part. In almost all his works, Lorenz remarked how the nervous structures originated from the integration of parts "already functioning", with a certain degree of reciprocal autonomy, and that, at each stage of evolution, the integration is only partial and never devoid of dysfunctions.

Popper, instead, opted for the inclusion of all animals in the genetic-dualism model, to the point of denying the distinction, then common among biologists, between "sense"[8] or "excitability", considered present in all living cells, and "sensation", traditionally restricted to the animal world. One must admit that, considering present developments in plant ethology, that on this point Popper was ahead of his times when he observed that plants "do have something like sensations or perceptions" (Popper 1990: 35).[9] However, the point at stake here is mainly philosophical. Even though he was not arguing for "conscious" knowledge processes in other organisms, Popper, following Kant, maintained that interpreting the behaviors of living beings "as if" they acted according to patterns of finalistic reasoning, analogous to that of humans, was the only way to underscore the active and selective character of those behaviors. On the contrary, in all his works Lorenz tried to interpret the sequences that, in many different animal species, lead from appetitive behaviors to the execution of a "consummatory act",[10] taking into

[7]In coelenterates (*medusa*) we find "groups of cells with specialized perception, sensitive to light and to position equilibrium. Some kind of cephalic specialization, however, still very far from a proper central nervous system, appears in the phylogenetic line only with anellids. In the anellids one observes "a metameric system, with groups of nerve cells (ganglia) organized in pairs, in every ring" anterior to the sense organs. In insects "besides metameric groupings, made more numerous by the fusion of metameres [...] emerges a very advanced specialization of the system of cephalic ganglia, anticipating the future development of a brain" (Fancello 1985: 110-111).

[8]"The capacity to react to stimuli (excitability) is a basic property of all living organisms, including plants" (*Nuovo Atlante Biologico*, Milano, Garzanti, 1989: 339).

[9]For an updated overview of the sensory and perceptual plant systems see Baluška, Mancuso, Volkmann, Dieter (Eds.) (2007).

[10]A "consummatory act" is defined as the final sequence of a hereditary motor co-ordination, as distinct from the "appetitive behavior" (active search of triggering stimuli) preceding it and "in natural conditions, leads to the disappearance of the pulsion" (Craig et al. 1918). In complex motor sequences, however, "an act may represent at once an 'appetitive behavior' for what follows and a 'consummatory act' for what precedes" (Heimer 1977: 32).

account the fact that, to the animal, each and every phase of the sequence is "self-compensatory" and acts as a sort of "present aim" (Lorenz 1937: 298).

22.6 Lorenz's Approach to the Problem of Mind/Body Relationship

More broadly, Lorenz's own position on the mind/body relation differed from that of Popper's on dualism: his approach was *monistic*, albeit of a special brand. More precisely, on a theoretical level Lorenz combined an ontological monism (theory of body/mind identity) with a "gnoseological" dualism, acknowledging the existence, within human experience, of a hiatus between the mental and the bodily. On a procedural level, this position was supported by a methodological parallelism entitling us to "draw our knowledge both from physiology and phenomenology" (Lorenz 1977: 4).[11] By "phenomenology", Lorenz here means the methodical self-description of subjective experience in its inception. In the opening pages of *Behind the Mirror*, in explaining the theoretical groundings of his analysis, Lorenz summarized this position into two postulates:

- Identity between living body and experiencing subject (*Lieb* and *Subject*), the main consequence of which, as already stated in the Russian Manuscript, is that "Spiritual processes *simply do not exist* without parallel processes operating in a living organism" (Lorenz 1992: 158).
- Coexistence, with an "identical degree of reality", of subject and object of knowledge. Knowledge, accordingly, results from the interaction of these two poles, none of which can be dispensed without leading to paradoxical conclusions.

Lorenz returned on this same question in *The Waning of Humaneness* (1983), the sixth chapter of which is devoted to the soul (*Seele*)—body problem. Here he criticizes and rejects the two main classical hypothetical solutions to the problem, namely "reciprocal action" and "psycho-physical parallelism", and proposes a third hypothesis, that of "identity", as the only consistent one with EE.

His criticism of the reciprocal action hypothesis, according to which physiological events are the cause of the parallel subjective experiences, which in turn

[11]Against Behaviorism, Lorenz argued that behavior does not coincide with its motor components visible to, or induced by, an external observer. On the contrary, it also comprises activities triggered by internal processes and others that are only manifested through internal processes of the organism, being therefore only recognizable by that living subject and not by others. These last, however, can become manifest at an observable level through direct symptoms and clues, e.g. facial expressions, eye micro-movements etc. In this sense, Lorenz's theory equated thinking, internal representation of objects, activities and/or situations, imagining and daydreaming, reasoning and questioning and the very activities of perceptive discernment not involving appreciable movement, to motor modalities, all of them being *behavioral forms*.

retroact on the physiological sphere, is summarized in a classical example. The effects of a sudden slap can be described either from a "subjective" or from an "objective" (neurophysiological) standpoint. In the first case we would say that "the slapped person senses shock and feels pain [...] but within seconds his depression gives way to rage (Lorenz 1983: 91). In the second, we will record that "a severe jolting of the head and the atlas vertebra along with simultaneously vigorous stimulation of certain sensory nerve ends produces, in the sympathetic nervous system, an abrupt decrease in the tone and contractibility of smooth muscle; this effect spreads to the central nervous system and a temporary paralysis of the voluntary musculature follows". Soon after, "the blood flows back into the head (ibid.), while "the sunken eyes bulge out and, instead of sagging muscles, motor excitation sets in" (ibid.). In both descriptions, the slap is assumed as the cause of both physiological and emotional reactions. To Lorenz, this was the correct interpretation, while it was wrong to interpret one kind of reaction as the cause of the other. Between psychic experience and its underlying physiological process, the following relation exists: "the one cannot be the cause of the other since, in a certain sense; the one is itself the other, except that it is experienced from the other side" (1983: 91–92).

The hypothesis of psycho—physical parallelism, according to which "two such chains of events [...] proceed parallel to one another but, basically, stand in no logical relationship to one another" (1983: 92) is, instead, rejected by Lorenz through the following argument: "no one contests that all experiential processes are accompanied by neural-physiological occurrences, but this sentence cannot be turned around and remain true. There are highly complicated physiological processes going on within the central nervous system that are equivalent to the most complicated calculating operations known, yet these are carried out completely unconsciously" (ibid.). To Lorenz, then, the only approach "that is tenable for the evolutionary epistemologist" rests on the assumption that "body and mind, physiological and emotional occurrences, are, in reality, in themselves, simply one and the same, and that we experience and recognize them—as we do matter and energy, or energy radiated in the form of wave or particles—by means of two independent and incommensurable cognitive capacities" (1983: 93).

22.7 EE and the Analysis of Human Contemporary Society

Even sharper were the differences between Lorenz and Popper's approaches in the interpretation of organic and human social evolution, and of the effects of modern science and capitalistic economy. Lorenz was highly critical of the idea of an evolutionary process generally following "the direction of a greater completeness of adaptation" (1983: 40), and offered a lot of empirical evidence against it. Despite his intention to correct some "mistakes" of neo-Darwinism, instead, Popper found

himself in general agreement with the idea that organic evolution was explainable as a gradual and progressive emergence of "the fittest", and *extended this model to the interpretation of human social, scientific and political evolution.* For Popper (and similar was Campbell's position on the subject), the "evolution of scientific knowledge is, in the main, the evolution of better and better theories" (Popper 1984: 395) and this is in every aspect "a Darwinian process. The theories become better adapted through natural selection: they give us better and better information about reality. They get nearer and nearer to the truth" (Popper 1984: 396). With these passages, Popper let his original falsificationist position "slip", as he put it, *from the methodological to the theoretical domain*, making it a model of interpretation of *the whole history of Western science* as a gradual progress towards better theories. Unfortunately, history does not seem to confirm this hypothesis: competition among scientific theories led for centuries to outcomes far different from those imagined by Popper. The fact that some scientific theories hindered an adequately critical study of empirical phenomena, favoring instead superstition and social privileges, has been in many instances *the very reason of their success.* On the contrary, the fact that certain theories offer tools for validating truths towards which mass media controllers are hostile lead even today to their being boycotted, as shown by numerous sources. Popper's model, therefore, seems highly simplified and idealized, inasmuch as it arbitrarily removes the processes of conscious and unconscious manipulation of information and processes of social selection of knowledge not aimed at the critical development of knowledge itself, but rather subordinated to other individual or collective goals, such as social control or profit.

After all, Popper extended his optimistic model of organic evolution and modern scientific progress to the political sphere: taking the US system as a model, he maintained that we are actually living in the best possible world, and that "democracies are always open to ideas, especially those coming from the opposition. Far from being masked dictatorships, democracies are always open to self-doubting" (Popper in Arrigoni 1991: 226).

Lorenz dissented from this idyllic approach, which in the last years of his life the same Popper doubted (Popper and Condry 1994), arguing that human socio-cultural evolution, especially in the age of advanced capitalism and triumphant technique, was led by selective processes different from those regulating organic evolution. In *The Wane of Humaneness*, he elaborated a perspective in which the "creative selection" underlying organic evolution "has ceased to influence humans. Creative selection has been replaced by intraspecific selection" (Lorenz 1983: 12). It is intraspecific selection, Lorenz argued, namely the selection of man by man, that determines now the social and biological "direction of development" of human evolution, and it is "our present technocratic world order" that sets the direction (1983: 13). For these reasons, to Lorenz the present democratic systems, just as the past and contemporary dictatorships, were taking on "more and more totalitarian aspects" (1983: 187).

22.8 Timeframes of Developments in EE

The subsequent developments of the EE can be divided into three phases, as I explain below.

The first stage lasted from the mid-1970s to the late 1980s and includes the constitution and developments of the Altenberg Circle (*Altenberger Kreis*), around the ethologist K. Lorenz, the biologist R. Riedl and the philosopher O. Oeser. This circle was an ever-growing interdisciplinary group of scholars, which regularly met at the Lorenz home in Altenberg, to discuss the theoretical implications and possible developments of the "evolutionary and cognitive" approach.

The second phase covered the 1990s and marked the transition, after the death of Lorenz (1989), to a new phase, which conducted to the foundation of the *Konrad Lorenz Institute for Evolution and Cognition Research* (1990–1991), and to the turning point of a "constructivist extension of EE" propounded by its first director, Rupert Riedl (1995). These developments contributed to the introducing EE in the international debate about the "naturalistic" approach in contemporary epistemology. They opened, on the other hand, its approach to so many different theoretical influences and alleged domains of application that the state of affairs caused a weakening of the internal consistency between its basic assumptions and its developments.

The third period started with the new millennium, but it was anticipated by the new lines of research expressed in the programmatic paper *Lean Evolutionary Epistemology* (1998) by W. Callebaut and K. Stotz. At first, it led to attempt a radical reform of the Evolutionary Epistemology and a more rigorous formulation of its basic assumptions. Following the emergence of the evo/devo (evolutionary and developmental) biology pushed scholars as W. Callebaut, G. Müller and M. Pigliucci to grope the ambitious goal of an "extended synthesis" of the contemporary theory of evolution. Their goal was to go beyond the Modern Synthesis of the early twentieth century, and to integrate the results of a broad set of disciplines as molecular archeology, genetics, epigenetics, neurophysiology, cognitive and cultural ethology, of the systemic and eco/evo/devo approaches and the study of evolutionary and cognitive processes (Pigliucci and Müller 2010). This attempt and this research are still now in progress.

22.9 The Contours of an Ethology of Knowledge

I consider that a critical outline of an ethology of knowledge, or of an ethological notion of the cognitive processes, should be drawn starting from the analysis of Lorenz's "Natural History of Knowledge" and of further implications of EE.

These contributions helped to clarify that the ability of organisms to interact with other entities in a way functional to their survival, or helpful to change their quality of life, demonstrates *a positive knowability of real entities and an actual capacity of*

knowing, present in different forms and degrees in every living being. In other words, as Lorenz suggested, they showed that the relation between "the real within and the real outside ourselves" is in principle explorable, but only and always *indirectly*, through an understanding that is constantly put to test *vis à vis* through acting and living, which is not absolutely true or false, but rather more or less useful to face the needs, and the circumstances or perils of life. In line with this premise, I consider that the perspective of an ethology of knowledge must lead to the overcoming of the traditional concept of knowledge as a form of compliance of the ideas to the external things, or *adaequatio rei et intellectus*, and the idealistic concept of the cognitive apparatus as a set of functions delegated to performing a *mere mental representation* of the external environment. In fact, in an ethological perspective, cognitive activities are always simultaneously exploration activities, energy exchange and interaction with the species-specific and inter-specific environment, testing and implementation of the capacity to which the organism is equipped, and *self-regulation activities*. Our cognitive organs developed their skills in the course of the phylogeny, and of the social, cultural and individual history; this means that they *acquired and modified their shape not only through a mental representation of the external environment, but through a material interaction with it*. The brain, or the eye, as the fin of a fish, *rather than merely representing an external environment, serve to move in it, to interact with it, to implement vital and social functions*. In this sense, the cognitive activity, as much as the bio-semiosis, manifests itself in all living beings, in different forms, as *a production of behavioral forms*, i.e. as a production of forms of interacting between the organisms and the external environment, and between the internal components of each individual organism, and a self-regulating activity, or an active change in their conditions of life and physiological states.

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