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Husserl's *Crisis* Text and the Spatial Turn in Philosophy of Science

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Résumé : *La Crise des sciences européennes et la phénoménologie transcendantale* (*Krisis*) marque le point culminant de la phénoménologie génétique de Husserl et le début d'une nouvelle philosophie des sciences, qui considère la science non pas comme un fait, mais comme un problème nécessitant d'une compréhension philosophique. Pour Husserl, la crise de la science galiléenne résulte de la rupture de sa relation avec le monde de la vie et de l'identification erronée de la « Nature » avec son objet mathématique ou quantifiable constitué. Dans la philosophie phénoménologique de la science, la science est une tradition formée par la praxis humaine, comme toute autre entreprise culturelle. L'objectivité dans la pratique scientifique est un principe régulateur constitué par le consensus des jugements de la communauté scientifique. La continuité de la connaissance scientifique se manifeste par l'unité du transfert de sens propagé, dont la sédimentation est assurée par le langage. Bien que le monde scientifique soit ontologiquement ancré dans le monde de la vie, Husserl a cherché de préserver l'autonomie des deux mondes. Afin d'apprécier pleinement les implications de la contribution de Husserl à la philosophie de la science, cet article identifie le « tournant spatial » que Husserl a introduit à travers sa notion « moins mathématique, plus physique » du monde de la vie avec le virage à 90° dans les études sociales de la science que Latour a proposé. Le monde de la vie fusionne la « Nature » et la « Société » en une seule entité ontologique qui donne naissance à la science, s'éloignant ainsi d'une science unidimensionnelle qui maintenait l'ontologie de la science ancrée dans l'un de ces pôles uniquement. Malgré les limites de l'épistémologie phénoménologique husserlienne, la *Krisis* s'est radicalement écartée du positivisme, la philosophie des sciences officielle de l'époque, en embrassant l'historicité et le langage pour élargir notre discours

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sur la science et en se rapprochant même de certains développements ultérieurs de la philosophie des sciences. Les méditations de Husserl sur la spatialité ont également favorisé une transition vers la compréhension contemporaine de l'espace, ouvrant des possibilités de dialogue avec Foucault.

Abstract: *The Crisis of European Sciences and Transcendental Phenomenology* (*Crisis*) marks the culmination of Husserl's Genetic Phenomenology and the beginning of a new philosophy of science, one that viewed science not as a fact but as a problem that needed philosophical understanding. For Husserl, the crisis of Galilean Science is born out of the severance of its relation to the life-world and the erroneous identification of "Nature" with its constituted mathematical or quantifiable object. In the phenomenological philosophy of science, science is a tradition formed through human praxis, like any other cultural enterprise. Objectivity in scientific praxis is a regulative principle constituted by the consensus of judgements of the scientific community. The continuity of scientific knowledge shows in its unity of propagated transference of meaning, the sedimentation of which is carried through language. Despite the scientific world being ontologically grounded in the life-world, Husserl sought to preserve the autonomy of both worlds. To fully appreciate the implications of Husserl's contribution to the philosophy of science, this paper identifies the 'spatial turn' that Husserl brought in through his "less mathematical, more physical" notion of life-world with the 90° shift in the social studies of science that Latour proposed. The life-world fuses "Nature" and "Society" as one ontological entity that gives rise to science, moving away from a one-dimensional science that kept the ontology of science grounded in one of those poles alone. Despite the limits of Husserlian phenomenological epistemology, Crisis radically departed from positivism, the then-official philosophy of science, embracing historicity and language to broaden our discourse on science and even coming close to certain later developments in Philosophy of Science. Husserl's meditations on spatiality also urged a transition to the contemporary understanding of space, opening possibilities of dialogue with Foucault.

1 Introduction

Edmund Husserl's Genetic Phenomenology culminates with *The Crisis of European Sciences and Transcendental Phenomenology* [hereafter *Crisis*] [1970]. Unlike Static Phenomenology, Genetic Phenomenology embraces "historicity" as well as "language," those very notions Husserl tried to bracket earlier in order to arrive at an absolute certainty of knowledge.[1] *Crisis* also

1. See in this context Husserl [1965, 71–147]. In this 1911 essay, Husserl attacks philosophies that are grounded in "Historicism" and "*Weltanschauung*" in favour of a

marked the beginning of a new philosophy of science that viewed science not as a fact but as a problem that needed philosophical understanding. For Husserl, the crisis of Galilean Science is borne out of the severance of its relation to the life-world and the erroneous identification of "Nature" with its constituted mathematical or quantifiable object. In the phenomenological philosophy of science, science is a product of human praxis, like any other cultural fact. Objectivity in scientific praxis is constituted by the consensus of judgements of the scientific community, and the continuity of scientific knowledge shows in its unity of propagated meaning transference. Despite the scientific world being ontologically grounded in the life-world, Husserl sought to preserve the autonomy of both worlds.

In what follows, we discuss "The Origin of Geometry" in the larger framework of Husserl's *Crisis* text that inaugurated a new philosophy of science. We argue that this new perspective in the Philosophy of Science introduced by Husserl resonates with the "90° turn" that Bruno Latour proposed. The life-world fuses "Nature" and "Society" as one ontological entity that gives rise to science, moving away from a one-dimensional science that kept the ontology of science grounded in one of those poles alone. Despite the limitations of Husserlian phenomenological philosophy of science, *Crisis* radically departed from positivism, the then-official philosophy of science, broadening our discourse on science and even coming close to certain later developments in philosophy of science. Husserl's meditations on spatiality also urged a transition to the contemporary understanding of space, opening the way for possibilities of dialogue with Foucault.

2 *Crisis* and the new Philosophy of Science

Aron Gurwitsch places the phenomenological philosophy of science in the third phase of the philosophy of science [1967, 389–391]. According to him, the first phase extends from the mid-17th century to the 18th century. The characteristic work in this period is Descartes' *Meditations on First Philosophy*. The first phase of the philosophy of science is concerned with providing a foundation for and validation of the new science. It presupposes a sharp dichotomy between appearance and reality. The nature and structure of the universe is not given in common experience. It is not amenable to perception; rather, it should be uncovered by the use of mathematical models. In other words, reality is not what it appears to be but should be conceived and constructed by mathematical physics. Descartes based his justification of the new science on the principle of clarity and distinctiveness as the hallmarks of truth.

philosophy rooted in the "essences" of phenomena, i.e., an "eidetic phenomenology," worked out after a static analysis that he develops in his 1913 publication *Ideen I*.

If the first phase thus consists of justification and validation of science, the second phase accepts science as a fact, which no longer requires any justification or validation. Gurwitsch traces this phase to the work of the Swiss mathematician Leonhard Euler. For Euler, philosophy must be confined to the fundamental concepts of sciences, especially physics. However, a decision regarding the inclusion of a given concept into the domain of science is exclusively the job of a physicist and not that of a philosopher. The third phase begins with the work of Husserl, who, in his *Crisis*, views science not just as a fact but as a "problem" that is in need of philosophical understanding. Husserl calls the spirit of modern science Galilean Science, which mathematised nature. Through Galileo's mathematisation of nature, nature itself becomes idealised.

The mathematical model makes the study of nature a routine affair.[2] Husserl compares the Galilean Science to a machine. The method of science, once formalised, renders science into a mathematical process. The successful operation of the machine guarantees the success of practical achievement, especially in the form of technology. Thus, the scientist seems to be satisfied with the success of the "machine." If by "science" we understand merely the successful application of the method, then there is no crisis in science. However, for a philosopher of science, the mere working of the machine is no solace. They are bound to inquire into the nature and functioning of the "machine" itself. They raise radical questions regarding the meaning of science by tracing its roots. In that process, the philosopher tries to make evident the very presuppositions of science.

For Husserl, science, like any other cultural fact, is a product of human praxis. It takes shape from the interaction of the members of that professional community. It is an open community in so far as the works achieved by the predecessors are taken up and continued by the successors. Criticisms, confirmations, and corrections find their place in the activities of the community. This praxis aims at a justifiable agreement among its practitioners. Husserl criticises the Galilean style of mathematising nature. It misunderstands the objective nature as something hidden from the life-world, a reality to be explored beneath the appearances of the life-world. For Husserl, objective nature is a regulative principle, an idea with respect to which the members of the scientific community orient their work. The idea gets approximated in theories, which are the products of the scientific praxis. By such a regulative principle, the subjectivity and relativity of common experience can be overcome in so far as these ideals guide and direct the specific

2. However, unlike other "natural sciences," mathematics is concerned with objects that are "ideal" or "abstract" and not meant as "real." Husserl does not subscribe to naive realism or Platonism in talking about mathematical objects as "ideal." In the light of Husserlian phenomenology, mathematical knowledge will be reliable to the extent that our intentions towards mathematical objects are fulfilled. See in this regard Tieszen [1995]. As pointed out by Mirja Hartimo, Husserl's philosophy of mathematics is a "combination of constructivism, various kinds of structuralism, and Platonism" [2021, 173].

human activity. According to Husserl, to be objective means nothing but to have results attained by mutual criticism that withstands further criticism [1960, 5]. In other words, objectivity in science is the consensus or coincidence of judgements shared by the members of the scientific community. Now, we have to clarify the nature of this consensus. This consensus or coincidence is explained by the concept of truth. Husserl conceives truth as not predicated on judgements but on the state of affairs. It is an assertion of what is the case. This assertion is made possible by the phenomenological concept of "evidence." Evidence is a mode of consciousness, a manner in which an object is given to consciousness. The establishment of evidence has nothing to do with a mysterious vision; rather, it is an achievement of consciousness. It is established in the complex act of synthesis. The synthesis of evidence is a coincidence of empty intention and fulfilment. An intention is empty if we merely intend something as truly existing. In order to have evidence, we have to identify it with intuitive fulfilment. The evidence thus becomes the experience of self-givenness of something. Then, truth is an idea of the correspondence between meaning intention and meaning fulfilment [Ströker 1987, 31–53]. Nevertheless, Husserl talks about truth as idealised rational acceptability:

> In the logical sphere, in the sphere of statement, "*being truly" or "actually" and "being something which can be shown rationally" are necessarily correlated*. This holds, moreover, for all modalities of being, all doxic positional modalities. Obviously, the possibility of the rational showing referred to here should be understood, not as empirical, but as "ideal," as an essential possibility. [Husserl 1982, 326]

Thus, the notion of truth as a regulative principle enables Husserl to reinstate objectivity in scientific praxis.

Husserl writes about the origin of geometry to elaborate his points. According to Husserl, geometry originated in the practical needs of measurement in our everyday life. Every historical community, however primitive it may be, possesses some idea of measurement. The accuracy of our measurement depends upon the purpose for which we measure [Husserl 1978, 67–68]. The whole of science, like other cultural enterprises, exists through tradition. They have not merely arisen causally. Being a tradition, it has formed through human activity. Now, this tradition is not something that is handed down passively. Tradition is dynamic in the sense that we renew our traditions by way of sustained inquiry. It is, however, not just a forward process from one stage to another; rather, it is a continuous synthesis in which the earlier stage retains its validity. It thereby makes up a totality in which each present stage functions as the premise for the future project. Thus, all our scientific activities have a further project that awaits its execution. Thus, for Husserl, the past is what is present-for-us as the past for our future project. A primitive formation of meaning occurs for every science;

the meaning becomes evident in future realisation. Thus, what is realised successfully, i.e., what is self-evidently given, is already there as *originaliter*. The meaning as present *originaliter* with its whole content lies within the mental space of the inventor. Now, Husserl asks, how is it that this projecting and the subsequent realising that is purely subjective becomes objective? It is true that this projecting and the realising occur within the mental space of the inventor. However, science, for that matter, is not a psychic phenomenon. Science is objectively there for everyone. In fact, it is an ideal object in the sense that it is accessible to everyone, all actual and possible undertakers of scientific inquiry. Husserl says the objectivity of such a praxis lies in its expressibility or communicability. Here, language has a vital role to play. Transference of the subjective to the realm of the objective occurs by means of language [Husserl 1978, 47]. However, the linguistic structures are not to be mistaken for the idealities of science. The idealities of scientific theories are related to the objects or states of affairs. Whenever we assert something in language, we can distinguish what is asserted from the assertion itself. In other words, a distinction should be made with respect to what is "thematic," what is meant (its meaning) and the assertion. Ideal objects are precisely what are made thematic. Language is a function of humans and belongs to the horizon of civilisation. Living in a world, we are always conscious of the world as the horizon of our life. We are conscious of objects and things as the horizon of our actual and possible interests. Now, with this world-horizon, there always stands out the horizon of our fellow human beings whether they are present or not. We are conscious of them as "others" belonging to our external horizon. Each of us can enter into a particular mode of relation with the "others." By "empathy," we get along with others; it is a reciprocal "getting along." Thus, we gain knowledge by the habit of living on a world horizon [Husserl 1978, 48]. Language, which belongs to this world-horizon, is its correlative. Thus, we human beings as human beings, fellow beings, the world about which we talk, and the language by which we talk are all intertwined. These are all inseparably united in a relational manner of a horizon. Thus, even if something is psychic, if it can be understood by others and is communicable to others as something psychic to a particular person, it is *ipso facto* objective [Husserl 1978, 49].

In his *Introduction* to Husserl's "Origin of Geometry", Jacques Derrida [1962] problematises the sedimentation of "meaning" carried through language as forming traditions. Thus, he argues for the primacy of writing. Derrida writes:

> Speech [*langage oral*] has freed the object of *individual* subjectivity but leaves it bound to its beginning and to the synchrony of an exchange within the *institutive community*. [...] The possibility of *writing* will assure the absolute traditionalisation of the object, its absolute ideal Objectivity—i.e., the purity of its relation to a universal transcendental subjectivity. Writing will do this by

> emancipating sense from its *actually present* evidence for a real subject and from its present circulation within a determined community. [Derrida 1962, 87]

This also then necessitates the "historical a priori" as conceived by Husserl. He remarks:

> Of course, we need history too. Not, it is true, as the historian does, in order to lose ourselves in the developmental relations in which the great philosophies have grown up, but in order to let the philosophies themselves, in accord with their spiritual content, work on us as an inspiration. [Husserl 1965, 146]

However, the result of such an enquiry itself is not historical; it is, on the other hand, teleological or trans-historical [Soffer 1991, 30–39]. The Husserlian notion of the teleological differs from the Marxist view, which is absolutely historical or even "historicist."[3] However, Husserl's rearticulation of the "historical a priori" in terms of teleology is a critical device of philosophical reflection that underscores a philosophical self-responsibility, as pointed out by Miettinen:

> It is only on the basis of a teleological understanding of philosophy that we are able to free ourselves from that historicist preconception according to which all philosophical reflection remains ultimately a prisoner of its own time. Teleological reflection, rather than tying us into the great forces of history, aims at *liberation* and makes possible the emergence of something new. [Miettinen 2014, 275]

The historical a priori of geometry, i.e., the sedimentation of meaning of geometric objects in language and traditions that are part of the life-world, engenders a co-accomplishment by someone who understands what is produced by the other. Also, the identity of what is communicated and what is received is retained. This happens just as in the case of recollection, as in recollection,

3. Historicism rejects the notion of universal or objective validity and thereby characterises philosophy itself as a historically conditioned enterprise, as the Marxist view does. Marx calls his view "historical materialism," which has been provided with a teleological interpretation in the dominant tradition of Marxism by all important Marxists from Engels onwards who place historical materialism within the framework of dialectical materialism of which the former is supposed to be a mere application. Only philosophers like Lukacs deviate from such a received interpretation of Marx. Husserl is convinced of the task of philosophy as one to understand human existence and thus attacks historicism. However, the result of such an enquiry itself is not historical; it is, on the other hand, teleological or trans-historical [Husserl 1970, 394–395], [Soffer 1991, 30–39]. It assumes historical importance to the extent that we need to engross ourselves in historical considerations to understand the task of philosophy. Husserl thus rearticulated the notion of teleology as a critical device of philosophical reflection that underscores a philosophical self-responsibility.

one retains what is presented before him. Retention can be activated by reawakening the original presentation, resulting in increased clarity regarding the past experience. It is lived through in a quasi-new and quasi-active way. As Husserl says:

> [...] if the originally self-evident production, as the pure fulfilment of its intention, is what is renewed (recollected), there necessarily occurs, accompanying the active recollection of what is past, an activity of concurrent actual production, and there arises thereby, in original "coincidence," the self-evidence of identity... [Husserl 1978, 49]

Thus, in reciprocal linguistic understanding, the product of one subject can be reproduced from person to person. The continuity of scientific knowledge shows in its unity of the propagated meaning transference. The new results are based on earlier results, and as meaning is grounded on meaning, the earlier theory gives something of its validity to the later one and becomes a part of it. Hence, there is no isolated theory that has no link with a past theory [Husserl 1978, 53]. This is more true of sciences like geometry, which has ideal entities as its objects. In the descriptive sciences, however, each proposition can be made self-evident without recourse to the whole chain. This is because the theoretical interest of the descriptive sciences lies in classifying and describing, a task that remains in the sphere of sense-intuition. Now, one may ask why we require an epistemology that traces back to the genetic questions. Husserl answers that it is essential in order to render the sciences self-evident. If we do not do this, we will be inclined to deal with "ready-made" concepts in a rigorous, methodical way. This practice makes the sciences lose their meaning. It works by and large due to the practical success of the sciences in being useful in applications. Instead of this, Husserl wants the actual reproduction of the primal idealities so that the sciences will always be firmly founded and become genuine. And making a science self-evident means to disclose its historical tradition. The disclosure is effected precisely by reproducing and synthesising the earlier sedimented meaning of propositions and axioms. Husserl notes:

> [...] a genuine history of the particular sciences is nothing other than the tracing of the historical meaning-structures given in the present, or their self-evidences, along the documented chain of historical back-references into the hidden dimension of the primal self-evidences which underlie them. [Husserl 1978, 64]

A phenomenology of history counts the present as primary. What we know already is our present world and the present world is surrounded by an open-horizon which comprises hitherto known and unknown actualities. Now, the present and the history implied in it are coherent through its generative bond by the cooperative work and the reciprocal interaction by every scientist as a member of the scientific community. Husserl makes it evident that what

counts as primal self-evidence for the sciences is maintained by the community of scientists [Husserl 1970, 362].

3 Geometry and the spatial turn in Philosophy of Science

The primacy of the life-world has important implications for the phenomenological philosophy of science. Husserl maintains that the life-world is prior to the world of science. The world of science is a theoretical construction that comes later. However, this is not to rule out the reality of the scientific world; rather, it maintains that it is only through the life-world that we have access to the world of science [Soffer 1990, 83]. Gary Gutting, though sympathetic to the phenomenological critique of science, questions the rationale for assuming that scientific concepts or theories are wholly derivative from those of the life-world. He points out that mathematics, as well as the sciences that apply mathematics to the world, employ concepts that are irreducible to life-world concepts [Gutting 1978, 50]. Patrick Heelan, another phenomenological philosopher of science, also holds the same view. According to him, it may be the case that some modern measurement practices derive from life-world practices, but it is inconceivable that all current experimental practices derive from the life-world. Scientific entities such as "electrons" and "DNA" do not have a pre-theoretical presence in the life-world [Heelan 1987, 386].

However, Husserl himself provides resources to discuss the life-world in a manner that helps to meet the above criticisms. In "Appendix VII: The Life-World and the World of Science" of the *Crisis* text, he calls into question the contrast between the life-world and the scientific world [Husserl 1970, 382–383]. Steinbock notes that the life-world gets expanded and integrates the scientific truths. The scientific world validates the life-world as theoretical praxis becomes sedimented and forms part of the life-world [Steinbock 1994, 565]. Once it is accepted that the scientific world is part of the life-world and it gets integrated with the latter, we can hold that the current experimental practices too derive from the life-world, albeit the expanded life-world. Of course, it must be admitted that Husserl's construal of the relation between the life-world and the scientific world is not free from difficulties. However, he avoids the two extreme views prevalent in the philosophy of science of his time: the Physicalist view upheld by philosophers such as the later Carnap, according to whom scientific theories are elliptical descriptions of the physical world of public experience and, as such, are devoid of independent ontological content, as well as the view that the scientific world alone is real and the world of everyday experience is consequently unreal. Husserl seeks to preserve the autonomy of both worlds and even tries to relate them in such a way that

though the scientific world is ontologically grounded in the life-world, the life-world does not undermine the former's identity.[4]

Thus, though Husserl's views might appear not so radical, they made a fundamental departure from positivism, the official philosophy of science of his time. In effecting such a departure, he broadened our terms of discourse on science. It is against the background of such radical and broad terms of construing the aim and method of natural sciences that we have to understand the contribution of the *Crisis* text to the phenomenological philosophy of science. Then, Husserl could be regarded as one of the thinkers whose prolonged meditations on spatiality ushered in the transition from the modern to the contemporary understanding of space.

In Michel Foucault's short and rough spatial history of the West, "emplacement" has substituted the modern "extension," which itself had replaced "localisation" of the Middle Ages. Galileo constituted an infinite and infinitely open space, dissolving the medieval hierarchic, oppositional ensemble of places as mere points in the movement of a thing. The current "epoch of space" is defined by relations of proximity between points or elements, relations that can be formally defined as series, trees, or grids [Foucault 2008, 14–15]. According to Edward Casey, though Husserl regarded space as fully constituted, homogenous, and objective as per modern physics, he maintained a caveat by way of the lived body even in his initial, pre-*Crisis* forays into spatiality:

> External space [*der Ausserraum*] is homogeneous, even though it presents itself as oriented in various ways. [...] But the lived body and its bodily space break the homogeneity asunder.[5] [Husserl as cited in Casey 1997, 219–220]

In *Crisis*, Husserl explicitly points to the bodily basis of the abstracting and idealising operations of Euclidean geometry [Casey 1997, 230] by singling out

4. Husserl sought to preserve the autonomy of both worlds in terms of the formal structure of "whole" and "parts." The scientific world is a "part," more specifically a "piece," of the "whole" of the life-world [Husserl 1970, 382–383]. As a "piece" rather than a "moment" of the life-world, the scientific world is independent of the life-world—it subsists, can be presented apart and detached from the life-world, and becomes a whole in itself. As Soffer [1990, 88] points out, the foundedness of the scientific world on the life-world cannot be taken as the ground for denying the reality of the former.

5. Husserl points to the relation between corporeality and spatiality in *Ideen II* [Husserl 1989]. For him, "the here and now" of the lived body is significant in being the referential centre or "zero point" of orientation as well as in constructing the spatial world in its constitutive role of sensations. However, the sense of things in its entirety requires the presence of a plurality of lived bodies in conversation with each other such that the same "system of location" is given in another subject's viewpoint. Therefore, objective space, for Husserl, is founded on a change of location and empathy [Husserl 1989, 88].

the necessarily lived and extended body and its constitutive role in the life-world [Casey 1997, 223], [also see DuFour 2023, 338]. In the lived bodily experiences of kinesthesia and movement, especially walking, the lived body and the lived place are constituted as coherent wholes and linked up with each other [1997, 224].[6] By incorporating the living body into discussions of space and place and emphasising its foundational role in the origin and orientation of space and spatial thought, Husserl established an axis, parallel to that of Nietzsche, to criticise and unsettle the modernist conception of abstract space [Casey 1997, 229], [Whaley 2018, 25], [Paç 2023, 504].[7]

Husserl's corporeal turn was further developed by later phenomenologists [Whaley 2018, 25–27], marking a spatial turn in phenomenology [Peters & Kessl 2009, 21], continuing to influence discussions on place[8] and anticipating the contemporary heterogenous, network era of space. In addition to the notions of archaeology and historical a priori (for instance, see Hyder [2009], Aldea & Allen [2016]), the project of spatiality thus becomes another bridge between the works of Husserl and Foucault, continuing dialogues between their respective traditions [see Peters & Kessl 2009, 24].

To fully appreciate Husserl's contribution to philosophy of science, we may read the "Origin of Geometry" as portrayed in the context of the *Crisis* text through the critical lens provided by Bruno Latour. Latour attributes the stalemate of the Social Studies of Science to the one-dimensional science that keeps the ontology of science grounded in one pole alone, either "Nature" or "Society" [1992, 276–277]. Latour thus proposes another 90° shift after the social turn of the science studies, a turn which, in a way, fuses both "Nature" and "Society." We identify this new turn proposed by Latour with the "spatial turn"[9] that Husserl brought in with his notion of the life-world. The life-world, we submit, fuses the world of nature and society as one ontological entity that gives rise to science, as explained by Husserl in the "Origin of Geometry". This line of interpreting the life-world resonates with the "informational reconstruction of quantum theory," as pointed out by Berghofer, Goyal *et al.* [2020]:

> Instead of reifying mathematical constructs, the idea is to formulate physically meaningful postulates from which the quantum formalism can be derived or reconstructed. This is the program of *reconstructing* quantum theory. Proponents of this program

6. For accounts and explorations of Husserl's sustained enquiries into the problem of space, see Casey [1997, 433, n. 78], da Silva [2012], and DuFour [2023].

7. Nietzsche criticised the modernist understanding of space by categorising mental instincts as "Apollonian" and bodily instincts as "Dionysian" [Paç 2023, 504].

8. As seen, for instance, in the works of the humanist geographer Edward Relph [Withers 2009, 640].

9. The "spatial turn" in Husserl may also be seen in the notion of "expanded life-world" that Husserl discusses in the Appendix of the *Crisis* text that we mentioned above, following Anthony Steinbock.

> emphasise that this basic idea of deriving the formalism from physical postulates is successfully realised in other physical theories, special relativity being the prime example.[10] [Berghofer, Goyal *et al.* 2020, 426]

The above approach suggested by Berghofer, Goyal *et al.* [2020] is one that is less "mathematical" and more "physical," which coheres well with the project of Husserl in the "Origin of Geometry" that we characterise as the "spatial turn" in the philosophy of science.

4 Conclusion

No doubt, some of the central concepts of Husserl's philosophy of science are problematic and, in the then prevailing climate, might have appeared too speculative to square with science as it was actually practised. However, it is significant to note that some of Husserl's ideas come close to developments in the philosophy of science subsequent to Logical Positivism. His emphasis on the need to understand science in relation to a community of practitioners, the decisive role he assigns to tradition in the life of science as cognitive activity, and the importance he attaches to language in order to capture the epistemic character of science make him a precursor of the ideas we associate with philosophers of science such as Thomas Kuhn. Yet, he did not go as far as to adopt radical stances like science is to be understood only in sociological and not in methodological terms, or that science is essentially a tradition-bound activity called normal science to be occasionally disturbed by tradition-shattering activity. Also, the notion that scientific theories are putative descriptions constituted by the language that a theory uses to such an extent that the language determines reality and what is real is relative to the language of a theoretical framework—the ideas propounded and substantiated by Kuhn in his influential works.

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10. As noted in footnote 2, Husserl is not a naive realist or Platonist—he does not reify mathematical objects as Platonism does. See in this context Hartimo [2021].

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