

A conference was held in Prague, Czech Republic, in November 2002 that was entitled "Issues Confronting the Post-European World" and that was dedicated to Jan Patočka (1907-1977). The Organization of Phenomenological Organizations was founded on that occasion. The following essay is published in celebration of that event.

Essay 45

Kantian Euclidean Space and Husserlian Material Ontologies

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Abstract

Through a vindication of the Kantian claim concerning the a priori Euclidean character of our sensible experience I will try to expose the significance of the material ontology attached to the region "natural world" in Husserl. In the first part of this paper I will challenge the generally accepted view that the Kantian conception of space has been refuted either by the development of non-Euclidean formal geometries or by their empirical application within the framework of physical theories. Against this view I hold that the Kantian claim of an a priori Euclidean geometry is to be understood with an immediate sensible character and that, when so conceived, this claim is to be preserved.

The significance of the a priori Euclidean character of our spatial sensibility will be expounded by means of the Husserlian notion of the Life-world: the horizon which, previously to the constitution of scientific theories, is already in force for us.

This analysis will be used at the end of the paper to illustrate how are we to understand the significance of the a priori character of the material ontology attached to the region "natural world" in Husserl.

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1. The Standard Complaint against the Kantian View of Euclidean Geometry

When considering the relevance of Kant's transcendental position on Euclidean space, one widespread complaint goes something like this: In what concerns the transcendental validity of mathematics in experience, Kant failed to distinguish between pure and applied geometry the way we do today. Pure geometry, as Hilbert showed, is a mere mathematical multiplicity, an axiomatic system interwoven by means of formal relationships where a priori intuition plays no role at all. Its claims have no empirical content whatsoever. Applied geometry, on the other hand, as exemplified by the use of non-Euclidean geometries by Einstein, has to do with the application of a formal geometrical structure as a means of depicting the empirical world. This application is done under certain theoretical assumptions and the postulation of an empirical spatial congruence. Once the coordination of the geometrical structure with the empirical phenomena is established, it can be empirically tested. There is no place for the idea that Euclidean geometry is a priori and synthetic, a transcendental constitutive of experience. Euclidean geometry is just a possible "mathematical multiplicity", a formal structure whose correspondence with the physical world is not imposed. Thus, the transcendental a priori validity of geometry for all possible experience as implicitly ascertained in the mathematical principles of the pure understanding appears to have been refuted.

2. The Sensible Character of the Kantian Claim

The reasons summarized above do certainly look very compelling. However, I want to argue that these reasons do not at all refute what Kant actually stated when he claimed the necessary character of Euclidean space in all possible experience. This Kantian claim is only appropriately understood when taking into account the underlying sensible character that Kant gave to it. This is a necessary condition both not to misrepresent Kant and to make sense of the relevance and importance of his claim. Let us first consider why are we to understand Kant's transcendental view of Euclidean space within a sensible horizon.

The principles of pure understanding express conditions and necessary determinations of every object given in a possible experience. To understand what these principles really express, it is necessary to always keep in mind what

the “possibility of experience” means for Kant. “Possibility” is used here in the medieval sense attached to the term “possibilitas”, meaning the essence, *quidditas*, form or nature of something. The term “experience” refers to what is given but only inasmuch as it is considered in its objective character. “The possibility of experience is therefore that which gives all of our cognitions a priori objective reality”. (A156, B195)

For Kant, what is sensibly given is to be subsumed under forms of syntheses in order to appear as experience, that is, in order to conform an objective unity opposing us, something which can be determined through judgements. (Cf. A418, B446; B143) These forms of unitary syntheses that in Kant’s thought pre-configure the objective character of experience are the categories. For Kant then, the synthetic unity of experience “can be none other than that of the combination of the manifold of a given intuition in general in an original consciousness, in agreement with the categories, and applied only to our sensible intuition”. (B161) “Transcendental imagination” is the name given by Kant to the “faculty” that spontaneously combines or pre-configures what is given in sensibility so that it may take the character of an objective unity opposing us in apperception. What I want to emphasize here is that the a priori forms of unity that apply to experience are ultimately to be conceived as forms of syntheses of *what is sensibly given*, that experience is conceived by Kant as the product of an objective syntheses of *what is given in sensibility*.

While keeping in mind this sensible character of the syntheses which make experience possible, let us now consider on what ground did Kant claimed the a priori necessity of the propositions of geometry in all possible experience. For Kant, space and time are the a priori sensible forms of what is empirically given. The propositions of Euclidean geometry and those of mathematics in general are a priori because they are made possible solely by means of a construction achieved through an objective syntheses on pure intuition: “all geometrical cognition is immediately evident because it is grounded on intuition a priori, and the objects are given through the cognition itself a priori in intuition”. (A87, B120) What the geometrical propositions state a priori are necessary conditions of *all possible experience* because the sensible form under which geometrical propositions are constructed is also set a priori in experience, and because the same synthetic forms of unity which make up geometrical propositions are the ones which pre-configure what is objectively apperceived in experience.

In the section called “The supreme principle of all synthetic judgments” Kant explains the ground on which synthetic principles in general are to be

stated a priori for every possible experience. The following passage summarizes Kant's insight:

Synthetic a priori judgments are possible, if we relate the formal conditions of a priori intuition, the syntheses of imagination, and its necessary unity in a transcendental apperception to a possible cognition of experience in general, and say: the conditions of the possibility of experience in general are at the same time conditions of the possibility of the objects of experience, and on this account have objective validity in a synthetic judgment a priori. (A158, B197)

A priori synthetic principles of experience are to be found there where we express necessary conditions of a sensible objective apperception. Since geometrical propositions are nothing but objective syntheses constructed on a pure intuition that holds a priori for every possible experience, they are necessary conditions of every possible experience. *It is clear then that only in relation to a sensible experience can a priori validity of geometry be claimed.* To the passage previously quoted Kant added the following note in his copy: "the [principles] can never be proved from mere concepts, as if they dealt with things in themselves, but can only be proved from the possibility of the perception of things". (E LXIII, p.29; 23:28) This is the Kantian ground on which the a priori validity of geometrical propositions is claimed.

When Kant's claim concerning the a priori validity of the Euclidean nature of space is criticized, the sensible horizon of his thought is often forgotten. We will now see that there is a big misunderstanding when Kant's claim is allegedly refuted on the grounds of physical theories or the formal development of non-Euclidean "geometries".

3. A Vindication of the a priori Sensible Character of Euclidean Geometry

A. The Alleged Challenges Posed by the Theory of Relativity

Let us consider first the claim that the theory of relativity is an empirical refutation of the Kantian doctrine concerning the a priori necessity of the Euclidean space. A geometry gain empirical relevance within only after the postulation of certain physical invariants are assumed within the physical theory.

That is to say, before claiming that a particular geometry holds for the physical world it is always necessary to state, among other things, what are the elements that are taken as invariant within the physical theory, that is, what are taken as physically irreducible. In the theory of relativity, for instance, absolute criteria of spatial congruence have to be postulated for “rigid bodies”. These criteria are not absolute and, although not introduced at random, are certainly introduced “a priori” with the help of certain regulative principles: simplicity and homogeneity of physical theories for instance. What is most important to point out here is that physically applied geometries cannot therefore be merely qualified as empirically true or false. In the words of Hans Reichenbach:

Properties of reality are discovered only by a combination of the results of measurement with the underlying coordinate definition.¹ Depending on the definition, the same structure may be called a plane, or a sphere, or a curved surface... The question of the geometry of real space, therefore, cannot be answered before the coordinative definition is given which establishes the congruence for this space. We are now left with the problem: which coordinative definition should be used for physical space? Since we need a geometry, a decision has to be made for a definition of congruence. Although we must do so, we should never forget that we deal with an arbitrary decision that is neither true nor false.²

Since physically applied geometries are to be taken as empirically adequate only inside a certain theoretical framework, physical theories with the same empirical predictive power may give birth to different spatial and temporal accounts of the world. The decision to choose between them cannot be made in terms of mere empirical adequacy. This relative character of the physical adequacy of geometry is recognized in general. Classical expositions of this can be found in Poincaré³, Von Helmholtz,⁴ Albert Einstein⁵ and Max Jammer⁶.

¹ Hans Reichenbach, *The Philosophy of Space and Time*, §8.

² Hans Reichenbach, *The Philosophy of Space and Time*, §4.

³ Cf. “Non-Euclidean geometries and the Non-Euclidean World” in the collection *Readings in the Philosophy of Science* Ed. University of Minnesota, 1953, especially p. 180.

⁴ Cf. H.L.F. Von Helmholtz “On the origin and significance of geometrical axioms” in the collection *Philosophy of Science, the Historical Background*, ed. J. Kockelmans, The Free Press, 1968, pp.130,131.

⁵ Cf. A. Einstein “Geometry and experience” in *Readings in the Philosophy of Science* Ed. University of Minnesota, 1953, p. 192.

⁶ Max Jammer, in his classic book about the conceptions of space, points out: “it is a matter of convention which geometry we adopt, but only as long as no assumptions are made concerning

If we consider now how Kant understands the a priori validity of Euclidean geometry in experience, we realize that his claims have a completely different character from the empirical adequacy of a geometrical structure within a physical theory. When Kant says for instance that the shorter line between two points is a straight line he does not, of course, intend to express a physical relationship verifiable through a certain procedure of measurement. Spatial propositions of this sort have primarily for Kant an immediate sensible character: “[space] is to be regarded as the condition of the possibility of appearances, not as a determination dependent on them... Space is not a discursive or, as is said, general concept of relations of things in general, but a pure intuition.” (A24,B39) Thus, the physical adequacy of a geometry, established through measurements (that is to say, established through empirical relationships) within a theoretical framework has little to do with the a priori sensible adequacy of the Euclidean geometry which Kant claims.

B. The Alleged Challenges Posed by the Development of Non-Euclidean Geometries

Let us turn now to the non-Euclidean geometries and consider whether their mathematical development may counter the Kantian claim in some sense. As discussed earlier, it is the sensible character of geometry what allows Kant to safeguard its a priori validity in experience. Kant states that if void of this sensible character all mathematics would be empty fictions, a set of formal relationships with no direct relation with what is given in sensible outer experience. (A160, B199; Prol. p. 287) This is what effectively happens when geometries are introduced as implicit definitions void of all intuitive content as in Hilbert’s axiomatization of geometry. “Geometries” of this sort are to be understood as formal mathematical structures that operate with rules. A correspondence between primitive concepts and intuition is not intended there: “formal geometries” of this sort do not aim at describing any sensible experience whatsoever. Surely, such formal structures can find a model, a “physical

the behavior or physical bodies as implied in the measurements. Once these assumptions are laid down, the choice of the geometric system is determined. As Einstein explains, it is the sum total of the assumptions of correlation and of the system of abstract geometry that has to conform to experience. Once the principle that relates rigid bodies to Euclidean solids is accepted, it is experience that conditions the choice of geometry... Hence it is clear that the structure of the space of physics is not, in the last analysis, anything given in nature or independent of human thought. It is a function of our conceptual scheme”. In *Concepts of Space*, Dover Publications, 1993, pp. 172, 173.

application” in the real world but, as we have seen before, this application is only built under certain physical assumptions. Since formal geometries have no sensible significance at all, the development of non-Euclidean formal geometries neither supports nor hinder the plausibility of the Kantian claim concerning the a priori Euclidean structure of our sensible experience. On the other hand, it might well be said that the only thing proven by the development of non-contradictory non-Euclidean formal geometries is the synthetic character of the Kantian claim.

C. Vindication of the a priori Euclidean Character of our Sensible Experience

Everything said above is certainly not enough to assure the Euclidean character of our sensible experience. The main difficulty of Kant’s transcendental conception of Euclidean geometry is the following: if we have mathematically proved that other formal geometrical structures are possible, on what grounds are we to accept the claim that Euclidean geometry is a priori valid for all possible experience? Before carefully consider this problem, let us summarize what we have gained so far.

When talking about “geometry” we must distinguish among three different meanings attached to the concept. First, the term “geometry” may refer to a mathematical multiplicity emptied of any kind of intuition. Second, it may refer to a physically adequate relational structure, which results from empirical measurements and can only be gained empirically within a certain theoretical framework. And, finally, it can also refer to the structure of experience in an immediately sensible sense. I have argued that the Kantian claim concerning the a priori validity of Euclidean geometry in all possible experience is to be taken only in this third sense: since Kant always conceives geometrical propositions as rooted in pure intuition⁷, their validity in every possible experience is only assured inasmuch the sensible syntheses of pure intuition that makes geometrical propositions possible is the same that reigns in the apperception of sensible objects of experience:

The syntheses of spaces and times, as the essential form of all intuition, is that which at the same time makes possible the apprehension of the appearance, thus every outer experience,

⁷ Cf. I. Kant “All mathematical cognition has this peculiarity: it must first exhibit its concept in intuition and indeed a priori; therefore in an intuition which is not empirical but pure. Without this mathematics cannot take a single step; hence its judgments are always intuitive”. *Prolegomena*, §7

consequently also all cognition of its objects, and what mathematics in its pure use proves about the former is also necessarily valid for the latter. (KrV A165, B206)

Challenged by the development of non-Euclidean geometries the following question has been raised: why assume that our sensibility has a priori Euclidean configuration? In other words, why assume that it is not possible to sensibly represent and imagine non-Euclidean geometries? Let us now consider these questions. It is certainly true that anyone can have, to a certain degree, a representation of non-Euclidean geometries. For example, we can represent a curved surface and think of it as the horizon where a spherical or pseudo-spherical geometry take place. But, by doing this, we still lack a fully sensible representation of a non-Euclidean space: the *sensible* representation of the curved surface cannot be made any other way than within the framework of a three-dimensional Euclidean space. Actually this sort of “representation” of non-Euclidean relationships does not solely have a sensible character. Let me clarify this point. A space that possesses a non-Euclidean configuration, for instance, a Riemannian one, can only be represented as a relational structure that turns the sensibly given Euclidean space “only apparent.” But in no way can these geometries be represented with an immediate sensible character. It seems to me that, if taken sensibly, the shorter line between two points is necessarily straight in a Euclidean sense. This has, however, been challenged by critics such as von Helmholtz and Hans Reichenbach. They argue that in the same way that we visualize Euclidean space, we could also visualize non-Euclidean spatial structures. The only reason we give a privileged status to Euclidean space, they say, is habit, an empirical reinforcement of the relations we are used to encounter in objects given in everyday experience.⁸ And thus, they say, if we progressively got used to a spatial congruence different from the Euclidean one we could intuitively deal with non-Euclidean spaces so that we could have a different immediate grasp of new spatial relationships in the same way we do normally with Euclidean space. The tendency to attribute a Euclidean structure to space would then depend on the underlying assumption, based on empirical reinforcement, that our space has a Euclidean spatial congruence. This assumption, Reichenbach argues, is not necessary or a priori but something that

⁸ H.L.F. von Helmholtz, for instance, sustained that this type of intuitive necessity has its origin in an empirical reinforcement caused by the apprehension of empirical objects (not from an a priori necessity). Cf. H.L.F. von Helmholtz “On the Origin and Significance of Geometrical Axioms”, p. 132. The same view is found in Hans Reichenbach in *The Philosophy of Space and Time*, §11, p. 57.

could be progressively modified.⁹ Myself, I do not understand nor “see”, how a sensible visualization of a non-Euclidean space is to be made possible. While I am sympathetic with the idea that a readjustment of the immediate grasp of the spatial metrical relationships is possible, I disagree with Reichenbach’s claim that this possibility may have anything to do with a refutation of Kant’s claim of an a priori validity of Euclidean space in our sensible experience. The question is not which type of congruence we assume when ascertaining spatial relationships, and whether we can get used to a spatial congruence different from the Euclidean one. The question is whether or not we can make sense of sensible spatial relationships before any assumption of congruence is taken, and whether or not we can ascertain their immediate Euclidean structure. I believe we can. Let me explain this with a rough example. Assume a straight line within a non-Euclidean Riemannian space between points A and B is projected onto a plane (continuous line in the picture):



Now, the dotted line represents, within that Riemannian spatial structure, a longer line than the continuous one. I do not deny that empirically we can get used to a Riemannian metric to the point of immediately identifying the dotted line as a longer line than the continuous line. What I reject is that by acquiring this habit we can talk of having a sensible intuition of Riemannian space, as if we had reconfigured our sensible visual experience. What happens when we get used to this new metric is that we are introduced to an underlying set of relationships which define the type of congruence and metric that reign in experience. That is, we come through habit to a certain intuition of the Riemannian spatial metric, but this intuition is not purely sensible, it is gained only through the previous projection of metrical relationships. Now, the question to be posed in our example is this: Does the sensible apprehension of the dotted line as being shorter than the continuous line presuppose, in the same way, a previous projection of a Euclidean spatial metric or congruence? It seems to me this is only so if we take the relationship “being shorter than” as holding for real physical experience. But within the horizon of a mere sensible experience and prior to the introduction of a spatial metric, this relation is sensibly imposed on us. We come to apprehend this relation by means of an immediate recourse to

⁹ Cf. Hans Reichenbach, *The Philosophy of Space and Time*, §11.

sensibility. And, precisely, the point at stake here is that non-Euclidean spatial structures can never be sensibly apprehended in this same way. To put it plainly: non-Euclidean spatial structures do not configure our sensible experience.

Let us yet analyze the example considered within Kant's thought. Kant held that sensible geometrical relationships require a sensible syntheses to be objectively constituted in the unity of apperception. The Kantian syntheses of apprehension, reproduction, and recognition are necessary conditions for a sensible object to be given. Only through this syntheses, if we follow Kant, are the lines opposed to us as sensible objects. When we are accustomed to a Riemannian metric, what is sensibly apperceived continues to remain exactly the same: the sensible lines have not changed whether we assign a Euclidean or a Riemannian metric to the physical space where the sensible lines are contained. It is clear that the Kantian a priori syntheses of apperception does not impose a particular metric to the sensible space. On the contrary, only when the lines are apperceived, and only then, can we impose a certain set of metric relationships that do not yet have a sensible character. The sensible syntheses of the imagination has an a priori character which is foreign to the assumption of a particular metrical relationship. The assumption of a certain spatial metric seems like a relational projection. This relational projection could be understood as a syntheses, but then we must recognize that it is not the same kind of a priori syntheses that Kant deals with. Kantian sensible a priori syntheses of the transcendental imagination is already into force when any metric is projected and, what is most important, cannot be empirically reinforced or modified the way the assumption of a metric can. Again, the most important thing to notice here is that Euclidean relationships hold as soon as the objects are sensibly apperceived. That is, they hold with an a priori sensible character, which is already in force when any metrical relationship is projected. Euclidean geometry can therefore be taken to be inherent to any objective apperception, that is, inherent to every possible experience, although only inasmuch as it is immediately and sensibly given. It is not true, therefore, that the Kantian doctrine of space has been refuted by "scientific developments".

Finally, it is worth considering that a "sensible geometry" so taken do not explicitly define any particular metric at all. Within Kant's horizon, the justification for claiming that there is only a straight line between two points, that this straight line is the shortest of all possible lines or that two parallel lines never touch one another, is neither assured by appealing to formal axioms nor to a physical adequacy gained having recourse to certain physical postulates. The justification can only be given in itself in a sensible cognition. That is, the "a

priori” character of Euclidean space is something whose justification can only make appeal to a sensible syntheses whose necessity and evidence has to be expounded by direct consideration. It can only have, therefore, a *phenomenal* character.

4. Euclidean Space and the Philosophy of Science

My vindication of Kant finishes here. It must be now pointed out that Kant mistakenly thought that the constitutive conditions of all possible experience hold also as necessary features of the natural sciences. He claimed: “the principles of possible experience are then at the same time universal laws of nature, which can be known a priori. And thus the problem...’how is pure science of nature possible?’ is solved”. (Prol. p. 306) Thus, according to Kant, Euclidean geometry would be normative not only for all possible experience, but also within the theoretical framework of the natural sciences. With this claim, which has been factually refuted, Kant went beyond what he had actually shown in the *Critique of Pure Reason*. Taking into account the dominance of Newton physics during his lifetime, it is quite understandable why Kant exceeded the limits of his own achievements. But we should not lead us astray because of these Kantian claims. We must consider what is the legitimate meaning of an a priori sensible Euclidean space as Kant originally stated it, and what could it be its relevance to the philosophy of science.

Since the necessity of Euclidean geometry has a sensible character, its a priori validity has to be limited to what is immediately and sensibly given in experience. This limitation prevents us from mistakenly assuming that any empirically adequate scientific theory must hold to a formal Euclidean geometry but it does not block consideration of the possible implications of this a priori for the philosophical reflection of the Natural Science.

It is generally assumed that a priori normative principles cannot play any role at all in the philosophical reflection on science. While it is normally admitted that any particular determination of experience moves within the assumption of certain principles, it is usually denied that these can be normative a priori. And therefore, it is normally hold that “we must retain Kant’s characteristic understanding of a priori principles as constitutive... while rejecting the more traditional marks of necessity, unrevisability, and apodictic

certainty”.¹⁰ Myself, I certainly agree that the use of certain a priori principles is constitutive of scientific knowledge in the sense that we make use of theoretical projections in the constitution of every physical theory. But I strongly oppose the suggestion that none of Kantian a priori principles in science can be taken as normative. The normative character of Euclidean space, for instance, is certainly not legitimate when claimed beyond a sensible immediate experience, but, as we have shown, it is to be saved when restricted to it. Now, if we are to ask what is the relevance of this normativity for the philosophy of science we have to ask what role does our immediate sensible experience play for the constitution of our physical theories and what role should this a priori sensible configuration play in the philosophical reflection of the empirical sciences.

The a priori character of the Euclidean space must be conceived as an immediate feature of our sensible experience. Of course, this sensible experience is always into force before any theoretical scientific construct is constituted. The claims of every empirical science depend, in some way, on this immediate sensible experience; only within the framework of a sensible experience can empirical sciences stand up and constitute themselves as theoretical determinations. That the constitution of the empirical sciences are referred to the immediate sensible experience means that, while aiming at the determination of the irrelative-objective features of the world, the immediate sensible experience is the original ground to which all alleged or real justification of every theoretical construct depends. While the constitution of every empirical theory is referred to what is sensibly given in immediacy, the theories themselves are never given in that same immediacy but depend always in the institution of theoretical principles. On the ground of a sensible experience that has a Euclidean configuration we end up with physical claims, void of immediate sensible content, that support a non-Euclidean structure of the world. Now, the relevance of an a priori Euclidean sensible space for a philosophical reflection of science does not lie in vindicating a preeminence or privilege of Euclidean structures over non-Euclidean ones when used within physical theories. I claim for it something more humble. This normative a priori helps us to put into context the real character and meaning of what physical theories ultimately say, and can or cannot ascertain about the world. Physical theories are built up having recourse to an experience that has always a sensible Euclidean character. Therefore, we should not be willing to give blind ontological credit to whatever claim about the spatial structure of the world comes from a physical theory. The

¹⁰ Michael Friedmann, *Dynamics of Reason*, 1999 Stanford Kant Lectures, CSLI Publications, p. 73.

gap between the a priori form of our sensibility and what is claimed within an empirical theory should lead us to identify what are the theoretical projections and assumptions that make the latter possible and be also aware of the significance and limits of the claims stated in physical theories.

This relevance of the a priori validity of Euclidean sensible space to our reflection of the natural sciences can be linked with the Husserlian notion of the Lifeworld if we bracket out the transcendental constitutive status that this notion had in his thought. The Lifeworld can be understood as that which is always and already valid for us before any scientific theory is constituted. It is that which is “in force” as immediately given before any scientific theory is built. Thus, it forms the basis on which any theoretical science has to stand. This thesis does not have here a constitutive sense but a formal phenomenological one. Lifeworld is merely taken here as those immediate features of experience to which all justification of every theoretical scientific construct refers. That is, merely taken, in the sense derived by this words of Husserl:

Science is a human spiritual accomplishment which presupposes as its point of departure... the intuitive surrounding world as it is given in its particularity to the scientist. For example, for the physicist it is the world in which he sees his measuring instruments, hears time-beats, estimates visible magnitudes, etc. –the world in which, furthermore, he knows himself to be included with all his activity and all his theoretical ideas.¹¹

Taken the Husserlian notion of the Lifeworld in this limited sense, the Euclidean form of our sensible experience can be exactly conceived as an essential feature of our Lifeworld that is already into force before any theoretical scientific construct is constituted. In reflecting about the ultimate significance and relevance of our theoretical scientific achievements this ultimate dependence should always be kept in mind.

5. About the Meaning of the Material Ontology attached to the Region “Natural World” in Husserl

The clarification of the a priori normative character of the Kantian Euclidean space can help us now to make sense of the a priori normative

¹¹ E. Husserl, *The Crisis of the European Sciences*, §33.

character of the material ontology attached to the region “natural world” in Husserl. Let us first introduce this Husserlian notions.

For Husserl, evident judgements concerning essential relationships are made possible through essential intuition. Evidence is due to the fact that what is stated in such judgements is not something merely mentioned or presupposed but an identity originally given in itself.¹² Husserl has shown that the essential relationship that a judgement like “ $1+1=2$ ” enunciates, can be phenomenally intuited, that is, can be shown in itself in an unitary and synthetic conscience of identity. Because this essential relationship is phenomenally intuited *in its own identity*, it has the features of necessity and a priori validity of the relationships which are independent of questions of fact.

When essential relationships involve essences endowed with a particular material content (if they involve essences like colour, sound or material thing, for instance), they are a priori valid only in relation with the objects which fall within the essential region in which the relationship falls.¹³ If they are not attached to a particular material region, the essential relationship is formally valid with independence of the type of object considered. In short, it is possible to express essential relationships whose validity constricts a priori to regions endowed with a particular material content (material ontologies) or essential relationships which are formally valid for every possible object (formal ontology).

Since empirical science aims to determine what is factually given in experience, it is a kind of knowledge whose nomological structure cannot be taken to be a priori or necessary.¹⁴ Husserl points out, nevertheless, that every empirical theory submits to certain essential relationships. That is, every empirical theory, despite their factual character, has to conform a priori to certain “rules”. First of all, every theoretical structure aimed to determine experience objectively has to submit to the essential relationships revealed by a formal analytic inasmuch as these apply for every object in general and/or every apophantic statement referred to objects.¹⁵ Scientific empirical theories have to conform, therefore, to the essential relationships of a formal ontology. Besides, it seems that the empirical sciences would have to submit to the essential relationships revealed a priori within the material region “object of experience”: formal geometry, foronomy, a priori temporal structure, etc... That is, it seems

¹² Cf. E. Husserl, *Logical Investigations*, Sixth Investigation – *Husserliana XLIX/2* §65.

¹³ For the notion of region as the essential articulation which is inherent to an independent essence or “concrete” [*Konkretum*], Cf. E. Husserl, *Ideas I*, §16.

¹⁴ Cf. E. Husserl, *Logical Investigations*, “Prolegomena” – *Husserliana XVIII*, §72.

¹⁵ Cf. E. Husserl, *Ideas I*, §8.

that scientific empirical knowledge would have to conform to the material ontologies referred to the “natural world.”¹⁶

Allegedly then, it is a particular result of the a priori character of the material ontology attached to the region “natural world”, that essential geometrical relationships hold a priori for the empirical sciences. It seems, furthermore, that this is an idea that Husserl would have stated in some of his texts:

“Every study of the figures of the factual bodies is necessarily an application of the geometrical knowledge. That is the only right Method. And the study of the pure body forms produces the system of essential geometrical laws that build the absolute fixed frame, to which every empirical movement and structure is linked. This absolute fixed frame must be known in order to be able to use these scientifically in the Mechanic”.¹⁷ “That a natural scientific description can only be valid when it coincides with natural ontological laws is obvious and does not need further elucidation, because what is described is under the valid ontological concepts”.¹⁸

Again, this a priori validity of the material ontologies for the empirical sciences seems to be put into question by the development of scientific descriptions of the world whose features do not correspond to those essential relationships proclaimed to hold a priori within the region “natural world”. Making use of the previous elucidation of the character of the a priori validity of Euclidean sensible space we will now try to grasp the true significance of the a priori validity of the material ontology attached to the region “natural world”.

As we have just said, material ontologies are essential relationships which are necessarily valid within the framework of a determinate material region. These particular essential relationships are yielded through a process of ideation, through the imaginative variation of objects which fall within a certain type. Let us consider what is intuited in the eidetic variation of objects which fall

¹⁶ Cf. E. Husserl: “According to what we are saying, any empirical science belonging to the extension of a region will be essentially related not only to the formal but also to the regional, ontological disciplines. ... In this manner there corresponds, e.g. to all the disciplines comprised in natural science, the eidetic science of any physical Nature whatever (*the ontology of Nature*), since there corresponds to *de facto* Nature an Eidos that can be apprehended purely, the “essence” *Any Nature Whatever*.” *Ideas I*, §9, pp. 18-19.

¹⁷ E. Husserl, *Ideas III - Husserliana V*, §11, p. 70; Also, Cf. E. Husserl, *Logical Investigations – Husserliana XIX/1*, §6, B₁ pp. 18-19.

¹⁸ E. Husserl, *Ideas III - Husserliana V*, §17, p. 91.

within the region “natural world”. That is, let us consider what is the significance of the essential relationships discovered in that particular region. Under “natural world” Husserl understands the region that corresponds to objects given in experience. The essential relationships that apply to this material region are gained through the variation of those features which appear in objects given in an immediate experience: essential laws of geometry, corporality etc... The a priori validity of these essential relationships only refer, therefore, to what is empirically given with immediacy.

Scientific theories are empirical inasmuch as they refer to an immediate experience, but they do not aim at depicting experience in its immediacy but at determining the intersubjective-irrelative structure of experience¹⁹. This determination has not the character of a direct acquaintance of something given in an immediate experience: the determinations that science make can only be gained through theoretical projections. As a result of this, the essential relationships which we find in immediate experience do not have to be homogeneous with the elaborate scientific descriptions of the world. Because scientific theories do not aim at the depiction of the immediate and intuitive experience, physical theories like quantum mechanics or the theory of relativity can present a structure of the world which diverges from the essential relationships which impose on us in our immediate experience. Or, better said, because scientific theories do not have the character of an immediate description of the world, the essential relationships which conform that which is immediately given cannot prescribe the essential features of scientific empirical theories. Even if this difference seems at times to have been neglected by Husserl, specially in his first writings, there is no doubt that he was aware of it. Husserl was very conscious that the essential features that apply to experience, taken as the object of intersubjective determination, cannot be merely obtained through an eidetic variation performed solely in the constitutive level of that which is sensibly given²⁰.

The a priori character of the material ontology which applies to the “natural world” and its relation with the empirical sciences has to be understood the same way the a priori character of Kantian Euclidean space has previously been understood. The essential relationships attached to the region “natural world” do not show necessary features of every possible theoretical descriptions of nature, but features which are essential to our immediate experience. That is, they are to be conceived as the essential features of that which is given as

¹⁹ Cf. E. Husserl, *Ideas II – Husserliana IV*, §18g,h.

²⁰ Cf. E. Husserl, *Experience and Judgement*, §93b.

experience before any empirical theory has been built. Since any empirical theory can only be built up lying on the ground of an immediate experience, the epistemological meaning of an elaborate theory is dependant or relative to that ground. In short, the essential relationships of the region “natural world” express features of the Lifeworld. Not as if they could stand as that which is given before any ideation is carried out (as essential relationships they themselves are attained trough ideation), but in the sense that they express essential features of our immediate experience; features of that point of departure on which the constitution of any elaborate empirical theory depends.