THE SCIENTIFIC ROOTS OF LACAN`S STRUCTURAL TOPOLOGY

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Abstract: This article investigates the consequences of the adoption of Koyré's modern science conception, characterized by the mathematisation of the real, in the work of Lacan. One of them is the invention of *structural topology*, which has its roots in linguistic and mathematics, but reaches beyond their scientific domain. Therefore, the notions of structure, letter and real are appropriated and redefined by Lacan.

Keywords: science, topology, structure, real.

Resumo: As raízes científicas da topologia estrutural de Lacan. Este artigo investiga as consequências da adoção da concepção de ciência moderna de Koyré, caracterizada pela matematização do real, na obra de Lacan. Uma delas é a invenção da topologia estrutural que, muito embora enraizada na linguística e na matemática, ultrapassa o domínio científico ao qual pertencem essas disciplinas. Para tanto, as noções de estrutura, letra e real serão apropriadas e ressignificadas por Lacan.

Palavras-chave: ciência, topologia, estrutura, real.

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In *Encore* (*Mais, ainda* - 1972-73/1985), Lacan discusses the relationship between psychoanalysis and two disciplines, namely linguistics and mathematics. The reference to both can be seen throughout Lacan's work, but it becomes clear that psychoanalytic theorizing cannot be reduced to the practice of these disciplines - it goes beyond them and searches its own ways. Perhaps the criticism about the incompatibility between the practices typical of these fields and the way Lacan uses them, which were published as accusations of intellectual imposture (SOKAL & BRICMONT, 2001), fail to properly consider the following: the way Lacan uses linguistics, mathematics, etc., does not seek to employ their methods faithfully, that is, those practiced within those fields. When considering the comments by Glynos and Stavrakakis (2002) on the subject, psychoanalyst Paul Rona states that

> it is not mathematicians, with Sokal as their herald, who must ratify the relevance of a field supposedly foreign to psychoanalysis, but psychoanalysis itself that should sort out the way mathematics can help to solve problems faced in clinical experience. (RONA, 2002, p. 18).

Since Lacan, psychoanalysis has not contemplated adapting to any established epistemology in order to have its authenticity recognized, although it widely absorbs knowledge and methods from other disciplines. What Paul-Laurent Assoun says about *Freudianism* also applies to *Lacanianism*: "Psychoanalysis has no *need* of an epistemology, it already has one, and this is what is called *Freudianism*, which just needs to be objectified again" (1993, p. 19). In examining and discussing with remarkable depth epistemologies that influenced Freud decisively, the author finds its boundaries: there is something called Freudianism, an epistemological identity not reducible to its essential domains. The same goes for Lacan, with regard to his return to Freud: Lacan does not embrace Freudianism in its totality, it can neither be reduced to it, nor to Koyré, Levi-Strauss, Jakobson, Kojève, Bourbaki, etc. According to Foucault, in *What is an author?* (*O que é um autor* - 1969/2006), the return *to the founders of discursivity*, such as Marx and Freud, uncovers gaps and flaws in their texts, modifying them. This means that, unlike a return to Galileo, for example, where the history of mechanics, but not mechanics itself could be reassessed, a return to Freud modifies psychoanalysis itself. The present article, however, focus on investigating Lacan's return to Freud from the standpoint of his relationship with the scientific discourse, mathematics and linguistics.

In *Encore* we first find the announcement of Lacan's rupture with Jakobson and linguistics:

> (…) in order to preserve Jakobson's domain it is necessary to create a different word. I will call it linguistricks. (…) My saying that the unconscious is structured like a language does not belong to the linguistic field. (LACAN, 1972-73/1985, p. 25)

Soon after, Lacan states that linguistics belongs to the scientific discourse: "Linguistics in the field in which speech is produced, is not something spontaneous. It is sustained by a discourse, the scientific discourse" (*ibidem*, p. 42). In *L'Etourdit* (*O Aturdido)*, contemporary text to *Encore (Mais, ainda)*, Lacan insists that his reference to the unconscious "escapes linguistics, since, as a science, it has nothing to do with the *parêtre*" (1972/2003, p. 491). If it is inconceivable that psychoanalysis comes from a field other than science (LACAN, 1966/1998b, p. 232), it needs to go beyond science in order to deal with the unconscious. About differentiation between mathematics and all the scientific discourse, Lacan also sustains: "The analytical trick will not be mathematical. That is precisely why the psychoanalytical discourse differs from the scientific discourse" (1972-73/1985, p. 159).

Initial findings: Lacan includes both mathematics and linguistics in the scientific discourse. By distinguishing psychoanalysis from both he also distinguishes it from science. Interestingly, however, his reference to these fields is maintained. Lacan will use it widely, even stating that nothing seems "(...) better to build the horizon of the analytic discourse than the use of the letter in mathematics" (1972-73/1985, p. 61).

This brings about a movement of approximation and differentiation, where psychoanalytic theorizing dialogues with science, but does not merge with it. About mathematical formalization as a way to access the real, Lacan also says that "the real could just be brought to light through an impasse in formalization. That's when I believed I could draw its model on the basis of mathematical formalization (...) "(1972-73/1985, p. 125). The structure of the language, or its real, will no longer belong to the domain of linguistics, but to the logic-mathematical formalization, which, however, does not make psychoanalysis a kind of mathematics.

It would be a great contradiction if Lacan only affirmed the distinction between his psychoanalysis and these fields while making use of their knowledge and methods. Indeed, Lacan proposes new notions of mathematics and linguistics as a consequence of its appropriation by psychoanalysis. *Linguistricks*, mentioned above, is an example once it is both an approximation and a rupture.

An important Lacanian invention emerges from the recognition of an intersection between mathematics and linguistics, but it is, paradoxically, external to them. It belongs to psychoanalysis and forms a domain which is *extraneous* to both linguistics and mathematics, and actually to the scientific discourse. Lacan names it *structural topology*[1] (1972/2003), a resumption of linguistic structure based on the letter and mathematical topology. This demonstrates the "strict equivalence between topology and structure" (1972-73/1985, p. 17), since the "signifier (...) should be topologically structured" (*ibidem,* p. 29). The signifier, pure difference, constitutes a non-Euclidean, topological space. The analogy between topology and structure is not obvious and Lacan did not explain it completely. One of the thesis that tried to demonstrate this similarity is by the aforementioned author Rona (2012), who uses set theory to do it. The author shows that topology, more than a science of space, has its foundation in set theory, after all, "to display or not a topology is a property of a collection of sets" (RONA, 2012, p. 47). It would therefore be legitimate and not metaphorical the use that Lacan makes of the terms "logic of the signifier" and "topology of the signifier", because "a topology and its transformations are presented mathematically in operations with language, which psychoanalysis counts on for its work" (*ibidem*, p. 219-20). Finding - or building - the foundations of the unity between topology and structure will not, however, be our goal in this paper. We seek to trace the roots of structural topology in the mathematisation of the real proposed by the scientific discourse.

If the unconscious is structured like a language, and does not belong to the linguistics field, but to linguistricks, it will be necessary to define the term *structur*e. Lacan seeks to formalize what he calls the "inertia of language" based on the use of the letter (also mathematisation or literalization), and this is what he calls *structure* (1972-73/1985, p. 150) or *chain* (p. 152):

> (…) of the term structure, others make of it whatever they want, but I do that - language contains a considerable inertia, which can be noticed when we compare its operation with the signs we call mathematical, mathemes, solely because they are integrally transmitted. (*ibidem,* p. 152)

The structure, or chain, identifies with the inertia of language, that which returns to the same place and from which mathematical letters, composing mathemes, can absorb something. The structure is also equated with the "logical impasse" and "the real that comes to light through language" (1972/2003, p. 477)[2]. Being an *impossible* secreted by the language, the structure in Lacan departs from the idea of harmony. It will not have any relation to the "good form" - a term that refers to the pre-modern understanding of planetary motion in perfect circles. Therefore, Lacan does not consider Copernicus' heliocentrism as the promoter of a revolution, but Kepler's discovery of the ellipse (1972-73 / 1985, p. 59). If Freud identifies psychoanalysis to a blow on

[1] As we discussed in *A topologia estrutural de Lacan*, published in Psicologia Clínica, v. 25, p. 145-161, 2013. Available at <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-56652013000100010>. Acess: 02/06/2015.

[2] As we presented in Da ciência do Real à escrita do Real. In: SANTOS, T. C., SANTIAGO, J.; MARTELLO, A. (Org.). Os corpos falantes e a normatividade do super social. 1ed. Rio de Janeiro: Cia. de Freud, 2014. p. 171-198.

man's narcissism, comparable to heliocentrism and Darwinism, Lacan considers the discovery of the elliptical motion of the planets, since it is an attack on good circular shape, as one of the landmarks of modern science and therefore a requirement for the existence psychoanalysis. The structure therefore does not lend itself to a new, more "exact" or improved good form. It is rather the impossibility, the real that denounces the flaws in the good form. The formulas of sexuation in *Encore* (*Mais, ainda*) are an example of the impasse through mathematical formalization. The real is demonstrated by the impossibility of establishing a relationship (*rapport*) or sexual harmony between man and woman, represented in their respective positions through letters of Lacanian algebra.

Mathematizing the real" characterizes modern science the way it is conceived by Koyré and absorbed by Lacan. The psychoanalyst not only accepts this conception of science but also practices it. Again, we must recognize a possible contradiction, since Lacan explicitly excludes psychoanalysis from the field of science and at the same time takes on the mathematisation of the real. Excerpts from *Encore* (*Mais, ainda*) cited above already contain statements that differentiate psychoanalysis from scientific discourse. On the other hand, we saw that Lacan puts psychoanalysis as originating from science, that is, its viability is linked to the emergence of scientific discourse. We can develop these issues further by analyzing the role of Alexandre Koyré 's work in Lacan:

> (…) the analytic discourse can *resemble* something that *could be science*. For, in short, you are very little aware of this *could be science*, though you certainly have some reference of it. You know, I put them there because I believed it was a good time to make you notice history. You know there was a time when we could, not without foundation, be assured that the scientific discourse had been founded on Galilean turning point. It seems to me that I insisted enough there to assume that at least some of you have gone to the source, namely: the work of Alexandre Koyré. (LACAN, 1972-73/1975, p. 76, our translation)

Organizing the logic of Lacan's speech, we highlight three sentences: a) there is a moment in history in which scientific discourse was founded, b) this time is the "Galilean turning point" and c) Lacan refers to Koyré's work to affirm it. Lacan adopts what Milner (1995) calls "major cut", a historical break in the field of knowledge between the modern era (presence of science) and the period that precedes it: "But what needs to be seen is to what extent this is a step, a truly subversive step, from the standpoint of what we call *knowledge* "(LACAN, 03.13.73, our translation)[3]. This means that there are no non-scientific ways of knowing, and what the pre-scientific discourse produced was not knowledge about the real: "(...) there was nothing but fantasy about knowledge until the advent of more modern science "(LACAN, 1972-73/1985, p. 172). The philosopher Slavoj Zizek also comments on the relationship between Lacan and modern science:

> Lacan parts with the Cultural Studies historicism: for him, modern science is resolutely NOT one of the "narratives" in principle comparable to other modes of "cognitive mapping" – modern science *touches the real* in a way totally absent in premodern discourses (ZIZEK, 2002, p. 298).

It is a debatable reading from a historical point of view. Dick Teresi in *Lost Discoveries* (*As Descobertas Perdidas* - 2008) defends the presence of scientific methods and knowledge in times and civilizations largely overlooked by historians of science. The author refutes the version that modern science - which has its roots in Greek soil - was,from the Middle Ages to the Renaissance, merely "kept" by the Arabs, by simple scribes, translators and custodians, without proper scientific practice (TERESI, 2008, p . 12). Therefore, Teresi gathers ample evidence of activities and scientific discoveries - with special emphasis on mathematics - from non-European peoples prior to the Renaissance. The author explains the crucial role of mathematics in science:

> Farady wrote all the results of his experiments in plain English. But he never stated that "nature speaks English." While math may not be the language of nature, it is certainly the language of science. (...) If we say

[3] Excerpt absent in the Brazilian edition of *Encore*, translated from the version of staferla.free.fr.

> that non - European cultures had science long before Europeans export this product to them, we must prove that they had mathematics (TERESI, 2008, p. 31).

And that's what most of *Lost Discoveries (As Descobertas Perdidas)* is about. After extensive literature review, Teresi concludes that “the new math of Copernican Revolution came first in Islamic minds, not in Europe” (2008, p. 11). Besides the necessity of mathematical applications in the form of calculations and measurements for practical purposes, the Arabs were also interested in abstract questions, involving pure mathematics (*ibidem*, p. 77). Does this mean that the Lacan’s conclusions drawn from Koyré’s work are false? Was there higher scientific knowledge before the major cut?

Searching Koyré’s work for the notions which Lacan refers to in the sentences we highlighted above, we find that the philosopher defends that "history does not operate through sudden jumps" and that "the sharp divisions in periods and ages exist only in textbooks", after all, "once we look at things a little more closely, the borders we previously believed to exist will disappear" (KOYRÉ, 2011, p. 7). Koyré is not saying, however, that all historical discontinuity benchmarks can be relativized when sufficiently analyzed. You must not overuse the argument of historical continuity, because "the imperceptible changes in a short time engender a very clear shift in the long run” (*idem*). Clarifying his thinking, Koyré dismisses only "categorical and radical divisions” incompatible with the complexity of "humanity’s spiritual evolution history" (*ibidem,* p. 8). Finally - and providing foundation for Milner’s major cut - Koyré adds that, although the chronological limits are vague and overlapping, "however, periodization is not entirely artificial" (*idem*), after all, from a broader point of view "distinctions are presented fairly clearly and men from the same historical period have a lot in common" (*idem*). Our conclusion: the rupture that Lacan finds in Koyré is logical more than chronological. His goal is to situate psychoanalysis in relation to the scientific discourse and the social bond that is its correlate. Therefore, it is irrelevant to discuss the historical question in detail and it is enough for Lacan to consider the prior establishment of the scientific discourse as a condition for the emergence of psychoanalysis.

Lacan`s second sentence views Galileo as a "turning point”. According to Koyré:

> (...) the way Galileo conceives a correct scientific method implies the predominance of reason over simple experience, replacing empirically known reality with ideal models (mathematical), the primacy of theory over facts. (...) a method using mathematics (geometry) to formulate questions to nature and to interpret its answers. (KOYRÉ, 2011, p. 77)

This is about mathematics (more specifically geometre) as the very language of nature. In the modern world, after Galileo, immediate impressions, even fairly systematized observations, will have to give way to the data resulting from the mathematical investigations of nature. As there is not a well-defined historical moment that separates the periods before and after Galileo, the Galilean turning point defined how science should proceed from then on:

> Galileo knows that experience – I will use the Latin word *experimentum*, to place it in opposition to common experience, which is simple observation – that the *experimentum* is prepared, the *experimentum* is a question posed to nature, a question asked in a very special language, geometrical and mathematical language. It knows that it is not enough to watch what is happening, what is presented normally and naturally before our eyes; it knows that you need to know how to formulate the question and, moreover , how to decipher and understand the answer, that is, applying the strict laws of measurement and mathematical interpretation to the *experimentum* (KOYRÉ, 2011, p. 52).

These short passages by Koyré seem sufficient to clarify what Lacan refers to in the highlighted sentences above. The decision for the reference to Koyré, and not to any other conception of modern science, however, remains unexplained. We do not seek here the possible biographical reasons for Lacan’s option because there is no reason to do so. However, we can reap the consequences of such a choice.

Koyré believes that scientific discourse is inaugurated by the symbolic representation of reality, its mathematisation. According to the philosopher, the "mathematisation of the real, which is the astronomer's work (...) begins with the decision to discover under the disorderly appearance, an intelligible order" (KOYRÉ, 2011, p. 85). Here we already get a trace of Lacan`s structural topology: an order seized by letters. But what real does the philosopher of science refers to? The natural real, the one of physics. It is the replacement of the objects of the world by symbols, letters, which allows the investigation of the real at the same time mathematically and empirically even in the absence of these objects[4]. Lacan also uses the letter to mathematize the real, but which one?

> (...) a real that has nothing to do with what traditional knowledge supported and that is not what it believes to be reality but fantasy [fantasme]. The real, I would say, is the mystery of the speaking body, the mystery of the unconscious. (LACAN, 1972-73/1985, p. 178).

According to Koyré, it is precisely the fact that it can reach the real that justifies Lacan`s appropriation of the gesture that inaugurates modern science: "Only mathematisation reaches the real - and that is why it is compatible with our discourse, analytic discourse (...)" (KOYRÉ, 1972-73/1985, p. 178). The real, however, is a different one, it "has nothing to do" (*idem*). In Lacan it is like the hard core that resists symbolization, an impossible that the letter touches and circumscribes without grasping it in its entirety. Lacanian psychoanalysis uses in its own way methods that belong to the scientific discourse, that is, without being reduced to their epistemologies in order to investigate and define its own objects – as the unconscious and the real that, in turn, are alien to science. The use of the letters is identified as idiosyncratic to scientific discourse and, more specifically, mathematical logic. Lacan does not accept labelling such use as metalanguage, at least in psychoanalysis, for doing so would be just a reduction of material:

> (...) all scientific discourse about language is presented by a reduction of its material. (...) Reduction of the material means that the logic starts at the precise date in history when some elements of the language, working according to its natural syntax, are replaced by a single letter by a specialist on the subject. This inaugurates logic. It is from the moment you introduce an A and a B on *if this, then that*, that logic begins. It is only from then on that you can formulate, by using A and B, a number of axioms and deductive laws that will deserve the title of metalinguistic articulations, or if you prefer , paralinguistic (LACAN, 1968-69/2008, p. 34).

If, for Lacan, algebraization is the fundamental scientific gesture for the mathematisation of the real, and in Koyré, this gesture is due to Galileo, we find another disagreement in Teresi: "Galileo never wrote d = At2. He was considered a great mathematician, but did not dominate algebra". According to the author, the ancient physicist states that "[The universe] is written in the language of mathematics, and its characters are triangles, circles and other geometric figures" (TERESI, 2008, p. 61). Galileo's mathematical language is actually geometric (triangles, circles, etc.) and not algebraic and that transcription of his findings to algebraic language would conceal their original mental schemes. Again, it seems to be a "detail" to which Lacan is indifferent. Whether algebraizing or transcribing Galilean schemes in formulas conceals or distorts any particularities of the physicist's findings, it does not matter. It is as if formalization was always the heart of Galilean geometry, after all, it is through the former that the laws that rule the latter are manifested.

> Formalization is simply substituting any number of ones, for that which is called a letter. (...) Whichever number of ones that you put under each of those letters, you are subject to a number of laws ,laws of set, addition, multiplication, etc. (LACAN, 1972-73/1985, p. 177).

[4] Einstein's theory of relativity, for example, predicted at least two phenomena before they could be tested: the deflection of light (gravitational fields also act on light, that is, light rays are curved) and the relativity of time (time is not absolute and can go faster or slower according to the gravitational field where the observer is).

Contrary to Koyré, Teresi believes that Galileo's lesson is the prevalence of experimentation over theory and thus the famous Florentine would really have carried out the experiment on the tower of Pisa in 1589; not only to prove that gravitational acceleration does not depend on the object's mass, but also to prove that experimentation is necessary in order to get to know nature (TERESI, 2008, p. 50). Teresi's Galileo "ranked mathematics below experimentation," after all, "mathematics was the appropriate language to describe the results of an experiment, but the experiment needed to be carried out anyway" for experimentation remains as modern physics "foundation" (ibidem, p. 190). Since we are unable to establish a common denominator for the meaning of the term experimentation in Teresi and in Koyré , one that allows for discussion, we will only point out a fundamental difference: for Koyré, what Galileo demonstrates is the primacy of theory, and experimentation is itself an issue previously elaborated by a reasoning:

> Good physics is made a priori. Theory precedes fact. Experimentation is useless because, before performing any experiment, we already have the knowledge we seek. The fundamental laws of motion and rest, laws that determine the spatial and temporal behavior of material bodies, are mathematical laws (KOYRÉ, 2011, p. 212).

Since we will not discuss the different meanings of Galileo's experiment, we will turn to Teresi for the possibility of another version of the history of science that serves as a contrast which highlights the peculiarities of the version chosen by Lacan. As already announced, it is not the purpose of this article to investigate the reasons for Lacan's choice of Koyré – its significance will only be revealed by the consequences of it. And we propose the following consequence: Lacan, as Koyré's Galileo, does not experiment without a question, which in the context of psychoanalysis means that there is no clinic without theory. So far there is nothing new, after all, it is characteristic of psychoanalysis – and Freud can attest to it – that a theory creates a clinical practice and the events collected in this practice are interpreted in the light of that theory, modifying it when necessary. It was first necessary to know Sophocles' Oedipus and only after consider it as an unconscious complex. In a timely comparison with the relationship between Newton with his hypotheses, Lacan says:

> But to realize this, which allows to eliminate the hypothesis, it was really necessary that first, he would formulate it, this hypothesis. (...) The unconscious, I do not go inside it , not more than Newton, without a hypothesis. (1972-73/1985, p. 194)

Jean-Marie Vaysse, in L'inconscient des Modernes (1999), proposes psychoanalysis in continuity with the modern philosophical thought, trying to demonstrate in the latter the conditions for the emergence of the former. Although Freud`s unconscious appears as a subversion in the field of knowledge, the author denies that it has come from nowhere or that it is a novelty purely extracted from clinical practice. Bertrand Ogilvie, in Lacan: la formation du concept du sujet (1987, p. 7), believes that the issues raised by Lacan are not derived from psychoanalysis, that is, Freud, but from the psychiatric context and the philosophy of his time, which were subsequently rediscovered in Freud. Although the development of these early issues happened in their encounter with psychoanalysis, the author believes that they did not begin there. What we highlight as common ground between Ogilvie and Vaysse is the pre-existence of a thought or, in Lacan's words, a hypothesis in the event of discovery or concept creation. But Lacan's peculiarity, his mathematizing of the real, goes further: it can interrogate the unconscious through structural topology. As theoretical physicists and mathematicians do in the practice of pure mathematics, Lacan uses abstract means to find knowledge. In order to do so, he had to make an assumption similar to Galileo's: mathematics is to nature as structural topology is to the structure of language. Would Lacan have arrived to structural topology due to clinical need or due to scientific interest?

As in On a discourse that might not be a semblance (De um discurso que não fosse semblante) (LACAN, 1971/2009), in L'éturdit logic is elevated by psychoanalytic discourse to "its extreme power", the status of

"science of the real" (LACAN, 1972/2003, p. 449). Making it clear that the structure of language is no longer a field whose approach is unique to structural linguistics, Lacan allows himself to seek support in mathematical logic and topology, constituting what we call topologics5. It is trough the game of mathematical writing (taken by Lacan in a broader sense, not exactly obedient to mathematics) that the psychoanalytic discourse will "take whatever it can take regarding the function of language (...)" (1972-73/1985, p. 66).

The need to forge new words (linguistricks, structural topology etc.) to describe his practice is justified: Lacan wants to find his own theoretical ways. When he states that "my topology is not of a substance situated beyond the real that which motivates a practice. It is not theory" (1972/2003, p. 479), where we emphasize "my topology", moreover it rejects the thought of it as a theory that motivates a practice. He does not seek to "externalize this real in standards" which would mean finding another good form, but to show it directly in its impossibility due to impasses in formalization: "Topology was not 'made to guide us' in the structure. It is the structure – as retroaction of the chain order that is language" (ibidem, p. 485). If topology is not theory that guides a practice, nor is it meant to guide us in the structure, that is, it is the structure, we reinforce the hypothesis that Lacan proposes a homology between structural topology and the actual structure of the unconscious. What we find in one is homologous to what you can find in the other. Thus, the extensive use of Borromean knots is justified as, for example, in numerous lessons Lacan works them without referring to psychoanalytic concepts, without seeking correspondence between them. When insistently managing the knots, he is finding structural tissue itself, learning its laws and impossibilities, and not new images for psychoanalytical terms already known.

Although somewhat complex, Lacan`s relation with modern science and its disciplines, such as mathematics and linguistics, is discernable, as is the search for a structural topology through an epistemology of psychoanalysis. The analyst, however, does not first establish the foundation of this pathway and only then puts it into practice. This foundation will be left unfinished. We must recognize, then, both the importance of putting together the references that objectify that which is characteristic of Lacanianism – as Assoun does with Freud – and the need to practice the mathematisation of the real of psychoanalysis. Simply clarifying what remains hazy in Lacan's work, namely establishing an epistemology that indicates methods which psychoanalysis must obey, will perhaps just result in its stagnation. At the same time, the foundations should be solid, in order to point out ways for the production of knowledge, and flexible, to allow the new knowledge to maintain the very foundations under discussion.

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