What is Modern in the Crisis of European Sciences?

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Abstract

Although the notion of the crisis of European sciences has a general meaning, Husserl mainly focuses on this phenomenon in relation to the modern establishment of a mathematical natural science. However, he does not provide a definitive clarification of how its new method is specifically involved in bringing about such a crisis. Without trying to offer a faithful exegetical contribution, this paper further elaborates on Husserl’s analyses in the Krisis to give a possible answer to this question. After defining the concept of crisis in general, I single out why algebraic thinking is the core of the method that essentially characterizes mathematical physics. Then, I compare this method to a case of pre-modern discipline (namely, Euclidean geometry) to show that the sedimentation of meaning at work in the progressive technization of algebra is exceptional and sufficient to explain the specificity of the modern character of the crisis of the exact sciences. The exclusively technical development of formal mathematics, in fact, elicits those shifts of meaning (such as objectivism) that phenomenology is required to amend to overcome the crisis and to establish an authentic form of knowledge. On the basis of these results, I conclude by suggesting a few consequences that are useful for the understanding of the project of phenomenology of the later Husserl.

1 Introduction

In Die Krisis der europäischen Wissenschaften und die transzendentale Phänomenologie (henceforth: Krisis), Husserl famously stated that the “scientificity” of present-day sciences has become questionable. On his view, this thesis does not undermine the legitimacy and the actual theoretical success of sciences such as mathematics and physics, especially when they are compared to others, notably psychology and
philosophy, that have not reached an analogous standard of rigor and results. Yet, he traces a distinction between positive sciences as theoretical techniques, having the task of finding out more and more truths within a certain domain of being through the implementation of a certain method, and sciences as authentic knowledge (echte Wissenschaft or ἑπιστήµη) having satisfied the epistemological requirement of an ultimate justification of their own rationality. The problem lies in the fact that given sciences lack precisely such a second-level enquiry that would guarantee the logical validation of their method and truths. Without it, they can only rely on their factual efficacy. But if it is case, as Husserl notes in the lecture he gave in Vienna in 1935, “the rationality of the exact sciences is of a piece with the rationality of the Egyptian pyramids” (1970, 295).

Hence, the crisis of European sciences does not primarily regard their “loss of meaning for life” (Verlust der Lebensbedeutsamkeit). As Emiliano Trizio has convincingly shown (2016), the latter is instead a significant side-effect grounded in the epistemological question, that is, in the fact that sciences are just truth-seeking techniques satisfying a “prima facie scientificity,” whereas “the sense in which they achieve knowledge of a certain region of ‘ontos on,’ i.e. the ultimate rationality of their task and method (high level, and ‘authentic’ scientificity) is completely lost” (2016, 199). Husserl’s claim is that sciences are epistemologically incomplete. Even more dangerous in his eyes, however, is that the epistemological demand for completeness is not felt as a necessity anymore. Philosophy has in this way abdicated its guiding role in the construction of a universal science that is conscious of, and responsible for, the sense and the limits of its truths. Since the concrete possibility of the realization of this philosophical desideratum moulded the original project of the pioneers of modern science, the scepticism toward philosophy that is witnessed nowadays cannot be interpreted as a peculiar expression of our Zeitgeist. Husserl invites us to consider it as the sign of the “bankruptcy” of science overall. This attitude is paradigmatically embedded in Hume’s scepticism, which is then inherited by the neopositivistic conception that limits the domain of sciences to “facts” and thus “decapitates” philosophy. It symbolizes the definitive abandonment of the philosophical duty for an authentic epistemological clarification of sciences, and thus for the attempt to penetrate the ultimate “problems of reason.” In this “residual concept” of philosophy, those problems are catalogued as “metaphysical” and are ipso facto deprived of any value. The crisis of sciences is thus to be understood as a consequence of the crisis of philosophy because the latter leaves positive sciences without the epistemological foundation that would make their sense clear. But then, Husserl asks rhetorically:

Are science and its method not like a machine, reliable in accomplishing obviously very useful things, a machine everyone can learn to operate correctly

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1 As Husserl writes: “At any rate, the contrast between the ‘scientific’ character of this group of sciences and the ‘unscientific’ character of philosophy is unmistakable” (Husserl, 1970, 4–5).

2 As Husserl writes: “Thus the crisis of philosophy implies the crisis of all modern sciences as members of the philosophical universe: at first a latent, then a more and more prominent crisis of European humanity itself in respect to the total meaningfulness of its cultural life, its total ‘Existenz’” (1970, 12).
without in the least understanding the inner possibility and necessity of this sort of accomplishment? (1970, 52)

2 The Causes of the Crisis and Two Questions

In Husserl’s diagnosis, this unfortunate consequence does not come about by chance, but is implicit in the tendential “technization” (Technisierung) to which every method is subjected, and by the peculiar forgetfulness that is somehow coessential to it. What does this mean? This idea finds its roots in Husserl’s very early philosophy, and it basically expresses the fact that a method producing any cultural formations can be learned and then mastered without an internal understanding of its “logic.” What is transmitted through the generations, and possibly indefinitely improved, is precisely this exterior capacity, whereas the original meaning that established the method as such can be lost in the process. An example can easily clarify this idea. We employ the Indo-Arabic numerical system on a daily basis as a machine for expressing numbers and attaining correct results for ordinary calculations. We were taught how to use these signs and how to apply algorithms to make additions, multiplications, and so forth. Yet, most of us have no clue about the way in which such a method works, so that each of us mechanically relies upon its apparently magical properties without further questioning. This is fine if our concerns are not scientific. Once we get into science, and thus we are after truth, however, we need to ground the logical necessity of the technique beyond the empirical aid that it constantly provides.

Husserl expresses this idea as follows: “The developed method, the progressive fulfilment of the task, is, as method, an art (τέχνη) which is handed down; but its true meaning is not necessarily handed down with it” (1970, 56). The method of science is no exception. In the wake of its practical success, the need for a renovation of the concepts’ proper meanings easily fades away and a mere technical knowledge is all that remains. Scientists learn how to efficiently use concepts and instruments with a kind of passive understanding that has left the evidence legitimating the operations behind. The original meaning that gave sense to the method itself, and that for this reason Husserl also calls its “final sense” (Zwecksinn), is thus “exteriorized.” Still, he argues, this “exteriorization” (Sinnesveräusserlichung) is at the same time a “sedimentation” (Sedimentierung) of the very same meaning in the signs produced to express the scientific truths. The geological metaphor suggests that the original meaning is somehow covered by the sign: it is not visible on the surface anymore.

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3 This situation recalls in some respects the notion of “normal science” as “puzzle-solving” in the description that Thomas Kuhn (1962) gave in the Structures of Scientific Revolutions. What is common is the characterization of scientists as skilled technicians that exploit, rather than understand, the conceptual resources anticipated by a paradigm. Thus, “by bringing a normal research problem to a conclusion is achieving the anticipated in a new way, and it requires the solution of all sorts of complex instrumental, conceptual, and mathematical puzzles. The man who succeeds proves himself an expert puzzle-solver, and the challenge of the puzzle is an important part of what usually drives him on” (1962, 36).

4 Husserl writes: “Serving in the methodical praxis of mathematicians, in this form of long-understood acquisitions, are significations which are, so to speak, sedimented in their embodiments” (1970, 26–7).
although it is not completely vanished. Since it lies at the bottom of a series of historical strata that have transformed and covered it up, it is still implied in the ordinary and naïve use of signs. Hence, it can in principle be reactivated. As it is well-known, this is one of goals that Husserl assigns to his late phenomenology.

This initial clarification gives us the opportunity to appropriately approach two decisive questions. Even though Husserl, as I mentioned, argues that the intricate phenomenon of exteriorization-sedimentation of meaning affects every cultural practice, he stresses nonetheless that the “crisis” in question has a specific scientific character. But then, (1) what makes the sedimentation of meaning particularly “critical” for science in general? Moreover, Husserl is clearly preoccupied with modern science in particular. Although the definition of crisis is not to be necessarily restricted to the modern period, his focus is mainly directed to sciences after the decisive mathematization of natural science has taken place.\(^5\) Despite the theoretical and practical successes that it has occasioned, it is then the proper rationality of this mathematical method that has become questionable and that therefore characterizes the specificity of the crisis of modern sciences.\(^6\) But then, (2) why is this the case? That is, how is the mathematizing method proper to modern sciences involved in the sedimentation constitutive of their meaning?

### 3 What is Scientific in the Crisis?

The first question is easily resolved by recalling Husserl’s understanding of authentic science. Husserl ascribes this discovery to Plato, whose “theoretical reform” was in origin a confutation of the skeptic theories set forth by the sophists. In so doing, he paved the way for the possibility of an objective theory of reality that was at the same time grounded in an a priori account of its conditions of possibility (what Plato called “dialectics”). The main difference between Plato and his teacher Socrates is, in fact, that the latter naively exercised a philosophical method of clarification directed toward the identity of sense of the objects investigated, whereas the former “tackled

\(^5\) On some occasions Husserl speaks of a “Krise” in relation to pre-Platonic philosophy, for example, in a course he gave in Freiburg in 1919/1920 (2012, 194). Still, there are important differences that have to be taken into account. The “skeptical paralysis” (skeptische Lähmung) provoked by the sophists is revealed in the fact that they hindered the intellectual achievement of an exact natural science—an achievement whose pre-conditions (Vorbedingungen) were finally laid down by Plato’s “mathematical idealism:” “[Plato] durch seine idealistische Umgestaltung der Mathematik zu einer apriorischen Wissenschaft ihr diejenige Gestalt gegeben hatte, durch die sie allein das berufene methodische Instrument exakter Naturwissenschaft werden konnte” (2012, 195). The interrogation of the crisis of modern science has instead as its starting point the established existence of a successful exact mathematical natural science, which is in crisis notwithstanding. In fact, he writes, “the self-understanding which is so necessary in our philosophical situation, demanded clarity concerning the origin of the modern spirit and, together with that—because of the significance, which cannot be overestimated, of mathematics and mathematical natural science—clarity concerning the origin of these sciences” (1970, 57).

\(^6\) Husserl said in the Vienna Lecture: “What we must do, in connection with our problem of the crisis, is to show how it happens that the ‘modern age,’ which has been so proud for centuries of its theoretical and practical successes, finally becomes involved in a growing dissatisfaction, indeed must view its situation as one of distress. In all the sciences distress is felt, ultimately as a distress concerning method” (1970, 294).
the question of the possibility of knowledge by assuming the method as the actual object of philosophical speculation” (De Santis, 2020, 8). In Husserl’s narrative, this amounts to saying that Plato overcame the naivety inherent in Socrates’ pre-scientific philosophizing by laying down the foundations of logic, understood in the wide sense of “theory of science” (Wissenschafstlehre), that is, the doctrine yielding the eternally valid norms that all knowledge must satisfy in order to be “rational.”7 If this is the ideal of philosophy as authentic knowledge hinted by Plato, then it becomes clear why the passive technization of a method, otherwise acceptable in other contexts, is essentially incompatible with science: a science that does not ground the proper rationality of its method is simply not a philosophical science, but a technique. In a word, “technization is the opposite of philosophization” (Trizio, 2021, 154).

The second question needs further elaboration. Looking at the whole history of philosophy, there seems to be nothing peculiar in modern thought which would be against the Platonic ideal of philosophy. Quite the contrary: Husserl acknowledges the unprecedented epistemological value of a mathematized natural science, and emphatically so.8 How is it possible then that such an achievement is matched with the threat of the definitive forgetfulness of what an authentic scientific knowledge is supposed to be?

To solve the paradox, Husserl has famously engaged himself with the philosophical interpretation of Galileo in § 9 of the Krisis. He has tried to show that the radicalized versions of skepticism that we encounter in modern thought are not only compatible with an exact science of nature, but, quite astonishing, that they are derived from it; or better, from a misleading understanding of its results and accomplishments. This is how Husserl explains the passage from Galileo’s faulty objectivistic interpretation of his own mathematization of nature to Hume’s skepticism and eventually to the crisis of philosophy.9 The link between the technization of the mathematical method and the crisis is then objectivism, and it is therefore at this conceptual junction that the question has to be addressed. To be more precise, my goal consists in showing why the specific way of sedimentation of meaning that is at work in that method led to modern objectivism.

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7 These are philosophical-historical considerations that Husserl starts elaborating during the twenties. They are condensed in the introduction to Formale und Transzendentale Logik (hereafter: FTL): “Plato’s logic arose from the reaction against the universal denial of science by sophist scepticism. If scepticism denied the essential possibility of any such thing as ‘philosophy,’ as science, then Plato had to weigh, and establish by criticism, precisely the essential possibility of such a thing. If all science was called in question, then naturally no fact, science, could be presupposed. Thus Plato was set on the path to the pure idea. Not gathered from the de facto sciences but formative of pure norms, his dialectic of pure ideas—as we say, his logic or his theory of science—was called on to make genuine science possible now for the first time, to guide its practice” (1969, 1–2).

8 Husserl writes: “Is there in the history of the world anything more worthy of philosophical wonder than the discovery of infinite totalities of truth, realizable in infinite progress either purely (in pure mathematics) or in approximations (in inductive natural science)?” (1970, 66).

9 In this sense, Hume makes simply explicit a countersense in which modern objectivism since Descartes was already caught: “empiricist skepticism brings to light what was already present in the Cartesian fundamental investigation but was not worked out, namely, that all knowledge of the world, the prescientific as well as the scientific, is an enormous enigma” (Husserl, 1970, 89).
4 Galileo’s Mathematization of Nature

To single out the core of the method of modern mathematical physics, we have to take a brief detour and introduce the Husserlian account of the Galilean revolution. We can summarize Husserl’s famous reading of Galileo’s historical role in the following way. Thanks to the application to reality of the taken-for-granted geometry inherited by tradition, Galileo set forth the “hypothetical anticipation” (hypothetische Antizipation) of a completely mathematized universe whose exact laws are only mathematically expressible.10 Whereas the relationship between the real and the ideal was previously ruled by the Platonic notion of μέθεξις, in the Galilean mathematization of nature reality itself is idealized (idealisiert) on the basis of the new mathematics. Despite the inductive findings occasioned by this hypothesis and thus its ever renewed “verifications,” such an anticipation remains a hypothesis guiding the scientific research in its infinite project of a complete mathematization of the world.11 Idealized reality becomes the objective correlate of the “total idea of physics” (Totalidee der Physik), i.e., a Kantian idea that “does not lie in the infinite in the same way that a pure straight line does; even as an infinitely distant ‘pole’ it is an infinity of theories and is thinkable only as verification; thus it is related to an infinite historical process of approximation” (1970, 42). The findings made possible by this indefinite process were interpreted as the proof of the correctness of the hypothesis, so that the idea of the physical world being intrinsically mathematical could be taken afterwards as a mere “obviousness.”

Now, what does “mathematization” mean more exactly? According to Husserl’s decisive definition, with Galileo “nature itself becomes—to express it in a modern way—a mathematical manifold [mathematische Mannigfaltigkeit]” (1970, 23). This is a technical concept in Husserl’s phenomenology whose original formulation resulted from the rearrangement of some key ideas contained in the Philosophie der Arithmetik. We find a clear definition in Ideen I (§ 72), where a “definite manifold” (definite Mannigfaltigkeit) or “mathematical manifold in a proper sense” (mathematische Mannigfaltigkeit im prägnanten Sinn) is characterized by the fact that

a finite number of concepts and propositions derivable in a given case from the essence of the province in question, in the manner characteristic of purely analytic necessity completely and unambiguously determines the totality of all the possible formations belonging to the province so that, of essential necessity, nothing in the province is left open (1982, 163).

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10 As stressed by James Dodd, this must be taken in the strongest sense: “the claim is that this is the only way that the world can be meaningfully articulated as such; any other articulation is a failure to grasp the essence of things, it simply falls short of a comprehension of what is. […] if we are to understand, then we must engage the language of mathematics, because that is the very language in which one can say what there is to be said about the world” (2004, 94).

11 Husserl writes: “the Galilean idea is a hypothesis, and a very remarkable one at that; and the actual natural science throughout the centuries of its verification is a correspondingly remarkable sort of verification. It is remarkable because the hypothesis, in spite of the verification, continues to be and is always a hypothesis; its verification (the only kind conceivable for it) is an endless course of verifications” (1970, 41–2).
A classic example of manifold is the field described (albeit insufficiently) by Euclid’s primitive concepts and axioms in the *Elements*.\(^{12}\) A science proceeding axiomatically is called “nomological” by Husserl. The Galilean hypothesis sees idealized nature as a field that could be in principle constructed in such a way. Having a few concepts at the outset, one might ideally derive every true consequence and exclude the false ones according to a set of fundamental laws.\(^{13}\) The obvious difference between physics and an *a priori* nomological science like Euclidean geometry is that the axioms of the latter are, to use the vocabulary of modern philosophers, “innate” to the intellect since they express intuitively valid statements. On the contrary, we do not have an original insight of the most elementary laws of nature. They might all reside *in mente Dei* but must be laboriously obtained *a posteriori* by us through an inductive experimental method (see De Gandt 2004, 86–88).

Manifolds can be either material or formal. Euclidean geometry is a case of a material manifold since it has a proper object-domain (idealized space) whose denizens are points, planes, spatial figures *in specie*. An important feature of material mathematical manifolds, and correlatively of nomological sciences, is that they are prone to a “formalizing universalization” (*formalisierende Verallgemeinerung*) which has the goal to “let the material particularization of the manifold become completely indeterminate” (1982, 164). After this theoretical passage the objects of a certain field are no longer defined by their specific marks, but exclusively by the relations they have with each other. Because of formalization, the manifold determined, say, by the material theory of intuitive space (Euclidean geometry) is transformed into its *form*, that is, into the formal structure of any Euclidean-type (three-dimensional) manifold. In this respect, Euclidean geometry becomes a mere particularization (*Besonderung*) of such a manifold—in modern terminology, a “model.” Points, straight lines, and so forth are then considered as “something-in-general” (*Etwas überhaupt*), empty bearers of formal relations expressible as such by algebraic variables (\(x, y\), etc.). The eidetic relationships existing between them are deprived of their original meaning as well and become formal connections.\(^{14}\) In this way, the truths referring to a determinate ideal domain are transformed into the *form of truths* referring to a domain *in general*.

If nature is mathematized *ex hypothesi*, formalization can be also applied to it. A previously inconceivable theoretical perspective on physical things becomes thus normative. For instance, while in Aristotle’s doctrine of natural motions the inner

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\(^{12}\) Insufficiently because, as Husserl explains in the 1917–1918 lectures on *Logic and General Theory of Science*, Euclid “had passed over many axioms in silence” and “had made use of many obvious steps of inference whose principle is specifically geometrical [and thus not strictly analytical]” (2019, 276).

\(^{13}\) To avoid any misunderstanding, it is worth noting that the expression “mathematical manifold” is here certainly used in the technical sense just recalled. This is revealed, for example, by the following passage from the *Beilage IV*: “Die subjektiv wandelbaren, die empirischen Naturphänomene (…) verweisen auf eine mathematische Idee einer Natur an sich als Universum von Körpern an sich. (…) Darin fundiert die kausale Gesetzlichkeit, durch welche jeder Körper, dessen ideales Wesen in seinem raumzeitlichen kausalen Sein besteht, berechenbar ist. Die mathematische allgemeine Gesetzlichkeit ist insofern definiert, als sie die Form einer endlichen Zahl von mathematischen Grundgesetzen hat („Axiomen”), in denen alle Gesetze rein deductiv beschlossen sind, als reine Konsequenz” (1954, 387).

\(^{14}\) This is what has been accomplished in geometry by David Hilbert in his *Grundlagen der Geometrie* (1899).
nature of the experienced thing could explain its physical properties, modern scientists disregard any specific character to determine its movement. The “essence” of the thing and even the sensible qualities belonging to it (what Husserl names Fülle) are not relevant for a mathematical determination. The thing is reduced to a mere “example,” a “something” standing for a formal substratum. As Husserl already pointed out in Ideen I, the experienced thing

provides the mere ‘This,’ an empty X, which becomes the bearer of mathematical determinations and corresponding mathematical formulae, and which exists, not in perceived space, but in an ‘Objective space’ of which perceived space is merely a ‘sign’ – a three-dimensional Euclidean multiplicity which is representable only symbolically. (1982, 85)

This passage seems to describe the same formalizing step that I have noted above in the case of geometry. Still, the reference to the physical domain adds some important connotations. In particular,

1) the use of “X” to characterize the mathematized thing is revealing. On my view, it is not an innocent metaphor to refer to something that is “unknown” like the Kantian noumenon, but it must be interpreted quite literally. Through formalization the sensible thing becomes an indeterminate and general object that is emptied of all its proper contents, and that is therefore only symbolically representable as an x, an algebraic letter. In opposition to Kant, the x is not the sign for the unknowable, but rather for what is mathematically knowable despite its being beyond the limits of intuitive experience.

2) In fact, this x is not perceivable as such. It receives instead an indirect mathematical definition via the functional correlations it has with other Etwas. In virtue of their exactness and formality, these relations do not immediately refer to the intuitive space, which is inexact and concrete. They are theoretical constructions belonging instead to an “ideal” and categorial space beyond sensation.

3) This operation, consisting of “constructing beneath” a mathematical substratum to the perceived things, is named by Husserl “logical substraction” (logische Substraktion). When unconsciously practiced, it elicits a (problematic) metaphysical interpretation that hypostatizes the formal multiplicity, and lowers, conversely, the things perceived to subjective images of this exact mathematical world. I will develop this last point in the next section.

15 Alfredo Ferrarin remarks: “the starting point of the experimental method is not a sensible thing, an observable individual, but an abstraction, a universal: an object, not a thing – where the object is an idealization that applies to any possible natural entity, whereas a thing is a particular body or natural being” (2014, 75).

16 Here is the original version of this important passage: “Das eigentlich erfahrene Ding gibt das bloße ‚dies,’ ein leeres x, das zum Träger mathematischer Bestimmungen und zugehöriger mathematischer Formeln wird, und das nicht im Wahrnehmungsraum, sondern in einem ‚objektiven Raum,’ dessen bloßes ‚Zeichen’ jener ist, existiert, einer nur symbolisch vorstellbaren Euklidischen Mannigfaltigkeit von drei Dimensionen” (1976, 90–91).

17 It is still plausible, though, that Husserl took such a usage from Kant’s Kritik der reinen Vernunft, where the equation “Etwas = X” (to refer to the noumenon) is explicitly stated.
This threefold characterization makes sense of the possibility of the formal-mathematical treatment of natural phenomena. This does not amount to saying that physics is actually a formal discipline. It is instead a material theoretical science having a determined region of being as its object of study. Still, because of the assumed axiomatic structure of the region, the physical relations that subsist among the objects of the domain can be formally expressed through algebraic formulae. Algebra and higher mathematics are in turn, for Husserl, parts of formal logic which can function as instruments for material nomological sciences like physics. In fact, because they are not bound to a definite domain, but express general structures instantiable by diverse objects, algebraic formulae are differently interpreted depending on the domain at hand. The same equation “a + b = b + a” might express a general arithmetical law when applied to natural numbers, or a geometrical one when applied to lines. In physics, given the Galilean hypothesis, “formulae obviously express general causal interrelations, ‘laws of nature,’ laws of real dependencies in the form of the ‘functional’ dependencies of numbers” (1970, 41). What differentiates the physical case from the eidetic ones is that formulae are here used to determine in an exact manner the real behaviour of the individualities we face in everyday life. They become machines for prevision.  

That is, after having experimentally established the functional correlation between variable physical quantities, one can predict with the greatest precision what is going to happen in analogous cases. This is why “the whole method has a general sense, even though one always has to do with what is individual and factual” (1970, 41). On the one hand, we have the “subtraction” of the empty X referring to the pure mathematical substratum symbolically expressed; on the other, the body perceived hic et nunc, whose role within the overall method is merely exemplary.

We can finally come to a first conclusion. If mathematical physics is defined as a scientific technique whose scope is to make “inductions with an efficiency, a degree of probability, a precision, and a computability that were simply unimaginable in earlier times” (1970, 295), then formulae are the very core of this technique. It is only once “one has the formulae” that he “already possesses, in advance, the practically desired prediction of what is to be expected with empirical certainty in the intuitively given world of concretely actual life” (1970, 43). Because of the success in methodically predetermining worldly phenomena in such an infinitely more far-reaching and exact way than those simply based on empirical regularity, scientists are comprehensibly induced, Husserl notes, to devote their full interest to the determination of these “formulae,” and to the never-ending approximation of measurement they make possible.

The moral is that, in Husserl’s analysis, the “decisive accomplishment” (entscheidende Leistung) of the modern mathematization of nature is “the establishment of the actual correlation among the mathematical idealities which are hypothetically substructed in advance in undetermined generality but still have to be demonstrated in their determined form” (1970, 43). This is how “the methodical objectification of the intuitively given world” takes place and why it “gives rise to general numerical formulae which, once they are formed, can serve by way of application to accomplish

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18 As François De Gandt remarks: “The formula is like a ‘projection’ [Entwerfen] of the regularities that we can expect” (2004, 91).
the factual objectification of the particular cases to be subsumed under them” (1970, 41). Formulae are then the core of the methodical determination of natural phenomena established by modern physics.

5 Formalization and Modern Objectivism

Having established the method, we can now make the link between its technization and the original “culprit” of the crisis, namely objectivism. That is, we have to see why the sedimentation of the “formula-meaning” (Formelsinn) leads almost naturally to this interpretative result and to its philosophical effects. The objectivation of the natural world already begins with Galileo and is inherited and strengthened by his followers: the findings of new and more comprehensive “formulae” capable of encompassing larger portions of reality were simply welcomed as a progressive evolution toward the truth of the objective natural world without being matched by a philosophical understanding of their sense. Even the more recent scientific “revolutions” do not shed light on this, as they exclusively regard a refined determination of the very same exact world that is presupposed by physics since Galileo. For example, as Husserl remarks very clearly,

Einstein’s revolutionary innovations concern the formulae through which the idealized and naively objectified physis is dealt with. But how formulae in general, how mathematical objectification in general, receive meaning on the foundation of life and the intuitively given surrounding world—of this we learn nothing. (1970, 295)

More accurately, since formulae are the main product of the formalizing attitude, the incomprehension of the Formelsinn is linked to the progressive “technization of formal-mathematical thinking” (Technisierung der formal-mathematischen Denkarbeit). In Husserl, as we have seen, “technization” does not simply mean “mechanization” of scientific operations, i.e., their reduction to a form of calculus. It also implies a more dangerous “many-sided transformation and covering-over of the meaning [Sinnverwandlung und Sinnüberdeckung] of natural science” (1970, 48). Husserl’s critique, then, does not challenge the legitimacy per se of such a powerful and fruitful tendency, but points to the unperceived shifts of meaning that it elicits and that should be detected and corrected.

What are these shifts? Husserl mentions in § 9i a few possible “portentous misunderstandings” (verhängnisvolle Mißverständnisse) due to the “lack of clarity about the meaning of mathematization” (1970, 53). And it is easy to predict, the main misunderstanding is that of “objectivism.” It is the metaphysical thesis claiming the existence of an “exact” world behind the subjective one intuitively given in everyday experience. According to this “realistic” view, a certain thing in front of me would be just a sign of the supposedly real mathematical object transcending any possible experience; an object whose exact behaviour is somehow grasped by a mathematical determination, and which is in turn the hidden cause of perceivable events. By doing so, however, what is an objectifying method for empirical predictions is exchanged
for the “real being” of nature. Intuitive reality thus undergoes to a surreptitious “substitution” (Unterschiebung), as it is relegated into the subjective sphere of secondary qualities, whereas a world of purely categorial objects, despite their being grounded in that primordial experience, acquires an independent, “objective,” status.

Objectivism is not only a modern phenomenon. According to Husserl, this realistic interpretation was mutatis mutandis also shared by ancient philosophy, and it is even contained in nuce in “natural attitude” (see 1982, § 30). It arises from the straightforwardness of intentionality, which is naturally directed toward the object of experience, rather than toward the mode of experiencing. This attitude elides the subjective contribution in the constitution of what is taken to be “directly” given. All positive sciences, unlike phenomenology, are in this sense “sciences of the natural attitude” since they naively consider the objects of study as they are directly given, without taking into account the constituting role of subjectivity.

Modern science is no exception to this. Still, in the wake of the new mathematics, objectivism gets a different, strictly formal, character. In a way, it is an extreme radicalization of the Generalthesis according to which we assign without a second thought an independent existence to the world in which we live and operate. The paradox brought to light by mathematical physics is that we do not merely separate the empirical things that we encounter in the “external” world from our own sensuous perception and actions that constitute them. We reify even purely categorial objects that cannot be (sensuously) perceived, and whose origin totally lies in subjective acts.

Thus, according to this widespread objectivistic tendency stemming from science, we deem as “more real” the categorial objects indirectly represented by symbols, rather than the objects that are intuitively given before our eyes. As a consequence, the “garb of symbols” (Kleid der Symbole) of categorial formations “encompasses everything which, for scientists and the educated generally, represents the life-world, dresses it up as ‘objectively actual and true’ nature” (1970, 51).

To be sure, Husserl’s analysis strongly emphasizes the role that geometry and its technization plays in Galileo’s misunderstanding of his own mathematization (sometimes identified with “idealization”) of nature, so that it might seem that the objectification of this (material) idealized nature is a sufficient condition to spark the crisis that was only successively fueled by the further technization due to the application of formal methods. As Husserl himself notes, Galileo “was not yet a physicist in the full present-day sense; his thinking did not, like that of our mathematicians and mathematical physicists, move in the sphere of symbolism, far removed from intuition” (1970, 24). Yet, if “Galileo” is not simply taken to denote a determinate historical figure, but rather as a “collective name,” then the general impression changes. The conceptuality of modern formal mathematics, generated by a “formalizing abstraction,” is in fact also decisive for empirical sciences, insofar as “its rationalism soon overtakes natural science and creates for it the completely new idea of mathematical

19 This is claimed in FTL: “the formations with which logic is concerned are given exclusively from inside, exclusively by means of spontaneous activities and in them” (1969, 81).

20 This has been argued by Jacob Klein: “In analyzing the foundations of Galileo’s physics, Husserl does not intend to give a detailed historical account. Galileo’s name is, in this connection, somewhat of a collective noun, covering a vast and complex historical situation” (1985, 79).
natural science—Galilean science, as it was rightly called for a long time” (1970, 22–23). Thus, the overall “mathematization” of nature cannot be one-sidedly identified with one of its partial aspects: there is a continuum between Galileo’s idealization and the more recent formalizing tendencies in physics, both belonging to “Galilean science” as a whole. This is to say that with Galileo begins a process of objectivization, i.e., “begins the surreptitious substitution of idealized nature for prescientifically intuited nature” (1970, 49–50) which reaches its peak afterwards. It is in virtue of this continuity that the obscurities derived from Galilean objectivism could be “strengthened and transformed with the development and constant methodical application of pure formal mathematics” (1970, 56). In the end, if objectivism consists in the alienation of the intentional object from the activity of intentionality, then this alienation becomes more acute once the operation of formalization is at stake. The ultimate stage of modern objectivism is fuelled by the misconception of the intentional nature of purely categorial formations, to the extent that their formal character is not even recognized and its distinction from the intuitive, material sphere is finally blurred. For instance, Husserl writes,

‘Space’ and the purely formally defined ‘Euclidean manifold’ were confused; the true [wirkliches] axiom (i.e., in the old, customary sense of the term), as an ideal norm with unconditional validity, grasped with self-evidence in pure geometric thought […] was confused with the inauthentic [uneigentliches] ‘axiom’—a word which in the theory of manifolds signifies not judgments (“propositions”) but forms of propositions [Satzformen] as components of the definition of a “manifold” to be constructed formally without internal contradiction. (1970, 56)

Purely categorial formations present themselves as they are not: as objects or theories in the proper material sense, whereas they are just forms of those objects and theories. On Husserl’s view, to address this shift of meaning and recover from its objectivistic consequences, what is demanded is the exercise of phenomenological reflection. By bracketing the inherited truths of science and common sense, he questions back what is taken for granted by them. Formalization clearly has a main role to play. While being necessary for the opening of a new mathematical dimension, for Husserl it also transforms the concepts of previous science by assigning to them a derivative “symbolic meaning,” which remains (by the way) “unnoticed” (1970, 45). Why is it thus? Why is formalization responsible for these silent and dangerous changes? It is time to take the last step in our enquiry and to give the definitive solution to the enigma.

6 The Algebraic Roots of the Crisis

Husserl’s interest in formalization is in the limelight in FTL (a text that brings forward many central tenets of the Krisis) but is also present, sometimes implicitly, in the entire discussion concerning the modern mathematization of nature. Indeed, Husserl considers formalization as a typically modern phenomenon that has led to “the
actual discovery and conquest of the infinite mathematical horizons” (1970, 22). We find a sketch of an historical reconstruction in § 9f, in which he roughly divides the evolution of formalization into two great steps.\(^{21}\) The first corresponds to the emergence of modern algebra with François Viète (who introduced the first literal calculus in his \textit{Isagoge} in 1591), to the arithmetization of geometry, and to the mathematics of continuum. The second step consisted of the “surmounting of ‘arithmetization’” (\textit{Überhöhung der Arithmetisierung}), “an improvement and a broadening [\textit{Fortbildung und Erweiterung}] of the algebraic theory of numbers and magnitudes” (1970, 45). This process brought to a “completely universal ‘formalization,’” in which the algebraic method was applied to an increasing number of domains, as it opened up the possibility (already announced by Leibniz but never systematically developed until the end of the 19th century) of a \textit{mathesis universalis}, a completely formal discipline of “the forms of meaning of the ‘something-in-general’” (1970, 45). Mathematical logic, set theory, and Hilbert’s metamathematics clearly belong to it, although they do not exhaust the entire scope of the Leibnizian dream.

At the outset of this “incessant forward movement,” we find literal algebra, i.e., a calculus with letters standing for indeterminate quantities. But the entire process described by Husserl can be legitimately identified as a progressive “algebraization” of the world. That is, an extension of the very same \textit{modus cogitandi} originally embedded in algebraic calculations.\(^{22}\) Since its actual impact is still largely unilluminated, Husserl suggests taking into account “the enormous effect—in some respects a blessing, in others portentous—of the algebraic terms and ways of thinking that have been widespread in the modern period since Vieta (thus since even before Galileo’s time)” (1970, 44). The disclosure of the purely formal domain of the \textit{mathesis universalis} and, alongside with it, the renovation of the ancient ideal of universal science attained by Galileo and Descartes is certainly a blessing.\(^{23}\) Objectivism and the other shifts of meaning handed down by an “unquestioned tradition” (\textit{unbefragte Traditionalität}) are among the portentous effects. These two opposite consequences are not disjointed. Philosophy is supposed to emend those effects by coming back to their common roots.

We are thus closer to the solution. The technization of formal-mathematical thinking amounts at the very end to the technization of algebra. Formal algebraic thinking, in turn, is a modern scientific achievement. Thus, the understanding of the way in which the \textit{algebraic method} sediments its meaning would imply the disclosure of what is \textit{specifically modern} in the crisis of sciences.

It must be said that this solution is arguably \textit{not} the one that Husserl himself pursued. As I have pointed out in the previous section, his focus on Galileo emphasizes

\(^{21}\) As shown by Gérard (2008, 78–79), this interpretation is largely inspired by Oskar Becker’s great historical picture contained in the last part of his \textit{Mathematische Existenz} (published in 1927).

\(^{22}\) In fact, as explained by Dieter Lohmar: “der reine Sinn der Formalisierung tritt auch historisch in der Algebraisierung zutage. Man kann also mit gleichem Recht von Algebraisierung sprechen” (1989, 121-2).

\(^{23}\) According to Husserl, Descartes and Galileo share the same \textit{forma mentis}, although they apply it to different disciplines: “After Galileo had carried out, slightly earlier, the primal establishment of the new natural science, it was Descartes who conceived and at the same time set in systematic motion the new idea of universal philosophy: in the sense of mathematical or, better expressed, physicalistic, rationalism—philosophy as ‘universal mathematics.’ And immediately it had a powerful effect” (1970, 73).
instead the role that *idealization* (rather than formalization) plays in relation to his self-misunderstanding of the process of mathematization of nature which eventually led to modern objectivism. Although his analysis is certainly insightful, it is incomplete in relation to the question that motivates this paper. The determination of what is specifically modern in the crisis cannot be found out by simply stressing Galileo’s passive inheritance of a set of theoretical procedures that are still deeply dependent upon a mathematical conceptuality (in particular, Euclidean geometry) that was not formal in the sense Husserl has established. There are good reasons, I believe, to go beyond Husserl’s text in this respect. Therefore, in what follows I do not mean to present a consistent philological description of what is *really* contained in the *Krisis*. My goal is rather to account for the specificity of the modern manifestation of the crisis by arguing that the sedimentation of meaning for which algebraic method is responsible is exceptional: it is not only greater in degree but “logically” different. This conclusion, in turn, is arguably not Husserl’s, even though it is based on Husserl’s text.

My strategy is the following. Taking for granted Husserl’s historical narrative, one might compare the algebraic conceptuality to another one, which is supposed to be beyond and before any formalistic treatment. For example, if we know how the original meaning of traditional Euclidean geometry is exteriorized and sedimented in its signs, then we would have an indirect understanding of the difference introduced by the algebraic method. That is, we would appreciate how the relationship between the original meaning and the signs changes once the diagrammatical images of geometry are translated into algebraic symbols. My claim is that it is precisely *this difference* that can explain what is distinctive in the crisis of modern exact sciences. Inasmuch as the latter play a crucial role in producing modern objectivism, my reading can shed light on the overall phenomenon.

Luckily enough, Husserl extensively discussed the technization of geometry in the famous *Beilage III* of the *Krisis*, entitled *Vom Ursprung der Geometrie* by Eugen Fink. As it is well known, Husserl argues there that the geometrical method runs the risk of losing its authentic meaning especially once it reaches the “virtual communication” assured by the embodiment in written language. At this stage, in fact, the ideal formations can be treated and manipulated as ready-made objects without the constant reawakening of their sense. Husserl was suspicious of this practice and talked of the “seduction of language” (*Verführung der Sprache*) exercised by spoken and particularly written words in the transmission of truth. This is the case because writing, albeit indispensable for the constitution of ideal objects, represents at the same time a removal from the egological subject—that is, in Husserl’s philosophy.

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24 Husserl’s fragmentary treatment has prompted Burt Hopkins’ recent criticism according to which “despite recognizing the distinction between the idealized conceptuality of Euclidean geometry and the formalized conceptuality of algebra and symbolic mathematics generally,” Husserl often falls in the “equivocation of ideal and formalized meanings” (2022, 80–81).

25 As De Gandt remarks: “The geometer works on these representations as if they directly offer the insight of such entities; he knows how to ‘manipulate’ [*hantieren*] the world of the ideal objects of geometry. The signs are nothing but supports, but the geometer treats them as the objects themselves” (2004, 59–60).
the original receptacle of meaning. More precisely, writing (1) parts from intuition since it renders “the concepts sensibly intuitable by means of drawn figures” and thus substitutes “the actual production of the primal idealities” (1970, 366), and (2) it parts from verbal language since it surpasses the need for an immediate communication in a given context. Written signs endure through time and cultures and thus secure “the persisting existence of the ‘ideal objects’ even during periods in which the inventor and his fellows are no longer wakefully so related or even are no longer alive” (1970, 360). The outcome is that “the means which secure the objectivity of a science at the same time endanger its original integrity” (Klein, 1985, 77). Ancient geometry was certainly a science, but it was at the same time in its way “removed from the sources of truly immediate intuition and originally intuitive thinking” offered by the Lebenswelt (Husserl, 1970, 49).

Husserl seems to imply that this analysis has a universal validity. It has been noted (Derrida, 1989) that the history of geometry functions as the paradigm for historicity in general. Still, not every sign works in the same way, nor are all ideal formations alike. To begin with, Husserl claims that geometrical idealities are accessible to “pure intuitions” (reine Anschauungen) because Euclidean geometry is a “material mathematics” (sachhaltige Mathematik). Its judgments are proper (i.e., not formalized) judgments and refer to ideal states of affairs. Therefore, albeit external to the subject, the signs that the geometer traces (concrete lines, triangles etc.) play an active role for the possibility of the actual givenness of ideal objects. They register, preserve the meaning, waiting for a possible re-actualization. Kant’s doctrine of schematic construction is clearly nourished by this idea; the sensible character of the sign is not an obstacle for the eidetic intuitive content, but rather its condition of possibility. Notwithstanding the possible nominalistic misinterpretations à la Berkeley, the scope of sensible signs is precisely to activate the eidetic understanding and support the geometer’s intuition of the limit-forms thus represented. Moreover, they are continuous with verbal language. A geometric διάγραµµα is in fact an appendix of the proof that is carried out through linguistic significations. Despite the psychological difficulty to follow its deductive passages, the same theorem could be demonstrated with the exact same apodicticity with imageless (bare) words.

Does the same apply to formal idealities and algebraic writing? It does not seem so. First, the function of algebraic symbols is not to make an eidetic intuition virtuously possible, but to make it superfluous. Through the formalization of geometry, for instance, geometric idealities “are transformed, so to speak, into pure numerical configurations, into algebraic structures [in pure Zahlgestalten, in algebraische Gebilde]” (1970, 44). Ideal figures are embodied in another type of sign, and thus indirectly manipulated through general formulae. This transfer allows the geometer

26 Jacob Klein describes this process in the following way: “The more we become accustomed to words, the less we perceive their original and precise ‘significance’: a kind of superficial and ‘passive’ understanding is the necessary result of the increasing familiarity with spoken and written words. The original mental activity, the production of significance, embodied in sounds and signs, is not reproduced in the course of actual communication” (1985, 77).

27 In the Logische Untersuchungen, speaking of the role of geometrical images, Husserl says that they “function as mere aids for understanding, and not as themselves meanings or carriers of meanings” (2000, 208).
to let “the geometric signification recede into the background as a matter of course, indeed drops it altogether; one calculates, remembering only at the end that the numbers signify magnitudes” (1970, 44). The alleviation of the burden of intuition has reached the perfect result of a writing that is not meant to preserve the original meaning, but rather to forget it. The quid of algebraic thinking is an original moving-away from meaning. It works through signs whose sense is voluntary disregarded. The separation of signs from meaning shows its technical advantages in the elaboration of non-Euclidean geometries, and thus in the liberation of pure thinking from the limits dictated by the imagination.28 Philosophically, though, the problem is not that the meaning of these formations tends to be lost in writing, so that a painstaking work of definition could be a good resource to avoid paralogisms and changes of sense. The problem is that the meaning is ab origine forgotten. Contrary to what Plato said about alphabetic writing in the Phaedrus, algebra is not the registration of the living voice of its “father,” but it represents purely objective formal relations. In this sense, the author is as equally distant from the symbolic representation that he has produced as are all the other people knowing that language. The writing does not “belong” to him, so that the author does not have a privilege in the reactivation of its meaning.29 This is the mark of an objective type of writing that is purely external because its meaning is radically separated from the subject. Husserl characterizes the “emptying” (Entleerung) of meaning that occurs in this separation as its radical sedimentation.30

Second, symbolic writing is not an extension of natural language. In accordance with logicism on this point, Husserl claims that algebraic symbolism is introduced to emend the logical flaws that easily flow into natural language.31 Ultimately, the goal is to substitute the latter with an unambiguous medium of expression which also works as a system for calculation.

In conclusion, the counterintuitive and prominent technical nature of the algebraic form of writing explains why it seduces more than other forms of writing. Despite its being essential for all modern mathematical sciences, it elicits to a greater extent a passive-associative (fundamentally empirical) way of thinking. This induces the following of its symbolic formations (e.g., concepts defined by the rules governing the syntactical behaviour of a symbol) and the forgetting of the epistemological status of the calculus. The result is that only those types of clarity which are indispensable for a technique as such, are in action. One operates with letters and with signs for connections and relations (+, x, =, etc.), according to rules of the game for arranging them together in a way essentially not different, in fact, from a game of cards or chess. Here the original thinking that genuinely gives meaning to this technical

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28 Husserl in fact puts non-Euclidean geometries among the theories of formal mathematics (2008, § 19).

29 Thus, one of the critical points addressed to writing by Plato, namely that the author is not always there to reply to objections (Phaedrus, 275 d-e), does not fit the algebraic case.

30 The fact that the word “Entleerung” is used in the Krisis in this critical sense, whereas it neutrally described the process of formalization in FTL (1969, § 30, note n.1) is an indirect proof of the soundness of my conclusions.

31 This is said, for example, in the lectures given between 1906 and 1907 as an Introduction to Logic and the Theory of Knowledge: “By introducing letters in place of the words of ordinary language, one is freed of all fluctuating ambiguity that clings to words to a far too great extent. […]. Naturally, no procedure offers such a guarantee against fallacies, if only because of the banning of equivocations” (2008, 79–80).
process and truth to the correct results (even the “formal truth” peculiar to the formal \textit{mathesis universalis}) is excluded (Husserl, 1970, 46).

Although these effects are partially shared by all types of signs, the sedimentation of meaning at work in algebraic writing is unprecedented. Language is thus \textit{completely technized}. This loss of meaning does not take place \textit{in vacuo} but is the semantic counterpart of the ontological commitment towards objectivism, that is, of the loss of the \textit{Lebenswelt}.\textsuperscript{32} Therefore, the constitutive role of this method in the establishment of modern science and its truth requires the intervention of a philosophical investigation aiming at the clarification of its new form of rationality in order to disengage the distortive effects of its technization.

7 Concluding Remarks

Inasmuch as exact sciences are concerned, my analysis has shown how the modern character of the Husserlian notion of “crisis of European sciences” is dependent upon the technization of the formal-mathematical methods developed since Vieta. More specifically, it is determined by the way in which these methods radically exteriorized-sediment scientific meaning through its “emptying.” I have made the hypothesis that this is what distinguishes algebra from the previous pre-formalized disciplines like Euclidean geometry.

If what I have argued is correct, then this perspective helps us to elucidate the project that Husserl sketched at the end of his life, and that is mainly contained in the third part of the \textit{Krisis}. Let me sum up and highlight the main points of my results:

If (1) the crisis consists in the abandonment of the Platonic ideal of an ultimate epistemological foundation of positive sciences and their methods, and (2) this abandonment is determined by the formal character of the formations that make modern science possible, then the overcoming of the crisis must pass through the restoration of the \textit{lost continuity} between these two. That is to say, what is needed is the renovation of the epistemological dependence of formal techniques on philosophy (meant in the Husserlian sense of rigorous science). Without the foundation of formal objects and their truth provided by a philosophical science that grounds both in their original intuitive sources, the authentic scienticity of such objects is left \textit{undecided}. Positive sciences are for us still an “enigma” (\textit{Rätsel}). Symbolic methods must find an ultimate justification in original evidence—a justification that so far has not been provided. Husserl assigns to transcendental phenomenology the fundamental task of realizing this and with it eventually restoring our “faith in reason.”

This should be done in two parallel ways. \textit{Theoretically}, by means of what Jean Cavaillès has called the “principle of reducibility” (1994, 532), i.e., the idea that to fully justify formal methods and higher categorial objects one must go back to the ultimate sources of intuition offered by the \textit{Lebenswelt}. That is, the subjective mate-

\textsuperscript{32} As Trizio remarks, “One could be wrong in thinking that the insistence on technization, on formal operations emptied of intuitive meaning, or even on mechanical manipulation of symbols has the function of depicting modern and contemporary physics as an enterprise devoid of ontological import. On the contrary, the technization of natural science has an ontological pendant, which is, once more, \textit{objectivism}” (2020, 241).

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rial sphere that precedes formalized science and grounds its authentic possibility. This indicates that Husserl’s critical handling of modern science has nothing to do with its putative “abstractness” with respect to the given subjective experience of the Lebenswelt. The story goes in the other way around: it is because we do not know how it refers to our world that we need to trace its subjective-intentional source. As Burt Hopkins clarifies, “it is his [Husserl’s] experience of the empty meaning formations of physics that—when combined with his expectation that they must somehow be ultimately founded in a reference to (or, more precisely, an intention toward) the world that is capable of being intuitively fulfilled at some level – leads to his discovery (…) of the prescientific life-world and its true origins” (2011, 90–1).

Historically, this original stratum of experience is somehow associated with the conceptuality proper to ancient Greek ἐπιστήµη, as it is supposed to be untouched by the formalistic methods conceived in modernity. Even in this case, the point is not to oppose an authentic form of knowledge to an inauthentic one, and thus to foster a kind of “myth of origins.” On the contrary, the “algebraic difference” is the occasion for a radical questioning concerning the proper sense of the Western tradition of sciences. Insofar as modern developments pretend to be ἐπιστήµη and not only techniques of calculation and prediction, they must be situated in the channel traced by ancient philosophy. For example, the geometrical developments of modernity remain geometrical only if its “pure ideal objectivities are confined within the field of aprioriness opened by the Greeks” (Derrida, 1989, 131). But is it the case? Or rather is formalized geometry something else, a deviation that has no chance to be traced back to philosophy? Does modernity hide an essential teleology that philosophy should reveal or is it a mere factual circumstance? These are the type of questions with which Husserl opens the Krisis. Phenomenology has the task to decide by bringing to light a historical continuity that is only implicit, if not forgotten. This epistemological-historical attempt clearly overcomes the “ruling dogma” dividing epistemological-logical clarification and historical-psychological explication spread by neopositivism. As a “limitation through which precisely the deepest and most genuine problems of history are concealed,” the latter is “fundamentally mistaken” (Husserl, 1970, 370).

Funding Open Access funding enabled and organized by Projekt DEAL.

Declarations On behalf of all authors, the corresponding author states that there is no conflict of interest.

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References

Cavaillès, J. (1994). *Oeuvres complètes de philosophie des sciences*. Paris: Hermann

De Gandt, F. (2004). *Husserl et Galilée. Sur la crise des sciences européennes*. Paris: Vrin

De Santis, D. (2020). The Theoretical Reformer: on Husserl’s Plato. *Journal of the British Society for Phenomenology*, 51(3), 231–246

Derrida, J. (1989). *Edmund Husserl’s Origin of Geometry: An Introduction*. Translated by J. P. Leavey Jr. University of Nebraska Press: Lincoln and London

Dodd, J. (2004). *Crisis and Reflection: An Essay on Husserl’s Crisis of the European Sciences*. Dordrecht: Kluwer

Ferrarin, A. (2014). *Galilei e la matematica della natura*. Pisa: ETS

Gérard, V. (2008). Husserl et la mathématisation galiléenne de la nature. In De F. Gandt, & C. Majolino (Eds.), *Lectures de la Krisis de Husserl* (pp. 63–102). Paris: Vrin

Hopkins, B. C. (2011). *The Origin of the Logic of Symbolic Mathematics. Jacob Klein and Edmund Husserl*. Bloomington: Indiana University Press

Hopkins, B. C. (2022). Post-Husserl Husserlian Phenomenological Epistemology: Seebohm on History as a Science and the System of Sciences. *Husserl Studies*, 38(1), 67–85

Husserl, E. (1954). *Die Krisis der europäischen Wissenschaften und die transzendente Phänomenologie. Eine Einleitung in die phänomenologische Philosophie*. Edited by W. Biemel. *Husserliana* 6. The Hague: Martinus Nijhoff

Husserl, E. (1969). *Formal and Transcendental Logic*. Translated by D. Cairns. The Hague: Martinus Nijhoff

Husserl, E. (1970). *The Crisis of European Sciences and Transcendental Phenomenology*. Translated by D. Carr. Evanston: Northwestern University Press

Husserl, E. (1974). *Formale und Transzendentale Logik*. Edited by P. Janssen. *Husserliana* 17. The Hague: Martinus Nijhoff

Husserl, E. (1975). *Logische Untersuchungen. Erster Band: Prolegomena zur reinen Logik*. Edited by E. Holenstein. *Husserliana* 18. The Hague: Martinus Nijhoff

Husserl, E. (1976). *Ideen zu einer reinen Phänomenologie und phänomenologische Philosophie. Erstes Buch: Allgemeine Einführung in die reine Phänomenologie*. Edited by K. Schuhmann. *Husserliana* 3. The Hague: Martinus Nijhoff

Husserl, E. (1982). *Ideas Pertaining to a Pure Phenomenology and to a Phenomenological Philosophy. First Book: General Introduction to a Pure Phenomenology*. Translated by F. Kersten. Dordrecht: Kluwer

Husserl, E. (1984). *Einleitung in die Logik und Erkenntnistheorie. Vorlesungen 1906/07*. Edited by U. Melle. *Husserliana* 24. The Hague: Martinus Nijhoff

Husserl, E. (1995). *Logik und allgemeine Wissenschaftstheorie. Vorlesungen 1917/18*. Edited by U. Panzer. *Husserliana* 15. The Hague: Martinus Nijhoff

Husserl, E. (2000–2001). *Logical Investigations* (2 vols.). Translated by J. N. Findlay. London: Routledge

Husserl, E. (2008). *Introduction to Logic and Theory of Knowledge. Lectures 1906/07*. Translated by C. Hill. Dordrecht: Springer

Husserl, E. (2012). *Einleitung in die Philosophie. 1919/1920*. Edited by H. Jacobs. *Husserliana: Materialien 9*. Dordrecht: Springer

Husserl, E. (2019). *Logic and General Theory of Science*. Translated by C. Hill. Cham: Springer

Klein, J. (1985). Phenomenology and the History of Science. In J. Klein (Ed.), *Lectures and Essays* (pp. 65–84). Annapolis: St. John’s College Press

Lohmar, D. (1989). *Phänomenologie der Mathematik*. Dordrecht: Kluwer

Trizio, E. (2016). What is the Crisis of Western Sciences? *Husserl Studies*, 32(3), 191–211

Trizio, E. (2020). *Philosophy’s Nature: Husserl’s Phenomenology, Natural Science, and Metaphysics*. New York and London: Routledge

Trizio, E. (2021). Crisis. In De D. Santis, B. C. Hopkins, & C. Majolino (Eds.), *The Routledge Handbook of Phenomenology and Phenomenological Philosophy* (pp. 151–159). London-New York: Routledge

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