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Andreea Elena MATIC

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THE INTERPRETATION AND INTEGRATION OF CONTRADICTIONS IN SCIENTIFIC KNOWLEDGE

Andreea Elena MATIC[1]

Abstract

The contradictions and the antinomies have a great significance in contemporary science. If classical physics considered that the outside world can be observed and known objectively, without any impairment from the knowing subject, the last century science has shown beyond any reasonable doubt that between the observing subject and the object to know exists is an inextricable link.

The contradiction implies a conflict between two opposed sentences, equally provable. Which one of them should be taken as a good by the scientist? The correct answer seems to be that both sentences should be taken in consideration. The Romanian philosopher Stephan Lupasco considered that, in order to understand and integrate into the human thinking the new scientific evidence (especially the theory of relativity and quantum mechanics) is necessary to abandon the principles of classical logic. He introduced the principle of the included third by building a system of logic called: the dynamic logic of the contradictory. Within this logic, any unit involves an internal diversity and is composed by sets of opposing elements between which there is a constant struggle, a creative and inherent antagonism. Every unit is composed of two contrary elements - A and non-A, which have a continuous voltage and therefore, instead of the principle of identity, the philosopher proposes a principle of diversity.

Within this system of thinking can be distinguished several types of contradictions: contradictions that open and contradictions that close, the negative contradiction and the heuristic contradiction, the strong contradiction and the weak contradiction, contradictions inherent of the relationship between logic and the real world and the contradiction inherent of the contradictions inherent to the rationality itself.

In the paper, the general philosophical ideas have been illustrated through examples, they consisting mainly of scientific issues that led the adjustment of the classical logic so that new scientific evidence, complex aspects of the universe, be integrated into knowledge.

Keywords:

Epistemology, scientific knowledge, contradiction, antinomy, anomaly, scientific evolution, scientific revolution, quantum mechanics, theory of relativity, modern philosophy, classical logic, dynamical logic of contradictory, law of excluded middle.

[1] Lecturer PHD, Faculty of Law, Social and Political Sciences, „Dunărea de Jos" University of Galaţi, e-mail: amiricass@yahoo.co.uk, emirica@ugal.ro.

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1. Introduction

The concept or notion of ***contradiction*** has a wide variety of meanings (both in the field of ontology and gnoseology and epistemology). One of the first meanings of the term relates to occurrence of a conflict between two sentences whose contents are equally provable, "situation of two things that oppose, conjunction of a sentence and its negation" (DEX, 2009).

At the same time, by contradiction is meant a *combination of two terms that exclude* or an *antinomy*. Antinomy is a "contradiction between two positions, principles, conclusions or laws apparently as just or necessary" (DEX, 2009) or a "contradiction apparently indissoluble between two (philosophical) laws, two sentences or two principles that exclude each other and, nevertheless, can be demonstrated separately, as conclusive" (DEX, 1998).

On principle, when we pertain to a contradiction, it involves two mutually incompatible solutions, but which both seem true. In order to illustrate such a situation, we have, for example, the conflict between the theories of general relativity and of quantum mechanics, which explains our universe from the physical point of view. The quantum mechanics describes the universe accurately, at very small, subatomic scale, as it looked in the first moments following the Big Bang (about the time between zero and 10^{-43} seconds nothing can be said, any of the known laws of physics no longer works) when the universe had subatomic sizes, and the theory of general relativity applies successfully to the universe on a large scale, in its present form. The problem is that the two theories are incompatible, cannot both be true, and now physicists are looking for a theory to unify the two, so that the contradictions are exceeded: the so-called Theory of Everything.

2. The Emergence and Overtaking of Contradictions in Science

An epistemological analysis of the problem of contradictions in scientific knowledge refers, especially to tracking down the *situations* generating contradictions. There are many examples, but before we refer to some of the most significant, it is properly to show that, underlying the scientific knowledge are scientific theories developed by specialists of each field. Stephen Hawking (and not only he) believes that "any serious scientific theory [...] should be based on the most fertile philosophy of science: a positivist approach formulated by Karl Popper and others. According to this direction of thought, a scientific theory is a mathematical model through which the observations that we make are described and codified. A good theory will describe a wide circle of phenomena based on a small number of

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simple postulates and will make well-defined predictions that can be tested. If predictions are in accordance with the observations, the theory survives the test, although it can never be proven that it is correct. "(S. Hawking, (2006): 31)

The main reason why Albert Einstein refused to accept the scientific validity of quantum mechanics consisted of the uncertainties that this area of physics involves. The physicist Niels Bohr, at the end of a difficult scientific endeavor, decided to join the two concepts of wave and particle and to declare them complementary, thus leading the way to a scientific innovation with great epistemological resonances, which involves the acceptance and integration of a contradiction in the scientific theory. The complementarity principle is an example of overtaking the contradiction by joining two opposing truths and accessing a deeper and more complex level of reality in quantum mechanics.

Sometimes, the situations generating contradictions relate to the mismatch between the internal coherence of a system of ideas which form a scientific theory and the reality explained by that theory. Usually, the inadequacy is probably caused by the limited and finite nature of our experience and cognitive possibilities, on the one hand, and the possible infinity of the object of knowledge, on the other hand. On this line, there is a *theory of hidden parameters* – proposed by David Bohm, who claims that the world around us has coherence, only that we, mere observers, cannot always discover it. And when we are dealing with unexplainable or contradictory phenomena we can only assume that we do not know the real causes or, at least, that we do not know *them all*.

Contradictions are frequent both in the areas of knowledge, and in that of the ontic, of existence. The Austrian mathematician Kurt Gödel, exposing the ontological concept of *mathematical reality,* has scientifically proven that a formal system without contradictions must be incomplete, or should give up the pretense of completeness (which is the same thing). The safer and more rigorous the system is, the narrower it gets (refers to less objects or aspects of reality).

The contradictions analysis in knowledge is much older in philosophy and it began with G.W.Hegel who considered that there is an infinitude of antinomies (Imm. Kant had postulated only four) and that their role is to make possible progress in science, to eliminate certain obsolete ideas (which have been imposed and persisted based on the principle of

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authority[2]), to come out of tautology and identity, of explaining things by themselves without bringing additional knowledge.

Contradictions in science are often only apparent and bring to light errors, and science, actually "thrives on the basis of errors, eliminating them gradually. There are drawn continually false conclusions, but which are always temporary. Assumptions are worded so as to be always rejected. A succession of alternative hypotheses is confronted with the results of experiments and observations. Science is moving blindly and hesitantly to a better understanding. Rejecting a scientific hypothesis can, of course, hurt the feelings of those who proposed or supported it, but such rejections are a central element of the scientific enterprise." (C. Sagan (2016): 38)

For example, the laws of classical mechanics, discovered by Isaac Newton, although they function almost perfectly in the world we are living, however, they include a few flaws. Thus, at speeds very high, close to the speed of light and under the influence of certain huge gravitational forces, the classical mechanics loses its efficiency. Then the relativity theory comes into play and phenomena description regains its precision and accuracy. Next, at quantum level, the theory of relativity no longer works.

The effect of discovering and integrating anomalies or contradictions in a branch of knowledge is shown through the attainment by scientists of the ability to explain "a wider field of natural phenomena or [...] more accurately, some of those already known."(Th. Kuhn (2008): 130).

Science teaches us that a law or a theory of maximum generality can be cancelled by a single empirical observation, a single case in which what has been postulated no longer works. The appearance of such a contrary case generates a crisis of the theory that rescinds it. In fact, in the scientific knowledge, the only thing we can be certain is the fallibility of our theories. When occurring an empirical element which contradicts the theory, even a very rare one, such as a black swan (Nassim Taleb's favorite example), we know for sure that our theory, the original generalization, was not correct. "A single observation can invalidate a general statement derived from the confirmations given by seeing millions of white swans throughout the millennia. All you need is a single (and from what I was told, ugly) black bird." (N. Taleb (2010): 15)

An example that perfectly illustrates the above comes from the history of science: During the Second World War, in Germany, "the Nazis launched a campaign against the Hebrew science and many German scientists who were Hebrew, this being one of the reasons for which

[2] An example classical and universally known is the persistence, for more than twelve centuries, of the geocentric planetary system and the difficult imposing of heliocentrism.

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Germany was not able to produce an atomic bomb. The main target of that campaign was Einstein and relativity. When he was told about being published the book *100 Authors against Einstein*, he replied: *Why a hundred? If I were wrong, one would have been enough.* "(Hawking (2006): 26)

3. The Internal Logic of Contradictions

From the formal point of view, the classical logic does not admit contradictions. Contradictions exist between atomic sentences that state or deny the same thing: it is impossible to be true the conjunction between p and non p. The non-contradiction principle from the classical logic has been defined by Aristotle and tells us that "it is impossible that to one and the same subject to match and at the same time not match under the same relation a same predicate (Aristotel (2010): 1005 b 19-20).

However, inevitably, in all areas of contemporary science (atomic physics, optics, biology), social life and in the psychic privacy of the individual contradictions occur, and scientists must accept them and attempt to overcome them. Saving can come, in the science itself, by introducing a complementarity logic which eliminates the law of excluded middle, but keeps the old principle of contradiction although, a new philosophy on the universe knowledge involves a rethinking of understanding this principle.

We find this idea also at the Romanian-born philosopher and Stephane Lupasco who, wondering whether the universe is or not contradictory is going, not from establishing the fact of the contradiction but from its nature; St. Lupasco wonders what is the content of contradiction, considering that the nature of this content affects the constitutive manner of thinking and reality. In the universe everything is energy (from electron up to thinking itself, being famous the formula discovered by Albert Einstein: $E=mc^2$), and energy involves a permanent antagonism, which is actually a creative conflict. Stephane Lupasco has developed an epistemological concept, targeting to integrate contradictions generated by the physics discoveries of the last century. Theory of relativity, quantum indeterminacy, principle of complementarity are realities that cannot be denied, but disagree with the classical logic postulates. For this reason it is necessary to rethink the logic in such a way that its application to be also possible in the most complex aspects of reality.

In this context, Lupasco is the author of a dynamic logic of contradictory, exposed in the paper with the same title (*Dynamic Logic of Contradictory)*. Within this logic, the unit requires, involves or hides a dramatic *tension*. By unit is meant the concomitant, not alternative, existence of A and its contrary, non-A, thus breaching the principle of non-contradiction. If we

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go back to the example from quantum mechanics, a quantum event is, *at the same time*, wave and particle. At the quantum level is obvious the tension between continuous and not continuous, updating and potentiation, identical and different. This tension is present among trends that need each other. If in a paradox A and non-A coexist, in a contradiction the two terms imply each other. Following this reasoning, the philosopher concludes that the principle of identity from the classical logic is in constant connection and interaction with a *principle of difference,* and *the law of excluded middle* is doubled, antagonistic and complementary, by an opposite principle of the *included middle*.

In the actual or perceptive knowledge there is, even if only temporarily, an antinomy between perception and idea: the more an object materializes from the perception viewpoint, the less we are concerned about the idea of the class containing it, and this does not disappear totally, but remains as virtuality in the object. If we take as example the analysis of everything in the physical world, a flower or a tree, we see increasingly more the specific traits of that thing, traits that reduce its extension and materialize it. These traits differ from the identical essence of the observed object, which is why they are considered virtual. From the Aristotelian logic point of view, these traits were mere *accidents*; for Lupasco because they are virtual differentiations as they cannot be actual, meaning they cannot be part of the subject concerns (St. Lupasco (1982): 191).

To conclude, considering that the existence of the subject who knows and the object to be known are inherent to the process of knowledge, the subject is updating, living, and the object can be an virtualized exteriority (if practical) or an idea (if the object is abstract). However inevitably, the two, subject and object, identify each other and thus governs the logical phenomenon of human knowledge.

In order to integrate in thinking the new scientific discoveries it had to be overtaken the traditional view on knowledge. According to this view, the contradictory phenomena - often identified with paradoxes - were considered a problem or a blockage of nature and thought and their absence was the health condition of the system. Lupasco considered that we can enter the upper level of knowledge only when the classical logic of identity, non-contradiction and excluded middle is eliminated from the process of thinking. For Lupasco, the supreme form of systematicity includes compulsorily antinomy since the elements of a system should attract and reject at the same time, associate and dissociate, attract and oppose one another. If there were only attraction or rejection among the elements, the system integrity would be violated. Based on these, the philosopher

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considers that the *energy antagonism between attraction and repulsion is the first law of systemology*" (St. Lupasco (1983)).

From the first law is derived a second law, *of potentialisation and updating*. According to the second law, the system elements should enable energy transition from potentiality to updating, the attraction and repulsion generating mutually. The universe, as we know it, and its elements, from the atomic nucleus to the galaxies, obey these two laws. The atom, for example, has stability, maintains and does not destroy due to the attraction and repulsion between the positively charged nucleus, on the one hand, and the negative electrons revolving around the nucleus, on the other hand.

If the first two laws of systemicity eliminate the principle of non-contradiction and law of excluded middle (by changing to the principle of included middle), the third law directs against the principle of identity from the classical Aristotelian logic. According to this law, the properties of a system's components, of their energy should be, at the same time, identical and different. In the case of electrons of an atom, these are identical on the one hand, and on the other hand, they obey the Pauli's exclusion principle saying that two different electrons have different quantum states. In this way the heterogeneity of atoms becomes possible allows the formation of all known chemical elements.

The third law is known as the *law of a dynamic contradiction*; is a law of mutual rejection between homogeneous and heterogeneous and, at the same time, of conditioning one another. Any other situation is logically unacceptable: if all elements of the system would be thoroughly homogeneous, the attraction among them would result in an accumulation of individual homogeneities to a global homogeneity; if they were rigorously heterogeneous, then the rejection would result in an accumulation of these individual heterogeneities in a global one.

From combining the three laws and using as a classification criterion of the homogenization-heterogeneity relation, Stephan Lupasco discovered three types of systems: a first type where homogenization prevails, a second with heterogeneity predominant and a third type of structure characterized by the balance between homogenization and heterogeneity. In the latter system type are met, especially, contradictions or antinomies. Such systems are: the atomic nucleus, the system neuro-psychological or social systems. In social systems, a high degree of homogenization has as effect the disappearance of liberty, and the contrary, exaggerating heterogeneous aspects leads to anarchy.

The inevitability of accepting contradictions in scientific knowledge had as consequence, at epistemological level, carrying out a classification of the contradiction types that may occur. Thus, the current epistemology

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distinguishes between four types of antinomy: 1) *contradiction that opens* - questions or discusses a prior conceptual construction by inviting to the abandonment of a false idea - and *contradiction that closes* (ends a discussion by removing an argument proved to be inconclusive); 2) *negative contradiction* (which signals an error of reasoning or thinking of the researcher) and *heuristic contradiction (*to which we owe either the discovery of a deep layer of reality or the reveal a hidden dimension of it, or the appearance of a meta point of view), 3) *weak contradiction* (which makes possible complex knowledge through the association of some contradictory terms) and *radical contradiction* (which targets to reach the limits of understanding and the undecidable is actually unintelligible); 4) *contradictions inherent in the relationship between logical and real* (which may occur at thinking level, both in the level of empirical knowledge, and of rational knowledge) and *contradictions inherent in the rationality itself* (eg the Kantian antinomies).

Conclusions

In the contemporary epistemology it makes its presence felt more and more the certainty that, for a thinking to become conscious of itself, of its potencies and limitations, the idea of contradiction can be integrated, losing its conflicting nature. Or, in other words, the conflict becomes meta-conflictual. The philosopher Edgar Morin considered that a complex thinking, which cannot avoid the contradiction in its processes, should not conclude that the occurrence of logical contradictions reflects contradictions appropriate to the real; a (logic) contradiction can occur when people resist to logic, this not being actually contradictory, but just insufficiently known. However, Morin accepted that in the world there can be antagonisms that our thinking perceives them as contradictions.

In opposition to the classical science which includes and successfully integrates the classical concepts of *causality, determinism and rationalism*, he began to develop modern science which has as constituent fundamental irrationality of the Universe, and *life, hazard and freedom* can no longer be known or understood at strictly rational level.

While classical science had planned an advance continuous, without obstacles, on the direction of full knowledge of a world deemed rational, the science of twentieth century found that there can be also advanced towards the direction of irrationality, with the consequence of reconsidering or rethinking the interaction between man and nature.

The complexity of the world we live in often involves, for the purpose of knowing and understanding, making antinomic connections and associations which, if adequately explained, become intelligible and logical

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(or meta-logical). However, in this way is not reached the denial of Aristotelian logic, which is absolutely necessary, but without being sufficient. From the modern science viewpoint, the principles of Aristotelian logic cannot cover the complexity of open systems and, especially, of the living world. The human being, for instance, is full of contradictions. "If you want to get an idea on the temperament, ethics or personal elegance of a friend, you should study him when being under unusual circumstances, not in the rosy light of everyday life. Can you assess the threat posed by a criminal by looking at his behavior in an *ordinary* day? " *(N.N. Taleb (2010): 23).*

In the academic environment, the normal atmosphere of scientific sessions involves warm polemics on the research topics. Often, scientists are divided into camps and try to prove by counterexamples and confutations, the lack of validity of theories issued by their opponents. From these discussions and struggles of the great minds emerges the progress in knowledge. Einstein himself spent the last thirty years of his life trying unsuccessfully to conceive experiments through which to show the lack of validity of the postulates of quantum mechanics. But many other times combating against theories and discovering contradictions have been successfully accomplished and slowly, asymptotically, our knowledge on the universe has become deeper. In science, if an idea does not work, you either give it up, or rethink it. Admitting and eliminating errors, as well as integrating contradictions constitute necessary steps in the process of knowledge.

In the epistemological context, contradictions are interesting and stimulating for a complex (especially scientific) thinking, they occur despite pressures of logical coherence of reason and reveal a hidden, deeper dimension of what we call reality. In the current philosophy and science, contradictions are deemed necessary elements that make possible to deepen the limits of our knowledge, the consequence being continuation of the knowledge process and *knowing the knowledge.*

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