KNOWLEDGE FOR EDUCATION

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Keywords: Knowledge, education, cognition, epistemology, biology, evolution, Bayes' Theorem, information

Contents

Summary

Education as a way to knowledge has a pure humanistic aim. A few basic sciences provide the fundamentals for the scientific method of cognition of out-of-subject reality, taking into account the inner processes and conditions of the subject itself. Mayr's concepts of *teleonomy* and Lorenz's concept of *knowledge* were created particularly to assist understanding of the processes of natural selection and adaptation. The latter is the increase of mutual *information* between an organism and the world around it, proceeding asymmetrically without any noticeable change in the properties of the world.

Under conditions of causality, the *retrospective character* of knowledge imposes essential limitations on its predictive ability for developing biosystems (also for non-equilibrium systems, especially near the points of bifurcation, and for chaotic systems). If it is true in biology that the present does not define the future (Lorenz), the presumption of universal progress must indeed be corrected because increasing the degree of order (i.e. the intrinsic organization) of biosystems cannot be programmed in less-ordered ancestors; therefore, every event within the virtual chain from less-ordered ancestors to developed descendants is casual and unforeseen.

The development of biosystems in the environment (*teleonomical* emanation and/or evolution) is realized as a *forced expansion*—the occupation and broadening of an ecological niche. This is strongly suppressed by the aggressively differentiating influence of an independently developing environment. By some appraisals, the *anthropological principle* **(see *Knowledge of the Environment*)** limited the scope of this independence.

The possible mode of cognition is a permanent *a posteriori* correction of the picture of the world by means of natural science methodology. It is worth supposing the presence of a deep connection of Popper's criticism with Bayes' Theorem, governed by the probabilistic character of causality. Selection and blind variations are the main strategies of cognition process, also providing the base for all acquisitions of knowledge forming by evolutionary pathways.

1. Introduction

> ". . . the advantage of knowledge is that wisdom
> preserves the life of him who has it." (*Ecclesiastes* **7,** 12)

Hardly anybody can doubt today that the meaning of knowledge is not a possession of power, as Francis Bacon proposed, but it is the salvation of the human race and of each person individually. It is widely known that the way to knowledge is through education. Arnold J. Toynbee in his dialogue with Daisaku Ikeda defined the aim of education as necessarily religious but not mercantile. Education has to be a search for understanding of the aims and meaning of life, which is fundamentally identical for all people—it is a decisive factor. That is the first aim of education. The second aim of education in this technological (information, etc.) era is professional activity. In Toynbee's opinion all who have an educationmust swear an oath to (like Hippocrates' δρχοζ [the Hippocratic oath]) to make use of professional knowledge and skill for the service of the people, and not for their exploitation; this is the third aim and meaning of education.

Knowledge is many-sided. But it can be precisely personified. The existence of knowledge bearers has particular significance in the process of education.

Education proper is a single-minded process of *creation* of new bearers of knowledge. It is possible that it is one of the important functions for conserving humankind.

Knowledge crystallized (as if spontaneously) from the magmatic chaos of information is not a synonym for scientific knowledge. The latter is a product of the living activity of science. The meaning of science consists of the creation of objective and significant knowledge that is independent of individuals, their personality and feelings, place and time. However, in reality knowledge grows with due regard for the virtues of the personality and feelings of its bearer, so the factor of time is not absolutely neutral (cf. Ilia Prigogine et al.).

A.L. Chizhevsky pointed out the necessity to date each scientific (chemical, physical, etc.) experiment because the characteristics of space-time are changing continuously. This reflects general empirical conformity to natural laws. This conformity to natural

laws was postulated by John Stewart Mill about the legal figurativeness of nature. In its modern interpretation this postulatation looks like an assertion about the "stickiness" of nature.

2. Cognitive Model of Hypothetical Biorealism

Konrad Lorenz finished the "biologization" of Kant's cognitive model in the last third of the twentieth century. Friedrich Nietzsche and Rudolf Steiner approached this point earlier from the philosophical position, but they were not able to penetrate the specific barrier of reflection constructed by philosophy at the turn of the nineteenth and twentieth centuries—in the period of the expansion of science into the sphere of knowledge. In D.T. Campbell's opinion, classical epistemology previously tried to solve problems of knowledge without considering knowledge in the process of acquiring it.

Now a few basic sciences such as physics, chemistry, and astronomy, as well as biology, psychology, and sociology, provide fundamentals for "descriptive" epistemology, which is a *hypothetical*, conventional, presumptive description of the subject of knowledge and the world as an object of knowledge.

2.1. Postulations and Principles of Cognitive Model of Hypothetical Biorealism Functions

Human cognition is a subject of study similar to other abilities of a person generated in the process of development for conserving the species. The basis of the *cognitive model of hypothetical biorealism* (CMHB) is human biology. Therefore, CMHB is able to form the human image in accordance with these fundamentals. The scientific method of cognition operates under the severe censorship of the principle of "objective nature"—the first principle of CMHB (J. Monod). This principle is related to the subject of research.

The second principle of CMHB (Lorenz) is based on the premise that human cognition is a process of interaction where human beings as real and active living systems and cognizing subjects are faced with the real outside world—the object of their cognition. As follows the next supposition forms the basis of CMHB: a subject of cognition and a knowable object are equally realistic. Hence, the third of Lorenz's principles of CMHB follows: during the cognition of outer reality it is necessary to take into account the inner processes and conditions of the subject itself.

Life is a process of cognition that (according to the third principle) rightly regards physiology and phenomenology as equivalent sources of knowledge.

Two new concepts were formed within the framework of CMHB for understanding the processes of natural selection and adaptation. Adaptation is the increase of mutual information between an organism and the world around it, proceeding asymmetrically without any noticeable change of the properties of that world.

The first is the concept of expediency for the conservation of the species, or *teleonomy*.

The second concept is knowledge proper. Any cognitive model constitutes a scheme of substantiation of knowledge. There are only two existing schemes: those of Aristotle-Descartes (A-D) and Popper-Einstein (P-E). The A-D scheme of the substantiation of knowledge is based on prearranged "universal absolute fundamentals"; the opposite P-E scheme operates cyclically on the basis of restricted *temporary hypotheses*—the latter doomed to permanent renovation.

According to Lorenz, the whole range of "built-in perceiving apparatus" from the nano-scale of the genome to macro-organisms, has the capacity to change when receiving "changing" new knowledge. So this "perceiving apparatus" belongs to the P-E scheme. Popper corroborated that *the thing in itself* is unknowable: "We can only know its appearances which are to be understood (as pointed out by Kant) as resulting from the thing in itself and from our perceiving apparatus. Thus the appearances result from a kind of interaction between the things in themselves and ours elves."

Also according to Lorenz, evolution is a process of cognition.

If as a result of adoption (not only of receipt) of any information by the living (*dissipative*) system its entropy is decreasing in the process of development, then the biological stability of this system must increase. That promotes the conservation of the species.

In principle, genetics and the theory of information both allow consideration of any biosystem as a system of treating information. The change of information (not the change of organism) is supposed to be the basis of biological evolution; moreover, only genetic information encoded in DNA is actually involved in this process. So, according to the theory of information, the development of biosystems is information development, the decisive role of which is the adaptively valuable changes of treating of cognitive information.

The character of information pooled from the environment and the result of its adoption by contemporary populations of *Homo sapiens* is investigated by physiological anthropology **(see *Bio-Social Knowledge: Human Adaptation in Different Ecological Niches of the Earth)*** and ecological physiology.

2.2. The Paradoxes of Lorenz. The Retrospective Character and Predictive Power of Knowledge

The first paradox of Lorenz (pL1) is: *the experience of the individual follows evolution.* The pL1 can be formulated (according to G.D. Gachev) as a way of filling the gap in antinomies by "the unity between logic and history": when logic doesn't find a way out it calls for help from history because the latter is a specific non-existence. Actually, the past does not exist but everyone senses history as "filled and known." It is as if *Homo sapiens* permanently breaks the Bayes' Theorem (BT) (the applicability of BT defines "past experience" as *B[(a priori)Ci]*) always acting in accordance with *the retrospective character of knowledge.* Knowledge approaches the finding out of "memories about the future" because it appeals permanently to "experience" and "history." In this view, Popper's criticism is also retrospective.

The possible way of cognition is a permanent *a posteriori* correction of the picture of the world by means of natural science methodology **(see *Methodological Knowledge*)**. It is worth supposing the presence of a deep connection of Popper's criticism with BT, governed by the probabilistic character of causality. Is *causality* a specific human form of thinking (Lorenz) or atavistic "great animal induction" (D.T. Campbell)? Both cases can be written with the formula of Bayes:

$$(i/j) = (j/i) \bullet [(a\ priori)Ci] \bullet \{\sum_i B(Ej/Ci) \bullet [(a\ priori)Ci]\}^{-1} \quad (1)$$

where: i = number of causes;

j = number of events;

[(*a priori*)Ci] = a priori probabilities of Ci;

(i /j) = *a posteriori* probabilities of i caused by j ("renewal of the past");

(j/i) = probabilities of j caused by i ; the mechanism of connection between them may be known

or unknown ("prediction");

or:

$$(i/j) \neq (j/i) \quad (2)$$

So, (1) or (2) proves the presence of fundamental asymmetry between "renewal of the past" and "prediction."

Under conditions of *causality* the retrospective character of knowledge imposes essential limitations on its predictive ability for developing biosystems, named hereinafter as "Lorenz Biosystems" (LBs).

The second paradox of Lorenz (pL2) is: *every superior organism has the majority of the characteristics of its ancestors but at the same time there is not any exact knowledge of a living creature which allows us to predict any of the characteristics of its developed descendants (DD)*. If really "in biology the present does not define the future," then BT is useless for description of LBs.

Indeed, the presumption of universal progress must be corrected because increasing the degree of order of biosystems cannot be programmed in less-ordered ancestors (LOA); therefore, every event within the virtual chain LOA $\rightarrow$ DD is casual and unforeseen.

The predictive power of knowledge is strongly limited in non-equilibrium systems, especially near the points of bifurcation. For chaotic systems, this limitation is defined by what is called the "Lyapunov temporal horizon."

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Biographical Sketch

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