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Research article

The Concealment of Meaning – On Husserl's Triple Critique of Mathematical Technization, Mathematization as Technology, and the Technization of Natural Sciences

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Abstract
In an era marked by the increasing proliferation of technology and frequent technological crises, Husserl's critique of the technization of modern European science is of great significance for understanding the essence of technology. Although he did not explicitly propose a definition of technology, he clearly delineated the differences between technological phenomena and scientific meaning, distinguished science from technology, and discussed the interactive relationship between them. He conducted a triple critique of mathematical technization, mathematization as technology, and the technization of natural sciences, pointing out that modern science has degenerated into technology, issuing a prophetic warning against the crisis caused by this transformation, and proposing a countermeasure to resist technological erosion and retrieve the primordial meaning of science by returning to the everyday lifeworld. This critique, however, does not imply that Husserl was opposed to technology as such. He understands that the formation of mathematical science results from a technological impetus. Therefore, an analysis of Husserl's thoughts on technological critique is conducive to understanding the technological essence of modern science and clarifying the relationship between science and technology. It also shows how strongly Husserl's phenomenology is committed to the tradition of rationalism and, as such, can function as a technical countermeasure to the technization and crisis of science.

Keywords: Husserl; Technology; Mathematization; Science; Lifeworld

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Научная статья

Сокрытие смысла – О тройной критике Гуссерлем математической технизации, математизации как технологии и технизации естественных наук

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Аннотация
В эпоху, отмеченную растущим распространением технологий и частыми технологическими кризисами, критический анализ Гуссерля в отношении технизации современной европейской науки имеет огромное значение для понимания сущности технологий. Хотя он не предлагал явного определения технологии, он четко очертил различия между технологическими явлениями и научным смыслом, разграничил науку и технологию, а также рассмотрел характер их взаимодействия. Он провел тройную критику — математической технизации, математизации как технологии и технизации естественных наук, — указав на то, что современная наука выродилась в технологию, высказав пророческое предупреждение о кризисе, вызванном этой трансформацией, и предложив контрмеру для противостояния технологической эрозии и возвращения изначального смысла науки через возврат к повседневному жизненному миру. Эта критика, однако, не означает, что Гуссерль был против технологии как таковой. Он понимает, что формирование математической науки является результатом технологического импульса. Таким образом, анализ размышлений Гуссерля о критике технологий способствует пониманию технологической сущности современной науки и прояснению взаимосвязи между наукой и технологией. Он также показывает, насколько сильно феноменология Гуссерля привержена традиции рационализма и, как таковая, может функционировать в качестве технической контрмеры против технизации и кризиса науки.

Ключевые слова: Гуссерль; Технология; Математизация; Наука; Жизненный мир

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INTRODUCTION

Modern science and technology have achieved brilliant accomplishments which are transforming and reshaping people's lifestyles. For example, the current rapid development of artificial intelligence (AI) has brought unprecedented convenience to people's lives, while triggering many new problems. Reflecting on technology has thus become an urgent task of the times. This paper revisits Husserl's critique of technology from his later years and his warning about the crisis of European science. Taking his interpretation of the development of modern science as a clue, it discusses his characterization of the technological essence of modern science, analyzes his assertion that technization has led to the crisis of European science, philosophy, and human nature, examines his proposed solution to overcoming the crisis by returning to the everyday lifeworld, and explores the contemporary significance of his critique of technology and warning of crisis.

The next section of this paper begins by elaborating Husserl's idea that modern European science was born out of the process of the geometrization or mathematization of nature. It analyzes the formation and development of geometry, showing that Geometric concepts were first idealized and then objectified. It explains the role of idealization and measurement technology in the objectification of geometric concepts, showing that geometrization is equivalent to objectification. Geometry can directly serve the description of the spatial characteristics of nature, that is, the direct geometrization or mathematization of the spatial forms of natural objects. According to Husserl's interpretation, Galileo took geometry as a model to carry out the indirect mathematization of all properties of nature different from the direct mathematization of spatial form, from which modern natural science or mathematical physics was born. Since then, natural science has been committed to the complete mathematization of nature, and Galileo has thus become the father of modern science. Accordingly, mathematized nature has become an objective nature that embodies mathematical relations, and natural science is committed to finding mathematical formulas for the laws of this objective nature – structural formulas have taken the place of phenomenal nature.

The next section then expounds Husserl's triple critique of mathematical technization, mathematization as technology, and the technization of natural sciences. Since the modern era, mathematics itself has achieved tremendous development, and formal mathematics has emerged. The idea of formalization has been applied not only to the mathematization of nature but also to mathematics itself, thereby transforming mathematics into a technology – this is meant by mathematical technization. Mathematical operations have become a game of symbols, and mathematics has lost its original scientific significance. Mathematization, which is based on technized mathematics, has also degenerated from a method of acquiring truth into a technology. Furthermore, when natural science uses mathematization as a technology to explore the mysteries of nature, natural science itself loses its original meaning and degenerates into a technology. Mathematical technization is the determining factor, mathematization as technology (or the technization of mathematical methods) is the intermediary, and the technization of natural sciences is the result. The essence of these processes of

technization is that all three induce a deviation from some original meaning. Taken together they result in a complete loss of connection with the given nature of the everyday lifeworld. Ultimately, this leads to the concealment of the meaning of the lifeworld by technology with technology replacing truth.

The third section then discusses Husserl's warning about the crisis brought about by the three dimensions of mathematical technization, mathematization as technology, and the technization of natural sciences. This triple technization has not only directly led to the crisis of European science – the loss of scientificity and the replacement of science by technology – but also to the crisis of philosophy and human nature. Positivist philosophy has replaced rationalist philosophy, and human beings have become technicized themselves. To resolve the crisis, it is necessary to retrieve the primordial meaning of science, that is, to return to the everyday lifeworld, advocate rationalist philosophy, and ground science in phenomenology. The fourth part reflects on the contemporary significance of Husserl's critique of technology.

FROM TECHNOLOGY ENABLING SCIENCE TO TECHNOLOGY REPLACING SCIENCE AND ITS METHODS

Technology and the Transition from Intuitive to Pure Geometry

Husserl argues that mathematization constitutes a pivotal moment in the development of modern European natural sciences. The modern era gave rise to the idea of the world as a rational unity of infinite existence – that is, all things in the infinite world are connected through reason (Husserl, 1954, p. 20). Thus, the world can only be comprehended through rational methods, and mathematics provides such a rational and objective approach.[1] Accordingly, the cognition of the world is the cognition of its rational essence, namely, the cognition of the various ideas that constitute the rationality of the world as their relations are considered eternal and unchanging. The rational essence of the world is objective, and so are mathematical ideas; therefore, the rational essence of the world can be expressed through mathematics, that is, through the process of mathematizing the world. From this, it became a universal consensus among moderns that "material nature has an ideal mathematical existence" (Neumann, 2001, p. 266) and that the language of nature is mathematics.

Mathematics originates from people's primordial intuition about the lifeworld – arithmetic begins with the counting experience of concrete objects (such as apples and stones), and geometry begins with the intuitive perception of spatial forms (such as tabletops and houses). The lifeworld is the original source of meaning for mathematics (Husserl, 1970, p. 79). Mathematics is not a static system of knowledge but an evolutionary process from "intuitive mathematics" to "formalized mathematics." Through "idealization" and "abstraction" it strips away the concrete properties of things in the lifeworld, forming a pure symbolic and axiomatic system (e.g., from concrete

[1] Mathematics is a template of rationality and objectivity, and the world understood through it is also rational and objective.

counting to abstract numbers, from intuitive geometry to pure geometry), and ultimately becomes a formalized field of meaning independent of the lifeworld (Husserl, 1970, pp. 430-431).

According to Husserl, under the influence of Plato's theory of ideas, ancient Greek mathematics, especially Euclidean geometry, idealized the geometric objects in the empirical world and ultimately established a deductive system of propositions composed of axioms and theorems – "a pure rational whole" whose task is to cognize "a finite and closed a priori" (Husserl, 1954, p. 19). In the modern era, as the concept of space expanded to the infinite, the task of geometry also expanded to the infinite. The idea of an infinite world and a systematic rational science that studies its objects began to take shape, which was further facilitated by the development of formal mathematics, namely, a comprehensive rational science: mathematical natural science or mathematical physics. Galileo transformed modern mathematical physics from an idea into a reality through the mathematization of nature. The essence of his thought on mathematization is to reform ancient physics with geometry, taking "geometry as the meaning foundation of exact physics" (Husserl, 1954, p. 21).

In ancient times, people abstracted the spatial forms of things (such as straight lines, triangles, circles, and cubes) from the objects they experienced in their intuition of the surrounding world. Different people had different perceptions of these forms, and the perfection of their depictions varied according to different practical interests and the technical level of the time. On the one hand, people could improve the depiction of forms by advancing drawing and measurement technologies; on the other hand, the ideal limit of each form could not be fully depicted even with the improvement of technology. For ideal forms do not exist in reality. The idealization and construction of these forms by people were objectified in an intersubjective community. The object of study of geometry is these objective ideal forms; therefore, it is the mathematics that studies spatiality, and this is the original intuitive geometry.

When people break away from empirical things and directly construct new univocal geometric forms using objectively identical ideal forms, for instance, constructing new polygons with triangles as basic elements, the intuitive geometric method is replaced by "an a priori, abstract, all-encompassing, and systematic method" (Husserl, 1954, p. 24), and intuitive geometry evolves into pure geometry. The new geometric method originates from the "technically applied methodology of measurement and determination" in the pre-scientific, intuitive surrounding world (Husserl, 1954, p. 24). People form subjective geometric concepts through intuition of the surrounding world, and these subjective concepts are universalized and objectified in practical measurement. For instance, in the process of using measurement technology, people first define the concepts and geometric forms of the measured objects, then determine their quantitative and positional relationships, and finally use as measuring tools rigid basic geometric things that are universally recognized as unchanging in practice. The entire measurement process is a process of jointly formulating standards through intersubjective negotiation. In the standardization process, geometric concepts and other related concepts become objective, universal, and univocal. Measurement technology was initially associated with land surveying in the empirical world, it later evolved into abstract graphic calculation by pure

theoretical geometers, facilitating the transition from intuitive geometry to pure geometry. Therefore, technology promotes the transformation of geometry.

Geometric concepts originate from the idealization of the forms of objects in the empirical world. People can find physical objects in the empirical world that are similar to the objects of geometric study. Measurement activities of these physical objects, under intersubjective coordination, further universalize and objectify idealized geometric concepts (Husserl, 1954, p. 25; Kockelmans, 1989, p. 370). Thus, the univocity of geometric concepts is established, and the truth of geometry is guaranteed. Ancient geometry provided people with a model of objective and reliable knowledge which possessed absolute, universally valid self-evidence and was applied by people within a limited range related to spatial forms—that is, the spatial characteristics of the forms of objects in nature were geometrized. According to Husserl, in the modern era, under the leadership of Galileo, mathematical methods represented by geometry were applied to the entire natural field beyond the quantitative forms of objects, which is what Husserl calls Galileo's mathematization of nature. How is such unrestricted mathematization of nature possible?

The Birth of Modern Natural Science — The Mathematization and Objectification of Nature Modeled on Geometry

Pure geometry has *a priori* self-evidence and universal objectivity, and it constitutes an ideal world of object shapes. When pure geometry is applied to practical measurement, a connection is established between ideas and reality. Ideas are abstract idealizations of reality; ideas can express reality, and knowledge of ideas becomes objective knowledge about reality. Thus, *a priori* ideas become the essence of reality, and the characteristics and dimensions possessed by reality can be deduced from those possessed by ideas. According to Husserl, inspired by geometry, Galileo drew this inference: since the *a priori* axioms of geometry are the objective truth of the shapes of real objects, the objective truth of other properties of objects besides shape should also be mathematical (geometric *a priori*). He further inferred that the truths about the entire world and the patterns of causal relationships between its objects are also mathematically *a priori* and objective. For "nature can be constituted and determined in the same way in all its other aspects" (Husserl, 1954, p. 31). Therefore, he intended to use mathematics to design "a method of systematically and, in a sense, *a priori* constituting the world and its infinite series of causes and effects" (Husserl, 1954, pp. 29-30). However, Galileo encountered a problem in his mathematization project: the shapes of objects can be directly geometrized or mathematized, but other aspects of objects cannot, such as their specific sensible qualities – temperature, hardness, color, taste etc. Specific sensible qualities of objects do not have a corresponding *a priori* and objective idealization system, so they cannot be further objectified through precise measurement, nor can they be directly mathematized like shapes.

The birth of modern science lies in the mathematization of physics. Properties other than object shapes fall within the scope of physics research. The mathematization of the specific sensible qualities of objects is both part of the process of the mathematization of physics and part of the process of scientization. The development of modern science lies

also in mathematization – that is, replacing the qualitative interpretation methods of ancient philosophy with the quantitative analysis methods of mathematics (Zhou, 2025, pp. 328-329). By establishing measurable quantitative concepts, quantitative concepts replace qualitative concepts. The increase in the number of quantitative concepts in a discipline indicates a higher degree of mathematization and scientization of that discipline (Carnap, 2020, pp. 53-62). To mathematize the specific sensible qualities of objects, it is necessary to establish relevant quantitative concepts, that is, objective concepts that can be measured. According to Husserl, to directly mathematize the specific sensible qualities of objects, it is necessary to first idealize them to form subjective concepts, and then to measure these subjective concepts to form objective concepts, just as in the case of defining geometric concepts. However, the specific sensible qualities of objects belong to the secondary qualities of objects related to the sensory organs of the subject – that is, they do not belong to the objects themselves – and thus cannot be idealized and directly mathematized.[2]

According to Husserl, to mathematize the specific sensible qualities of objects other than shape, Galileo shifted his mode of thinking: since direct mathematization was impossible, could they be mathematized through an intermediary? Given that the causal world determines *a priori* that objects in the world are tangible entities in space and time – their shapes are filled and possess specific sensible qualities, and shape is closely integrated with its filling and sensible qualities into a single whole – it can be inferred that there exists a causal connection between the shape of an object and its specific sensible qualities, such that a change in one will induce a change in the other. Therefore, as long as the shape of an object can be directly expressed mathematically, the specific sensible qualities causally connected to it can also be represented through the mathematics of shape change. For instance, temperature change is indicated by the numerical values corresponding to the volume change of a mercury column; color is derived from the analysis of the wavelength of light reflected by an object's surface; and sound is manifested according to the amplitude of the vibrational displacement of an object. In this way Galileo found a solution for the mathematization of the specific qualities of objects – indirect mathematization – thereby enabling their idealization and objectification as well. At this point, all properties of objects, from shape to other qualities, had been mathematized.

On this basis Galileo and his successors further achieved the mathematization of the whole of nature through direct and indirect mathematization. The tools they employed in the process of mathematizing nature were: first, mathematics and its latest achievements including algebra, the mathematics of continuity, and analytic geometry; second, there are universally valid measurement methods. Pure mathematical ideas pointed the way for practical measurement, and measurement in turn further objectified mathematical ideas and the nature associated with them, with nature itself being mathematized in this process. Thus, pure mathematics and practical measurement carried out a "two-level idealization" (Husserl, 1954, p. 38), and physics as the science that

[2] Objects that can be directly mathematized correspond to Locke's primary qualities; objects that can be indirectly mathematized correspond to Locke's secondary qualities (Rang, 1989, pp. 99-100).

studies nature “always presupposes a primitive physics, to which a metrology grounded in technology and practice belongs" (Neumann, 2001, p. 279).

Galileo’s purpose in mathematizing nature was to explain this causal world in a mathematical manner, even though the causal connections of the world were a hypothesis derived from universal induction. "The entire infinite nature as a concrete universe of causality – this was the essence of the peculiar concept – evolved into a uniquely applied mathematics" (Husserl, 1954, p. 36). He was not concerned with the presuppositions of this causal world; instead, he focused on how to use mathematics to make the causal connections of the world manifest in a self-evident way – expressing causal relationships through mathematical formulas, that is, "laws of real dependencies in the form of functional dependencies of numbers" (Husserl, 1954, p. 40).

Galileo’s process of mathematizing nature was simultaneously a process of idealizing and objectifying nature, through which nature acquired its objective existence. For in the process of mathematizing nature on the model of geometry, the concept of objective nature was established, measured, and applied. "In Galilean mathematical mathematization of nature, this very nature is now idealized under the guidance of new mathematics, and itself becomes — in modern terms — a mathematical manifold" (Husserl, 1954, p. 20). "Nature is mathematically defined in its ‘true being-in-itself’" (Husserl, 1954, p. 54), and physical research aims to find the mathematical expressions of causal connections between objects. In this way, Galileo founded modern mathematical natural science, whose purpose is to discover the laws of nature. The mathematical expression of a law of nature is a formula, whose value lies in explanation and prediction. The predictive power of a formula stems from the mathematical relationships formed among the various concepts through mathematization within the formula,[3] and these mathematical relationships are translations of the causal relationships obtained from inductive hypotheses about phenomena. Ultimately, the hypotheses about causal relationships originate from the intuition of experiences in the lifeworld. Therefore, formulas can influence people’s practical activities in the lifeworld through prediction. Natural scientists, however, focused their research on finding the formulas of nature, to the point of separating the formulas from nature itself. “People were led to grasp the true being of nature itself through these formulas and their conceptual framework." (Husserl, 1954, p. 43)

The Alienation of Science from the Lifeworld: Husserl’s Triple Critique of Mathematical Technization, Mathematization as Technology, and the Technization of Natural Sciences

According to Husserl, the new developments in mathematics have intensified the separation between formulas and nature. First, the arithmetization of geometry has emptied the meaning of pure geometry, and algebraization has severed geometry’s connection to the pure intuition of spatial forms. Furthermore, a completely universal formalized mathematics that transcends arithmetization has emerged – namely, the *mathesis universalis* (universal science) conceived by Leibniz, which represents the

[3] "The significance of formulas in the world of formulas lies in idealities" (Husserl, 1954, p. 48).

highest formalization of algebra (Husserl, 1954, pp. 44-45) – and this has weakened the meaningful connection between mathematics and concrete nature. A universal formal logic, a science of the whole of manifolds, is a fully algebraized or arithmetized formal mathematics. It is employed to mathematize nature in general or nature as a whole, that is, to mathematize genera and species, yet it disregards all concrete individual cases of nature. Therefore, the mathematization of nature by formal mathematics loses its meaningful connection to concrete nature. Finally, the aforementioned formal algebraic (arithmetical) thinking has been applied to algebra and arithmetic themselves. This higher-order algebraization has become a technique – the technization of formal mathematical thought – and mathematics has turned into an abstract symbol game based on operational rules. Mathematics itself is thus first to lose its connection to the world on which it bases.

When such technized mathematics displaces formal mathematics and undertakes the mathematization of nature, people completely lose the meaning of the formal expression of nature and any intuition of nature. Thus, the "technization of mathematics empties the meaning of mathematical natural science" (Husserl, 1954, p. 45). On the one hand, mathematical technization has replaced the mode of thinking in which natural science constructs theories through experience with a mode of thinking that engages in a game of symbolic concepts. On the other hand, mathematical technization has supplanted the methods of natural science, making "all methods essentially tend to externalize themselves into integration with technization" (Husserl, 1954, p. 48). "Thus, the natural science is subject to multiple transformations of meaning and overlapping of meanings" (Husserl, 1954, p. 48). As mathematics has become a technology, the original meaning of mathematization – that mathematics is the rational essence of the world – has been forgotten, and mathematization has instead become a technology for explaining nature. Therefore, mathematical physics has thus degenerated into a technology (Husserl, 1954, pp. 51-56).

Mathematical technization is both the cause of mathematization becoming a technology and the cause of technology replacing science and concealing nature. Therefore, it is the foundation of Husserl's critique of the technization of science. As indicated above, the formalization and symbolization of mathematics itself are the causes of mathematical technization. If Husserl holds that mathematical technization is worthy of critique, does this mean that the development of mathematics itself should be criticized, or that mathematics should not be used to explain nature? To answer this question, it is necessary to clarify what the original meaning of mathematics is for Husserl and whether the technized development of mathematics has deviated from its original meaning. On this basis, the essence of mathematical technization, the essence of mathematization as a technology, and further the essence of the technization of science can be revealed. Only then can the significance of Husserl's critique of technology emerge.

As noted earlier, according to Husserl, geometry originates from people's intuitive perception of the spatial forms of objects in the surrounding world. It is the result of people's idealization of these spatial forms and the objectification of the idealized achievements in practical measurement. Geometric concepts have corresponding living world experiences, and the original meaning of geometry lies in expressing these

experiences. Arithmetic begins with people's counting experiences of concrete things in the surrounding world. Counting is a mental activity of people, and numerical concepts are originally given in a collective act or categorial intuitive act of people's consciousness (Melle, 1983, p. 481; Rang, 1989, p. 109). Arithmetical algorithms are methods for deriving truth (Rang, 1989, p. 114), and truth represents the real numerical relationships of things in the surrounding world. Therefore, the meaning of mathematics derives from people's rich and intuitive experiences in the lifeworld. The original meaning of mathematics is that it is a "cognition of the world" (Husserl, 1954, p. 46; Rang, 1989, pp. 123-124). This world cognition truly "gives meaning" to formal mathematics and the technization of formal mathematics, and "gives truth to norm-conforming results" (Husserl, 1954, p. 46; Rang, 1989, p. 108).

Husserl does not oppose the combination of mathematics and technology. He understands that the formation of mathematical science is the result of a technological impetus. Ancient measurement technology enabled the emergence of geometry: "All of arithmetic is a sum of technized methods which are designed to overcome the essential imperfection of our intellect touched upon here" (Husserl, 1970, p. 192; Rang, 1989, pp. 112-113). The establishment of arithmetic benefited from the application of the sensory-semiotic method, because symbolic representations can replace the intuitive representations of large numbers that are beyond the reach of human capabilities (Rang, 1989, pp. 110 and 120).

Arithmetic needs to rely on derived symbols to represent numbers and expand mathematical knowledge. Original numerical thinking is both the meaning foundation and the source of validity of derived symbolic thinking (Rang, 1989, p. 113). The introduction of symbols is the application of technology in arithmetic and also makes arithmetic resemble a technology. However, the symbolic method precisely enables arithmetic to become a science (Rang, 1989, p. 113), because arithmetic as a science arises from the "disclosure of the idea of the telos of truth" (Rang, 1989, p. 108).

This original sensory-semiotic method was not yet a formal game based on arbitrary rules; it remained connected to content-based thinking and could lead to truth (Rang, 1989, p. 114). According to Husserl, the relationship between formal systems and content-based thinking is determined by three methodologically consecutive steps: "transformation starting from symbols, then calculation, then transformation of symbols generated in thought" (Husserl, 1970, p. 258; Rang, 1989, p. 114). The formalization of mathematics is a transformation starting from symbols: first, the formalization of mathematical content, then the formalization of mathematical methods, and finally, the technization of formal proof completely eliminates content-based thinking linked to truth. This causes the meaning of the algorithmic symbolic system, or the semantic interpretation of a formal calculus, to deviate from the original meaning of mathematics (Rang, 1989, pp. 115-117; Mazijk, 2019, p. 531). Mathematical science as an established system of truth is replaced by technical methods for acquiring truth. Although, formally, technized mathematics remains a form of cognition, it is no longer a cognition of the world. Only when a formal "calculus is endowed with signification in terms of content" (Rang, 1989, p. 124) can mathematics continue to exist as a science of cognition about the world.

The mathematization of nature marks the birth of modern mathematical natural science and modern mathematical physics, while the mathematization as a technology marks the point where modern natural science and modern physics begin to turn into a technology. The original meaning of physics lies in exploring the world perceived by human senses: "Thus, the original meaning of physics is the cognition of the sensible world, which means the cognition of our everyday lifeworld" (Rang, 1989, p. 121). The original meaning of physics stems from the rich sensory intuition of the lifeworld. Yet highly mathematized-technized modern physics is dedicated to finding mathematical formulas for the universe, completely severing its connection to the lifeworld and deviating from the original meaning of physics. The ideal world established by mathematical formulas "has taken the place of the only real world that is actually given through perception, experienced and experienceable—the world of our everyday life" (Husserl, 1954, p. 49). The lifeworld is enveloped in "a garment of ideas, the so-called truths of objective science" (Husserl, 1954, p. 51).

"Since Galileo, then the idealized nature has imperceptibly taken the place of the pre-scientific intuitively given nature." (Husserl, 1954, p. 50) Nevertheless, the lifeworld, or the pre-scientific intuitively given nature, is the source and locus of meaning for all sciences, the ground of self-evidence upon which science is established, and the prerequisite for all scientific inquiry (Husserl, 1954, p. 60). Hence, Husserl remarks that Galileo was "both a genius of discovery and a genius of concealment" (Husserl, 1954, p. 53). "The original living meaning" has been covered up by "technical meaning" (Husserl, 1954, pp. 57 and 60).

From a phenomenological perspective, therefore, mathematical technization, mathematization as technology, and the technization of science all represent a deviation of science and its methods from their original meanings, a degeneration from science to technology, or what may be called "the descientification of science" (Rang, 1989, p. 105). Hypothesis and verification have become the essence of science, and in particular, the positivization of science has ultimately led science to completely lose the grand, living meaning it once possessed as a branch of philosophy (Husserl, 1954, p. 197). The mathematization is the secret behind the birth of modern science, while technization is the secret of its rapid development. "Degenerating into a technique" (Husserl, 1954, p. 201), "modern physics as a technology is precisely what distinguishes it from ancient physics" (Rang, 1989, p. 103). The technical character of modern natural science is embodied in the fact that "not only its mode of observation, but also its theories themselves have become products of productive activity and thus precisely products of technical action" (Rang, 1989, pp. 103-104). Modern natural science no longer takes the pursuit of truth as its core goal; instead, it seeks mastery over nature, and its theories have become technologies for achieving this end (Rang, 1989, p. 104). This is the core insight that Husserl aimed to reveal, and it also serves as his warning against the growing technization of the contemporary world. "Yet technique is not science" (Husserl, 1954, p. 197).

As a technology, mathematization has played a tremendous role in the development of modern physics and all the other natural sciences. With the aid of mathematizing technology, the entire field of natural science has achieved unprecedented theoretical and

practical accomplishments. By means of these achievements, humans have deepened their understanding of nature and strengthened their ability to transform and control it. In this sense, mathematization is necessary for practical societal needs. It is often taken as an unquestionable fact that technology promotes the development of science and drives social progress. Technology plays an important role in all domains of human life, and there is scarcely any sphere of contemporary society untouched by it; indeed, the comprehensive technization of human society appears to be an irreversible trend. Yet why does Husserl go against this current and subject it to sharp criticism? Is he an opponent of science and technology, a primitivist who longs for a return to nature? Or are his critiques simply mistaken and outdated? To address these questions, we had to first clarify what "technization" means for Husserl, as well as what he understands by science and by technology.

Husserl is neither an anti-scientist, nor is he a thoroughgoing anti-technologist. He does not deny or oppose modern science and its achievements, nor does he reject the necessity of mathematization and the importance of technology (Husserl, 1954, p. 53). He merely engages in a philosophical reflection on the development of modern science, pointing out the essence of modern science and the crisis brought about by its abandonment of original meaning, as well as indicating a path to overcoming this crisis – returning to the lifeworld to retrieve meaning.

RETURNING TO THE LIFEWORLD AS THE FOUNDATION OF SCIENCE

As elaborated above, mathematics in its entirety – both geometry and arithmetic – derives from the pre-scientific intuitive experiences of the lifeworld. Similarly, natural science originates from the experiential realm of the everyday lifeworld, and its original meaning lies in the cognition of the sensible world. Therefore, the original meaning of both mathematics and natural science is rooted in the cognition of the everyday lifeworld. Ultimately, however, the rapid development and escalating technization of both domains have obscured their original meanings beneath the veneer of technology, thereby precipitating a profound crisis. The process through which original meaning was constituted has accordingly faded into obscurity, "sinking into the realm of passive genesis" (Rang, 1989, p. 131; Arnold, 2022, p. 216). For Husserl, the technization of science is the process by which science deviates from its original meaning and from the lifeworld: as technology is increasingly applied within science, the connection between science and philosophy is severed, and science ultimately degenerates into mere technology. This is precisely what Husserl seeks to criticize. Thus, to restore science to its authentic essence and reclaim its original meaning, it is imperative to reactivate the process of original meaning-formation and to excavate the living, experiential ground of the everyday lifeworld that underpins technical knowledge.

From the perspective of progressivism, however, the development of mathematics and natural science is an inevitable trajectory, and their technization represents an irresistible tide of history. Initially, technology facilitated the emergence of science; subsequently, it propelled the growth of scientific inquiry; and finally, the technization of

science ensued, stripping science of its independent significance and reducing it to a mere appendage of technology. Concurrently, technology has continued its relentless advance within all quantifiable domains, ceaselessly evolving and expanding. The essence of technology lies in its power to transcend original meaning; its inherent nature drives it to depart from its foundational roots, perpetually undergoing transformation, advancement, and proliferation. Therefore, a defining characteristic of technology is its tendency to develop at breakneck speed, severing ties with its origins while using its material and theoretical outputs to conceal them. Technology functions as a homogenizing force that levels all distinctions. In an era dominated by the accelerated development of technology, its triumph and hegemony appear inexorable, and the tangible benefits it bestows upon humanity seem to multiply endlessly.

In addition, those who disagree with Husserl argue that modern micro-level particle science and macro-level cosmological science – such as quantum mechanics and the theory of relativity – appear to be far removed from the everyday lifeworld, seemingly unrelated to intuition and requiring a departure from ordinary experience. Although modern science has become highly technized, aiming at human control and the planning of nature, it nevertheless reveals truths about the natural world. Modern science is not merely technology, it remains science. Furthermore, for Husserl, the core of the technization of science lies in the formalization and technization of mathematics. Yet mathematical formalization appears to be an inevitable aspect of the development of mathematics itself. Mathematics cannot remain at the level of intuition alone; its advancement requires abstraction grounded in intuition. Like physics, mathematics follows a developmental trajectory from the simple to the complex, and from the intuitive to the abstract. From this perspective, the technization of mathematics and of science more broadly can be seen as intrinsic to their own development. Given this state of affairs, why does Husserl refuse to acquiesce to the unbridled development of technology? Why does he critique technology's occlusion of science's original meaning? And why does he advocate a return to the lifeworld – to the locus of science's original meaning? Does Husserl's critique of technology represent a conservative and anti-progressive stance?

According to Husserl, the mathematization and subsequent technization of modern natural science can be characterized as empirical positivism. This paradigm prioritizes the correspondence between empirical observations and physical theories. Positivism reveres verified objective truth, thereby gradually eroding the rational elements inherent in scientific inquiry (Thomson, 2009, p. 197). Thus, Husserl argues that the positivist trend sweeping across Europe has precipitated a crisis of philosophy, science, and human nature on the continent. This crisis of European science is not merely a crisis of scientificity, but also a crisis of the profound significance that science holds for human life (Heffernan, 2017, pp. 232, 254). The essence of this crisis lies in the misguided philosophical doctrines that have come to guide scientific practice – specifically, positivism, skepticism, irrationalism, and other philosophical currents that supplanted the rationalist core of Europe's philosophical tradition. This displacement has deprived philosophy of its rational underpinnings, rendering it incapable of steering the course of scientific progress.

Husserl follows the philosophical tradition from ancient Greece to modern times in distinguishing two levels of science. First, philosophy is understood as an "all-encompassing science, the science of the totality of beings" (Husserl, 1954, p. 5). Phenomenology he founded is conceived as the most rigorous science: a transcendental science of the world experienced in consciousness, a "science of the Lifeworld" (Luft, 2015, p. 47). Second, there are the particular sciences belonging to the natural sciences and the human sciences, which investigate specific phenomena and objects. The second level of science is grounded in the first: "phenomenology is a descriptive, *a priori* science of the subjectively experienced world; all other life-sciences — apart from other eidetic sciences such as mathematics and logic — are empirical and take as their objects what are experienced within the world" (Luft, 2015, p. 48). In modern times, science gradually emancipated itself from philosophy. As a branch of philosophy, it was originally tasked with seeking the truth of being; in its early stages, it still maintained a close connection with philosophy, was capable of self-reflection, and retained access to the lifeworld. However, as the process of technization intensified, modern science developed into positivism, thereby losing its connection with philosophy. Husserl holds that genuine science must preserve this link. He criticizes modern positivistic science for taking objectivity as the sole criterion of truth and for excluding both the human subject and universal philosophy from the domain of science (Husserl, 1954, pp. 5–8).

Despite the unprecedented achievements wrought by technology, it has simultaneously engendered a momentous crisis. Husserl stands among the few philosophers who have astutely identified and presciently warned against this technological crisis. What is even more remarkable is that he has proposed a solution to overcome it: to restore science to its original meaning by returning to the everyday lifeworld, by reestablishing the connection between science, the human subject, and philosophy.

For "all sciences are founded upon the self-evident basis of the lifeworld" (Husserl, 1954, p. 128), which constitutes "a realm of original self-evidence" (Husserl, 1954, p. 130). Thus, to resolve the crisis, a return to the lifeworld is indispensable. Within the lifeworld, the subjective status and autonomy of human beings are reaffirmed, and the rational elements of science are restored (Ruggerone, 2013, p. 182). Husserl advocates re-establishing the guiding role of rationalist philosophy in scientific inquiry, restoring philosophy's metaphysical primacy, and reclaiming philosophy's status as the first science. To this end, he proposes the establishment of a new, absolutely rigorous, and truthful science – phenomenology – which can provide a foundational grounding for natural science and thereby resolve the crisis.

CONCLUSION

The development of both mathematics and natural science constitutes a process of technization whose essence lies in the loss of scientific significance. This is the core of the crisis of European science as revealed by Husserl: Technical thinking has supplanted scientific inquiry, rendering science groundless and incapable of self-reflection. Technology has come to dominate the world; human beings have become objects of

technical manipulation, and even integral components of technology itself (Liberati, 2016, pp. 213-214). Individuals have lost the personalized lived experiences of the everyday, reduced the lifeworld to standardized entities regulated by technical metrics. The unique existential significance of human beings has been emptied. Hence, the technization of science is not merely a crisis of science, but a crisis of human nature.

To overcome this crisis, Husserl proposed tracing back the historical trajectory of scientific development and returning to the everyday lifeworld. This would lift the veil of technology that shrouds science, restore science to its authentic meaning, and ground modern natural science in phenomenology. The essence of the technization of science lies in the growing estrangement between science and philosophy. When Husserl opposes the technization of science, does he thereby espouse a view similar to Hegel's – namely, that philosophy should regain its hegemony over science and that science should return to its philosophical roots? While acknowledging that science originated from philosophy, Husserl does not oppose the independence of science relative to philosophy, nor does he deny the tremendous achievements made possible by the technization of science since the modern era. He calls for a return to the original meaning of science, seeking to reestablish its connection with philosophy and to ground it in phenomenology, in order to promote a more sound and balanced development of science. He exposes the process of technization that has accompanied the rise of modern science, opposes the reduction of science to mere technique, and criticizes the rootless development of science resulting from its complete technization. Science must not lose its way in the course of development; instead, it must be able to define its position, clarify its origins, and draw sustenance from those origins for further growth. Constant retrospection is the prerequisite for continuous innovation.

Husserl's critique carries important practical significance for the scientific community in the present age of Artificial Intelligence. It reminds us that scientists should understand the historical development of science, grasp the meaning of science itself, recognize its intrinsic connection with philosophy, and clearly distinguish the essence of science from that of technology. It also underscores the distinctive significance of the human being in the age of artificial intelligence, as well as the irreplaceable role of the human sciences. Although Husserl's critique may not fully align with certain aspects of the development of modern science, his thought undoubtedly serves as a corrective to objectivism, positivism, scientism, and technological optimism (Wagner, 1974, p. 183).

REFERENCES

Arnold, T. (2022). The Tragedy of Scientific Culture: Husserl on Inauthentic Habits, Technisation and Mechanisation. *Human Studies, 45*, 209-222.

Carnap, R. (2020). *Introduction to the Philosophy of Science* (translated by Zhang Huaxia and Li Ping). China Social Sciences Press.

Heffernan, G. (2017). The Concept of Krisis in Husserl's The Crisis of the European Sciences and Transcendental Phenomenology, *Husserl Studies*, *33*, 229-257.

Husserl, E. (1954). *Die Krisis der Europäischen Wissenschaften und die Transzendentale Phänomenologie, Eine Einleitung in die Phänomenologische Philosophie* [The

Crisis of European Sciences and Transcendental Phenomenology: An Introduction to Phenomenological Philosophy] (W. Biemel, ed.), Martinus Nijhoff. (Original work published 1936)

Husserl, E. (1970). *Philosophie der Arithmetik mit Ergänzenden Texten (1890-1901)* [Philosophy of Arithmetic with Supplementary Texts (1890-1901)] (L. Eley, Ed.), Martinus Nijhoff. (Original work published 1891)

Kockelmans, J. J. (1989). Idealization and Projection in the Empirical Sciences: Husserl vs. Heidegger, *History of Philosophy Quarterly, 6*, 365-380.

Liberati, N. (2016). Technology, Phenomenology and the Everyday World: A Phenomenological Analysis on How Technologies Mould Our World, *Human Studies*, *39*, 189-216.

Luft, S. (2015). Phänomenologische Lebensweltwissenschaft und empirische Wissenschaften vom Leben - Bruch oder Kontinuität? [Phenomenological Science of the Lifeworld and Empirical Sciences of Life — Break or Continuity?]. In *Phänomenologische Forschungen* (pp. 47-65). Felix Meiner Verlag.

Mazijk, V. C. (2019). Heidegger and Husserl on the Technological-Scientific Worldview, *Human Studies*, *42*, 519-541.

Melle, U. (1983). Husserls Philosophie der Mathematik [Husserl's Philosophy of Mathematics], *Tijdschrift voor Filosofie*, *45*(4), 475-482.

Neumann, G. (2001). Galilei und der Geist der Neuzeit: Husserls Rekonstruktion der Galileischen Naturwissenschaft in der Krisis-Schrift [Galileo and the Spirit of the Modern Age: Husserl's Reconstruction of Galilean Natural Science in the Crisis Text], *Phänomenologische Forschungen* (pp. 259-279). Felix Meiner Verlag.

Rang, B. (1989). Die bodenlose Wissenschaft. Husserls Kritik von Objektivismus und Technizismus in Mathematik und Naturwissenschaft [The Groundless Science: Husserl's Critique of Objectivism and Technicism in Mathematics and Natural Science], *Phänomenologische Forschungen*, *22*, 88-136.

Ruggerone, L. (2013). Science and Life-World: Husserl, Schutz, Garfinkel, *Human Studies*, *36*, 179-197.

Thomson, I. (2009). Phenomenology and Technology, In J. K. B. Olsen, S. A. Pedersen, & V. F. Hendricks (Eds.), *A Companion to the Philosophy of Technology* (pp. 195–201). Blackwell Publishing.

Wagner, H. (1974). Husserl's Ambiguous Philosophy of Science (translated by J. N. Mohanty), *The Southwestern Journal of Philosophy*, *5*, 169-185.

Zhou, B. (2025). Koyré's Mathematical Interpretation of Galileo's Scientific Thought: Philosophical Perspectives and Methodological Implications, *French Thought Review*, *26*, 315-336.

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