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Axiological Criteria And Conceptual-Theoretical Connections In The Scientific Paradigm On A Constructivist Educational Model In The Philosophy Of Science

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Abstract — **The structure and the methodology of research suppose at the level of the scientific knowledge a perspective where the complex problems of the reality of this world are obvious. Choosing and analyzing such problems emphasizes the necessity to take into consideration an epistemological model of pure science. Also, the research programs obvious in the social practice suppose approaches of the practical-instrumental interaction which can be put into correlation with the results obtained from the scientific researches. Hence, one can admit that the necessity to individualize a certain model of scientific research reminds of an operational knowing which comes up in accordance with certain conceptual-theoretical connections. Therefore, the appearance of interdisciplines and transdisciplines in the field of the scientific knowledge offers a wide horizon of approaching and developing the physical and objective reality.**

Keywords: axiological structures, cultural norms, scientific knowledge, epistemological model, pure science, (inter)transdisciplinary paradigm, conceptual-theoretical connections

I. INTRODUCTION

The scientific interpretations on the physical reality often rely on meanings and significances specific to a philosophy of language. In fact, through language there are emphasized levels of knowledge and paradigms of communication. From this perspective when the contemporary society has to face a series of scientific paradigms lately we can admit that there is a conceptual-theoretical convergence between the theoretical and practical activity. Thus, trials of (re)constructing the theoretical models generated methodological unifications meant to justify the practical organization of the scientific community in general. Therefore, if one admits the idea of progress in science then we should admit that the forms of scientific knowledge concretize through the extension of laws in different disciplinary fields.

II. NEW PARADIGMS OF UNDERSTANDING ON THE SCIENTIFIC KNOWLEDGE

This situation expresses after all a passing of the process of knowledge from simple to complex. In other words, the acceptance of some structural phenomena and processes allowed the making of interdisciplinary connections and interpretations within the theory of science related to levels of reality (the group of systems always under the influence of a number of general laws: for instance, the quantic entities following the quantic laws which are radically different from the laws of the macro physical world). The passing from one level to reality to another supposes a conceptual apparatus which could give an adequate explanation to reality.

We take into account especially Jean Piaget's concept of "structure" through which one understands that system of transformations which in its quality of system supposes the existence of some laws and preserves itself developing through the game itself of its transformations. In this mode, in the analysis of the genetic structuralism, J. Piaget is in favour of the interdisciplinary researches which suppose a reorganisation of the knowledge fields through changes which consist in the construction of successive combinations. [1] Thus the complexity of these structural processes determined the making of interdisciplinary connections and interpretations by relating to levels of reality.

However, an analysis that aims at such scientific approaches must relate to special methodologies too. From this point of view we have in mind in this sense what in the reference literature is known under the name of *theoretical disciplines* and *experimental ones*. Such a distinction supposes a scientific approach through which there are emphasised the conceptual dimensions of a scientific paradigm: disciplinarity (monodisciplinarity), multidisciplinarity, pluridisciplinarity, interdisciplinarity and transdisciplinarity. The passing of one discipline (monosdiscipline) within the multidisciplinary dimension is done through the appearance within the area of the scientific knowledge of some new approaches, totally different from the classical ones. In this sense, the multidisciplinarity which results from the applicative character of a science is generated through the different domains where it becomes objective. In other words, in a multidisciplinary analysis the scientific approach has as aim a special methodology with well defined techniques. Therefore, one can admit that a disciplinary dimension ("a new science") takes place characterized through its own individualization. So, it has to do with the fact that any form of human reasoning reminds of a historical moment.

This situation is also mentioned by R.C. Colingwood when he asserts that history and philosophy are one and the same thing [2]. In other words, the existence of an identity between

the type of philosophical approach and the historical one supposes an interdisciplinary form of understanding. Its analysis can justify the process of understanding itself. In a contextual way, it means that from the point of view of the content one can find different forms of interpretation. There is still one thing which is certain: both the philosophical approach and the historical one remind of an identity of the philosophy of history transposed, in fact, in a paradigm of the interdisciplinary understanding. Therefore we consider that as long as the process of knowledge acquires a high degree of specialization there are necessary certain integrating perspectives which can be interpreted in an interdisciplinary way. Thus, we think that one can accept the distinction between real and reality (through "Reality" Basarab Nicolescu means what resists in front of experiences, representations, descriptions, images or mathematical formalisations [3]).

In B. Nicolescu's vision, the interdisciplinarity supposes a transfer of methods and implies applicative, epistemological degrees of knowledge. An adequate language necessary to describe the physical reality shows us that a certain intediscipline can be reduced to only one discipline. For instance, biochemistry can be reduced, within the process of explanation either to biology or chemistry. But through this reductionism the theory must satisfy certain criteria of scienticificity. That is why, when describing the physical reality there are accepted explanatory schemes meant to make easy the transfer of methods or concepts.

From this point of view the research of the process of knowledge supposes correlations through which a special importance is given to the usefulness of the information. Moreover we think that in this way one justifies such an interdisciplinary research based on disciplinary connections where the information is re-evaluated. Practically, through this idea it is shown that the general theory of the systems becomes an interdisciplinary research because it finds multiple applications in disciplinary field such as: physics, biology, sociology.

There are imposed, however, certain explanatory notes referring to the interpretation of some paradigms that approach the scientific knowledge. Therefore, an interdisciplinary analysis implies both a conceptual transfer and some trial to permanently overcome a scientific paradigm. This image emphasizes the fact that at the level of the theory of science there takes place a transformation meaning that the scientific analysis does not concentrate exclusively on the justification of the induction, the structure of the explanation, the confirmation of the falsification of the hypothesis but more on themes such as the progress and the reasoning of science, the change and commensurability of the theories.

For instance, the biological revolution since 1950 appeared as a result of the transfer of methods among different disciplines such as biology, chemistry and physics. E. Schrödinger extended over the biological organism aspects of the physical organisation. Moreover, the scientists tried to find out the genetic structure of the DNA. However, the new interdicipline, the cellular biology has not had its own disciplinary status being born from disciplinary connections considered illegitimate („concubinages illégitimes" [4]). In this way, the transdisciplinarity installs another level of epistemological Reality and gathers *the disciplinary absolutes."* [5].

There are complementary interpretations on the physical reality, therefore, in this image. Still, when he analyses its structure Basarab Nicolescu asserts that one must make the distinction between Reality and Real. Thus, if Reality can be accessible, Real is shrouded in mystery and cannot be disclosed. His conception on the transdisciplinary model of the reality manifests a continuity specific from a theoretical point of view. An example in this sense can be given by the structure of the transdisciplinary imagined which implicitly supposes degrees of transdisciplinarity. Through these degrees of transdisciplinarity one passes from the horizontal perspective on reality to the structured vertically. That is why, the transdisciplinary paradigm as a result of the confrontation between two levels of reality (macroscopic and quantic) emphasizes a new image of the reality. Also, a peculiarity specific to the term of "reality" is given by its double meaning: pragmatic and ontological. Basarab Nicolescu states that the "transdisciplinarity" is relatively new and was introduced by Jean Piaget in 1970 in his work *L' épistemologie des relations interdisciplinaires* presented in the colloquium organised at Nice. Due to its universal character the transdisciplinarity supposes fundamental principles which can be found in fact in the Transdisciplinarity Charta adopted during 2-7 November 1994 in The First Transdisciplinarity World Congress (Convento da Arrábida, Portugalia).

The necessity of a transdisciplinary language supposes the desire to know the reality. When he analyses the problem of the transdisciplinary language R. Juarroz starts from the famous proposition 5.6 belonging to Ludwig Wittgenstein from *Tractatus logico-philosophicus* "the limits of my language mean the limits of my world"[6]. He analyses the idea of reality from a perspective reversed to that of L. Wittgenstein's that is "the limits of my world represent the limits of my language." If we accept the second formulation the conclusion that is reached is that Reality could be *extended*. Thus, it is obligatory to have a transdisciplinary language within a transdisciplinary methodology "[7], which could constitute in fact a global language. As it is known the problem of causality in the classical philosophy brought about a real interest among thinkers. For instance, this problem can be found at David Hume who admits that the causal relationship results from a psychological act meaning that the feeling constitutes a common passing of the imagination from an object to the one that accompanies it. Therefore, the experience constitutes the source of faith in the causal necessity that is the following of the cause-effect type connections. Also, the problem of causality was interpreted in accordance with the dialectical rapport between cause and effect, a situation that brings into discussion the problem of identity in fact.

It is a completely different situation in the case of the Kantian conception where the causality represents a pure concept of the intellect. In fact, I. Kant claims that his analysis referring to the problem of causality has its origin in D. Hume's theory who considers that the experience plays an important

role in the knowing act, a situation possible through the concept of causality. Thus, formulating the principle of succession in time following the law of causality, I Kant asserts that any change takes place according to the law of the connection between cause and effect.

Later, as the physics develops the notion of causality knows new interpretations. For instance, M. Born will assert that the new theory from physics ruined I. Kant's category of causality. Thus, underlining the important role that the statistics has in quantic M. Born asserts that the new mechanics within physics ruined I. Kant's concept of "causality" through the fact that in the classical physics it was interpreted in a determinist sense and in the new paradigm one speaks about a statistic mechanics [8]. Passing over these peculiarities of a historical nature we claim the fact that bringing into discussion this problem of causality in fact, there is an analysis in new terms of the scientific theory. This new perspective reminds of a transdisciplinary paradigm of the physical reality where an important role is played by the concept of "levels of reality".

B. Nicolescu asserts that W. Heisenberg who knew E. Husserl very well introduced the idea of "three regions of reality" through which one can give a meaning to reality. Therefore, in his famous *Manuscript,* W. Heisenberg makes a distinction between the region of classical physics, the region of quantic physics (but also of the biological and psychical phenomena) and the region of the religious, philosophical and artistic experiences. Starting these concepts, B. Nicolescu will develop his theory on the levels of reality.

Also, the existence of some levels of reality within this universe is suggested, in K.Popper's view by the science related to the phenomenon of complexity. It is about a creative or inventive universe where the physical reality is explained in accordance with these levels. Karl Popper distinguishes four such levels when he approaches the problem of the natural selection and its scientific status. The first level is given, on the one hand by the existence of the theory of atomic nucleuses at the centre of the big stars and on the other hand by the appearance in space of the organic molecules.

The second level of reality reminds of the origin of life. In this sense, K. Popper claims that although life could be replicated in the lab it brings the element of newness in this universe. For instance, the particular activity of organisms and implicitly the actions orientated towards a goal of animals.

The discovery of some instruments of research led to the appearance of some polemics connected to the structure of the physical reality. Thus, on the one hand, the process of knowledge is enlarged by the problematization of the main ideas from the quantic physics on the microstructure of the matter (the level of the microphysical reality) and on the other hand, the research is orientated through the theoretical parts from the relativist physics on the macrostructure of the universe (the level of macrophysical reality). Contesting the principle of causality does not mean that it loses its validity, it means in fact that one becomes aware of the existence of some structural forms through which one explains the physical reality. For example, there is the discovery of the fact that the elementary particles represent complex structures. This situation emphasizes the effort of science to discover the fundamental particles of the universe. This is the reason why the researches from the microphysics have extended so much.

The appearance of some fundamental mutations in the field of the scientific researches determined the appearance of a special dialectics of science. In this case it is about a non-Cartesian epistemology where new postulates are proposed for the scientific activity. Ş. Lupaşcu, representative for this orientation is the one who proposed, in this sense, that the principle of contradictory complementarity should replace the principle of non-contradiction. Thus, in his analyses he starts from the idea of structure. In this case it has to do with an approach of the complexity of the physical reality. On the one hand, these structures, Ş. Lupaşcu says, can be found in macrophysics where there are already other structures. In this context, he mentions in fact that any system proves to be a system of systems which can be explained in accordance with the relationships of antagonism. That is why according to Ş. Lupaşcu the fundamental axiom of logic is based on the principle of antagonism according to which the energy contains antagonist dynamisms which "are and must be of such nature that the actualization of one should involve the potentiality of the other one or both should be on the two trajectories of the passing from potential to actual or from actual to potential." [9].

Starting from the idea that to any phenomenon one must associate an antiphenomenon, Ş. Lupaşcu aims at making connections between affirmation and negation, between identity and non-identity. Thus, (re)constructing a contradictional logic of identity and diversity, Ş. Lupaşcu admits that two elements are heterogeneous because they are connected through negation and homogeneous because they are connected by an affirmation. It is relevant here the idea that no matter what two elements marked through p and q can only generate, through the simple fact that they exist a connection of affirmation or negation. In other words, in the first case, of the heterogeneity, the negation represents a non connection and in the second case (of the homogeneity) the affirmation supposes a certain identity between those certain elements. The conclusion that is reached is that no matter how much one tries to conceive two or more elements as identical, this thing is not possible because there must be something through which the latter can differentiate. In these conditions, one cannot talk about the existence of an identity of elements but of an actualization of these identities where one can find a bit of diversity. An absolute identity (rigorously contradictory) can only result from the actualization of the identity as infinite which can make any bit of diversity disappear. As a result, the classical logic can be understood as a logic of the relative actualizations of the identity. Maybe, that is why, in Ş. Lupaşcu's case an identity is nothing but the negation of the diversity.

III. GNOSEO(LOGICAL) AND EDUCATIONAL STRUCTURES OF THE SCIENTIFIC KNOWLEDGE

The birth of thinking determined the appearance in philosophy of some theories which had a major role in explaining the scientific revolutions. Thus, the manifestation of the forms of the scientific knowledge emphasizes the premises of constituting the first scientific subjects. The results obtained determined a new approach in understanding the physical reality and implicitly a new attitude towards nature. Moreover the results obtained as a result of the scientific researches on the physical reality emphasizes the fact that the theoretical approaches concretize by applying some methods of research necessary in fact to understand the process of elaborating the knowledge.

This whole process of passing from simple to complex and from complex to simple constitutes a proof of the fact that the idea of increasing the scientific knowledge can be found in understanding the physical reality. Maybe not by chance the appearance and the development of the most daring theories reflect the long series of discussions and disputations in the history of science. Such an example is represented by the theory of relativity. Therefore, in this case one can accept the fact that theory constituted an enigma till G. Galilei made the first paradigm which remained valid until 1905 when A.Einstein elaborated the restricted theory of relativity. Then in 1915 A. Einstein presented the general theory of relativity, a situation which emphasizes the fact that the general theory of relativity enters a metadigm stage. In this way, it is significant the idea according to which a theory can be at the basis of another theory or that a paradigm replaces another paradigm.

The scientific revolution appears at the same time with the different way of seeing the physical reality. At this moment there is a process of making the sciences mathematical. Also, a second scientific revolution present in the 20th century also known under the name of "technical-scientific revolution" is characterised through a process of making the sciences mathematical and also a process of cybernitization of the activities. In this situation one notices an obvious connection between the used mathematical conceptual apparatus and the language. Such a connection between mathematics and language is obvious in the new interdisciplinary theories. The problem which arises in this case is, if through this correlation there is in fact a process of (re)discovery or (re)construction of the physical reality. There is one thing which is certain though: any form of language concretizes according to a certain logical structure. The latter in its turn emphasizes a linguistic structure. The image of this state of fact is determined on the basis of experience. The interactions between individuals, on the one hand, and different disciplinary fields, on the other hand, led to the extrapolation of this experience. Therefore, the complexity is present on different levels of organisation fact emphasized by the latest scientific developments. All these developments constitute a complex process characterized through the appearance of new theories (paradigms) meant to replace or complete the previous ones. For instance, in physics the notion of "force" is replaced by that of "field". This fact is due to Faraday and Maxwell's experiments which showed that each task produces a state (perturbation) around it so that another task should feel a certain force.

In this context, we can mention the fact that the impact of the scientific revolutions on the idea of (re)interpretation of the world determined what is known under the name of crisis of knowing. The more we advance in knowing the more obvious its crisis becomes. The accumulation and the recognition of new data in the field of the scientific research disagree with the generalizations and interpretations accepted at the initial moment. Also the impact of the discoveries from the field of science has manifested in the field of the political structure of the world. From this point of view there are known the results of the researches from the atomic physics and their implications in taking the decisions at a political level (the example of the atomic weapon).

Together with the quantic revolution, the IT revolution has as an objective the passage beyond certain human limits. The mathematical IT revolutionised the possibilities of working out the data which have to do with the intellectual processes themselves. The field of IT has developed as a result of an experimental activity focusing at the same time on the instruments of logics and mathematics. This field has known two tendencies: a constructive one (which focuses on the motivations connected to the problem of information) and a structural one (which is correlated with the general algebraic aspects of the basics of IT).

The step-by-step development of science allowed the appearance of some scientific methods of abstractization. By compiling the information one gets a whole alphabet of symbols and the language becomes more and more abstract. The fields where there are visible such situations are the physical and the mathematical ones where some terms are replaced by symbols. For instance, in physics the process of understanding relates to the possibility of formulating an explanatory model. But this model which must be explained in the terms of a common language, in order to understood also by the people who do not have the competence in that certain specialty, results from the elaboration and the acceptance of a mathematical formalism. In other words, this conceptual mathematical apparatus represents the result of the correlation of some experimental facts referring to the phenomenon which must be explained. Therefore, through this mathematical model that certain reality is described through symbols.

In the contemporary period there takes place a rethinking of the reality and in this sense some theoreticians of science made the distinction between information and knowledge. If information is more important than the processing, knowledge supposes an opening and closing relationship between the knower and what is known [10]. In this mode, the opening that closes can offer a methodological unification of sciences, and the disagreements which generate certain problematical situations inside the scientific community can be overcome.

In this way, the passage from one level of organisation to another supposes the passage from simple to complex. Elaborating a vision of the world and the human derived from

the principles of the molecular biology J.Monod shows that the law of hazard is the one that governs the world of the living beings. Beside this there is also the law of necessity which offers an explanation through the invariance (the capacity to conserve from one generation to another its own structure) and teleonomy (the capacity to transmit your descendants the same invariable content). Thus, it is admitted a qualitative difference between the physical and biological laws. This difference emphasizes, in fact, a genetic perspective through which one shows that any organism develops in order to accomplish its own goal. In fact, E. Morin claims, this paradox can only be analysed by starting from a theory which considers life as a system of permanent reorganisation, based on a logic of complexity. In effect, what E. Morin stresses out is that the informational and cybernetic notions can, not only be applied to the artificial machines but they also have anthro-sociomorphic connotation.

This image emphasizes the new image according to which at a mental level one can conceive a superior organisation which is at the origin of life. In other words, by using some cybernetic concepts by biology one made a true epistemic jump meaning that the new biology explains life through the interactions between molecules. In this mode, it is overcome the paradigmatic significance of the notion of "particular organisation" through which the classical biology explained life by relating to the nucleus-proteic substratum. As a result, it is obvious that it is necessary to have a conceptual transfer ("information", "code", "message", "communication" etc) in explaining complexity. Thinking of the individual-society relationship in a ternary relationship: species-individual-society, E.Morin emphasised the idea of logical complexity.

In conclusion, we can admit that the scientists' trial to admit connections between the laws of physics and the biological ones reminds of the idea of complexity. Furthermore, the trial to reduce the laws of biology to the laws of physics can only be accepted as long as one admits the important role that this complexity plays in explaining a scientific theory. If it was a success or not, the result can be seen exactly in this pragmatism which science tries to prove.

By accepting such a paradigm one admits a new form of communication meant to bring back into discussion the metaphysical problem of existence. Consequently, we take into account the relationship complexity-consciousness which constitutes a criterion of explaining the reality. On the other hand, the limit of the human is forced at the same time with the improvement of the genetic mechanism. The element of artificiality present in the transcultural horizon of reality enriches and destroys the language at the same time. It seems a paradox which can only be solved by the simultaneous understanding of the aspects connected to the idea of complementarity.

IV. CONCLUSIONS

The new paradigm of the physical reality supposes a process of structuring the phenomena but also an interconditioning of the disciplinary fields. The mechanic nature is associated to the mechanisms of the mechanic engineers and the mechanical philosophies correspond to this nature. The cybernetic nature is associated to the cybernetic techniques and the actual "scientific" philosophies correspond to it. Therefore, the analysis of such a perspective denotes the fact that the transformations of science made from a methodological point of view can be explained in accordance with certain notions and structures of organisation such as: "the law of causality", "complexity", "level of reality", "information". In this sense, we consider that one can accept the idea that the levels of reality know an advanced complexity and can become levels of scientific construction.

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