HORIZONTES

ENSAIO

DOI: https://doi.org/10.24933/horizontes.v39i1.1235

Implications of method in Gaston Bachelard[1]

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Gaston Bachelard is an “instigator of discourse”. The time concept of A. Einstein's Theory of Special Relativity and the behavior of the infinitesimal elements of Quantum Mechanics (microphysics) led knowledge to a new field of thought.

Bachelard calls into question concepts ingrained in Western scientific thought. How to think about a reality without substance? How to think about discontinuous progress? What is an epistemological rupture? How to break with the idea of cumulative knowledge? How to think of complementarity breaking with Aristotelian Logic and Hegelian Dialectic? What about temporal continuity and multiplicity? Is it possible another form of rationality?

Doing a chronological reading of the works of Gaston Bachelard, I noticed, in this thinker, three moments concerning with his method of investigation. A first moment, inscribed in his analyzes and shown by himself, speaks of a more objective method possible, both in the epistemological perspective and in the “images” of the imagination. Bachelard (1974, p.3) states that the method used to speak about the elements, that of scientific prudence, was insufficient to support a metaphysics of the imagination.

In the same period of time in which he writes books on epistemology, Bachelard also writes books on the images of the elements (fire, earth, air and water) wishing to be as objective as possible. At this moment, the French philosopher makes no difference between discursive language and poetic language, to the point of affirming that Thought has two edges, like a river, one that is clarified by *imagination* and another by *reason*.

In his first epistemology book, *Essai sur la connaissance approché*e, Bachelard defends the thesis of approximate knowledge. Here, he refers to the method as something circumstantial that is quickly replaced by a more effective method.

In this aforementioned work, Bachelard discusses his main ideas present in all

[1] This work is the result of many reflections that were originated at the Bachelard Brasil Congress – 2020

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epistemology books. His thesis on the concept of "approximation" (*approchée*), which is translated "approximated" in Brazilian editions, is actually surrounding the whole object. This thesis states that “description is the purpose of science. It is where we started from. It is where we turn to[3]” (BACHELARD, 1973b, p.14).

Thus, the author postulates for epistemological analyzes the always unfinished character of knowledge. The immediate data “(…) is formed in opposition to reflection[4]” (BACHELARD, 1973b, p.18). He considers knowledge in its ebb, in its movement. For Bachelard, the real is inexhaustible.

Still in *Essai* sur la connaissance approché, the author refers to mathematics as an instrument to deduce the experimental knowledge of contemporary Physics and Chemistry. Knowing and experimenting are the two initial elements of scientific thinking. It should be noted that in his epistemology books he always punctuates the issues of knowledge linked to experience and its impasses.

In *Essai*, too, he draws our attention to the importance of error. In relation to knowledge, the error is more important than the truth, because it is what impels knowledge to the truth, it is crystallizing, we only reach it by testing as much as possible the errors that appear in the relationship of knowledge after countless verifications. According to Bachelard (1973b, p.252), “the world is my verification[5]”, the infinite and necessary rectification for current discoveries. "In what situation is approximate knowledge objective? [6]” Reality and knowledge have a dynamic reciprocity.

The *Essai* is a Theory of Knowledge book that addresses criticisms about idealism and experimentalism (the empiricisms and mistakes that immediate knowledge produces), speaks of the importance of detail in knowledge and how it dictates the law.

For knowledge to exist, a curious subject and an object to be known are needed. “The approach is the unfinished objectification, but it is a prudent, fruitful, truly rational objectification, as it is both aware of its insufficiency and its progress[7]” (BACHELARD, 1973b, p.300).

[3] "(…) la description est, tout compte fait, la fin de la science. Il faut en partir. Il faut y revenir".
[4] "(…) est formée justement en opposition avec la réflexion".
[5] "Le monde est ma vérification".
[6] "Dans quel sens peut-on dire qu'une connaissance approchée est objective?"
[7] "L'approximation, c'est l'objectivation inachevée, mais c'est l'objectivation prudente, féconde, vraiment rationnelle puisqu'elle est à la fois consciente de son insuffisance et de son progrès”.

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The considerations brought by Bachelard in *Essai sur la connaissance approché*e are fundamental for the *new scientific spirit* to be based on his first idea of approximate knowledge.

In our reading, the work *La philosophie du non* is enlightening to understand what Bachelard proposes as a *new scientific spirit*. Defending the bases of empiricism and rationalism, he proposes his "applied rationalism", a prospective rationalism, different from traditional rationalism. The idea of *surrationalism* also appears in this work, drawing inspiration from the surrealist movement that then emerged as a novelty in the artistic thought of that time.

Bachelard is, without a doubt, the first philosopher to innovate in his analysis of Quantum Mechanics, comparing the concepts of Newtonian physics to this new reality, that is, the real of microphysics. With the appearance of quantum mechanics, another type of reality arises that puts into question everything that was said about the concepts of classical physics. Contemporary mathematical physics presents a novelty unprecedented in history.

Through his interpretation of Quantum Mechanics, he analyzes the behavior of the microphysical elements, that is, the quantum corpuscles. From these infinitesimal elements his analysis of confrontation with the microphysical elements, Bachelard poses questions never addressed before. With the new concepts, which are related, but are not denied, a new field of assumptions appears.

Bachelard is a philosopher who creates concepts and these have their own significance within his epistemology. Therefore, the Bachelardian concepts are proper, they are not reworkings of concepts created by other philosophers, such as those of Hegel or Husserl, for example. Bachelardian notions can only be meant in his own thinking.

In the analysis of the notions of *time* and *space*, not only based on Einstein's Theory of Relativity, but also on Quantum Mechanics, Bachelard demonstrates that these concepts completely change their meaning in relation to Newtonian Physics. In addition, the author points a new way of looking at these notions (among others) used by previous scientists.

My analysis of the fundamental concepts of Gaston Bachelard's thinking takes as its starting point his arguments elaborated in *Essai*. These are arguments based on concepts that run through all his epistemological works, that is, until the work *Le matérialisme rationnel*. In *La philosophie du non*. the author upgrades his main concepts, already launched in *Essai*, for example.

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Le nouvel esprit scientifique, from 1934, and *La philosophie de non*, from 1940, are two books that complement each other. I believe that this second work explains more accurately the new scientific spirit by enunciating the essence of his “applied rationalism” and his notion of dialectic. In these two books, he makes an analysis of contemporary Physics, which is his starting point to highlight the ideas of his epistemology. So, it is necessary, in a systematic reading to understand his notion of a *new scientific spirit*, starting from the work of 1940 in which he prepares an essay in order to clarify what is the new epistemic reality of the 20th century, already demonstrated in the work of 1934.

In *Le nouvel esprit scientifique* Bachelard points to the "limit" of certain theories such as deductive ones from Descartes and the concept of adequacy and empiricism "*tout cours*" that until then were seen as opposite theories (mathematics and experience). The connection of the new Physics with algebra reveals an unprecedented "approximation" that makes the history of physics reveal another problem (Newton and Einstein). There are two different paradigms and, thus, the axiomatic field changes completely. However, these two bases of thought are not mutually exclusive, but complement each other when considered through a *philosophy of no*.

Bachelard's "no" is not negation, but difference, insofar as it points out the limits. Therefore, it is not to deny by exclusion. It should be noted that many interpreters confuse Bachelard's "no". It is not a matter of no (*aufheben*) that is affirmation (a new thesis) and overcoming at the same time. Bachelard's "no" is a difference and is based on the idea of strength.

The idea of Bachelardian negation runs counter to the Hegelian dialectic in this sense. Bachelard's no is not a negative thought, it is distinction, exception, detail. It is equal to Nietzschean thought. “Superman” (*übermench*) against whom? In Bachelard's *dialectical negation*, his logic is of opposites and not of contradictory ones, truth/falsehood, but Truth and truth, False and false.

As we said before, his book *La philosophie du non - Essai d'une philosophie du nouvel esprit scientifique* is a maturation of the thinker in relation to Le nouvel esprit scientifique written in 1934. What is interesting to note is that passed six years between them, a time when the author matured his epistemological thinking.

During that period he wrote *La Formation d’esprit scientifique* where he advises his

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readers on the need to overcome epistemological obstacles in order to better understand the development of scientific knowledge in relation to its present day.

In order to achieve objectivity, it is necessary to know, through the History of Sciences, the factors that block its development. “The era of the new scientific spirit begins at a time when Einsteinian relativity deforms primordial concepts which we believed were immutable[8]” (BACHELARD, 1977b, p.7).

According to Bachelard (1977), epistemological obstacles appear in the act of knowledge. “When looking for the psychological conditions for the progress of science, one soon arrives at the belief that it *is in terms of obstacles that the problem of scientific knowledge must be posed*[9]” (p.13).

There are external obstacles related to the complexity and fugacity that are characteristic of the phenomena itself, and also the fragility of the senses. However, the notion of *epistemological obstacles* does not refer to external things, as these obstacles always accompany the act of knowing. It is for this reason that Bachelard treats them as psychological conditions that interfere in the achievement of objectivity.

The obstacles highlighted in *La formation de l'esprit scientifique* are: first experience as a correlate to common knowledge. Bachelard, in all his books on epistemology, calls attention to the need to break with common sense. For him, the *epistemological rupture* between common sense and scientific knowledge becomes an instant of the method.

In this 1938 work, the author also draws attention to the danger of *general knowledge*, considered as a major obstacle. The generalization that was in force from Aristotle to Bacon and that still remains in some fields of knowledge (BACHELARD, 1977b). The *verbal obstacle*, *substantialism* (believing that phenomena always have a substance, a core, which makes them objective), *unitary and pragmatic knowledge*, *animistic obstacle and quantitative knowledge*.

To the French philosopher, it is necessary that the scientist, to be part of a “scientific city”, elaborates a catharsis of the errors of the ancient scientific spirit, with the purpose of overcoming epistemological obstacles, that is, overcoming by becoming aware of the existence of obstacles ideas to the progress of knowledge.

[8] "L'ère du nouvel esprit scientifique en 1905, au moment où la Relativité einsteinienne vient déformer des concepts primordiaux que l'on croyait à jamais immobiles".
[9] "Quand on cherche les conditions psychologiques des progrès de la science, on arrive bientôt à cette conviction que *c'est en termes d'obstacles qu'il faut poser le problème de la connaissance scientifique*".

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To Bachelard (1977b) the "observation" that comes from the senses does not guarantee the truth. The history of science, mathematical physics and mathematical chemistry (two well-formed sciences because they have a history) that can only be analyzed through their history. The implications of the method, starting from these two sciences (the theory of relativity and quantum mechanics) point to a new conception of real(*res*).

The main methodological rules presented that appear in *La formation de l'esprit scientifique*: 1) breaking with common sense as a critique of immediate knowledge. 2) His criticism of "tout court" empiricism, that is, of a naive empiricism that preceded his thinking, is now an "applied rationalism" proposed by him.

From 1928 to 1953 G. Bachelard began to mean his philosophical concepts more clearly. For his time, Bachelard is very daring, as it contradicts philosophers and scientists. However, when the French philosopher criticizes these thinkers, he does so in debate with their ideas.

In other words, during twenty-nine years of epistemological writing, when writing, he clarifies his concepts better, such as *rupture* (instant of the method where it is necessary to break with common sense and immediate knowledge), *objectivity - objectification*, *applied rationalism - rationalism and empiricism*, *phenomenotechnics - phenomenon - technique*, *surrationalism - surrealism*, *dialectization - dialectic*.

The concepts created by Bachelard only make sense in his thinking. They are not, therefore, the appropriations of meanings of other thinkers. The *principle of the identity* of Aristotelian Formal Logic is replaced by *no* that is difference. In the *new scientific spirit*, the Hegelian contradiction is challenged in the physics of infinitesimal elements when presenting a new ontological status of the object of knowledge.

Thus, it is possible that considerations of Husserl's phenomenology about the notion of *phenomenon* are contested by Bachelard saying that Gaston Bachelard's thought is singular, has no predecessors. He will introduce the *new scientific spirit* through concepts that have never been used before.

Quantum Mechanics, Physics of infinitesimal elements, leads Bachelard to an analysis of the behavior of these elements, then another way of seeing phenomena arises, which cannot be compared to the phenomena of common reality that are *things* (*res*), as these have as characteristics the question of origin, temporality, spatiality independent of time. The

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infinitesimal elements do not answer these questions. In the infinitesimal object, time becomes a dimension of the phenomena: length, width, thickness and time. This analysis leads to thinking about phenomena with different temporalities. Foucault refers to two temporalities juxtaposed, of the subject who observes and that of the phenomenon that is observed. With the Newtonian conception of absolute time it was impossible to think in this way, thus pointing to the limits of classical concepts. To point to the limits of a given theory is to show its errors by seeking them in the history of science in the light of the most current science.

So there is, in Bachelard, the concept of *historical recurrence*, which means starting from the present to analyze the past of science through conceptual significance. The concept of relative time cannot be analyzed as a continuation of the concept of time in Newton. For this reason, Bachelard presents the idea that concepts are *dynamological*. The significance is given in the historical analysis of the sciences.

> [...] only mathematics as a thought that has a symbolic, inventive language, works with dynamological concepts, concepts that accompany the dialectical movement of phenomena [...] everyday language is conditioning, because it is already established, it is already coded. It is necessary to use a type of language that adapts to movement, to changes, so there is a need for science to work with symbolic language[10] (BARBOSA, 1996, p.52).

In order to understand what Bachelard calls “approximate knowledge” (the mathematical judgments related to experience, which he will later call applied rationalism), it is necessary to realize the importance of the concept. The work with conceptual significance is important insofar that it is necessary to know when the concept is empty, when it no longer applies to certain events.

The concept of “real” as *res* (*thing*) with general characteristics only applies until Einstein's Theory of Relativity and the advent of Quantum Mechanics, when time loses the meaning of absolute (it is said, the real is in time) and becomes a dimension of object. The

[10] [...] só a matemática como um pensamento que possui uma linguagem simbólica, inventiva, trabalha com *conceitos dinamológicos*, conceitos que acompanham o movimento dialético dos fenômenos [...] a linguagem cotidiana é condicionante, pois já está estabelecida, já está codificada. É preciso usar um tipo de linguagem que se adapte ao movimento, à mudança, por isso há necessidade de a ciência trabalhar com a linguagem simbólica (BARBOSA, 1996, p.52).

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concepts of Physics move to another meaning. This new perspective of time makes it possible to think of “juxtaposed realities”, different temporalities.

It is a real revolution in the conception of time as linearity, as origin (when?), as cumulativity. Einsteinian time allows us to think of "discontinuity", "rupture", concepts related to the act of knowing and not as the property of being.

Historians of scientific knowledge start to have a new starting point, no longer the cumulativeness of the past, but, to think history from the present, from the current concept with its current meanings, from the present to the past. Therefore, history needs to be rewritten, reframed. It must start from the present to "judge" the past.

In *Le matérialisme rationnel*, Bachelard says goodbye to his epistemological writings, clarifying which are the subjects of reason and which are the subjects of the imagination. In his work *La poétique de l’espace*, he revolutionizes his thinking about the method. No longer reason or experience. Now a creative imagination that starts from contemplation and observation, “the image in an individual consciousness, to help us restore the subjectivity of the images and measure the amplitude, the strength, the sense of the image's transubjectivity[11]” (BACHELARD, 1974, p.36).

The phenomenological method in Bachelard has its own significance, it is that of the creative imagination. It is a method of a new image. In contrast to Husserl, we can see that it is not a descriptive method, but a method of creative imagination.

According to Bachelard (1968), the phenomenological method allows the identification of the subject with the object, between the subject and the object there is no mediation (in Husserl, in consciousness there is a material part (*Hylé*) that permeates this relationship). Bachelard's phenomenological method is that of creative imagination. According to him, imagination goes beyond reality, it sees the invisible, it goes to the bottom of things (BACHELARD, 1974).

If we analyze the Bachelardian work chronologically, we realize that the author takes us to a path that corresponds to that of his existence. He starts it looking for a method as objective as possible, both in his epistemological analysis and in his analysis of the images of elements until

[11] "(...) l'image dans une conscience individuelle — peut nous aider à restituer la subjectivité des images et à mesurer l'ampleur, la force, le sens de la transsubjectivité de l'image".

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he reaches total freedom in his poetics, where he reaches a point without compromise with anything material, concrete until reaching “the wings of imagination”.

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