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The Relevance of Judgment for Philosophy of Science

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Jure Zovko

The relevance of judgment for the philosophy of science: reflections from the perspective of Kant's Third Critique

Jure Zovko

University of Zadar, Department of Philosophy, Obala kralja Petra Krešimira IV. br. 2, 23000 Zadar, Croatia

The British philosopher of science Elie Zahar claimed in his essay "Conventionalism and Positivism", "that Kant was, among other things, one of the greatest philosophers of science of all time." (Zaher, 1980) Kantians were *mutatis mutandis*, according to Zahar, William Whewell, Ernst Mach, Pierre Duhem, Henri Poincaré, Émile Meyerson and Karl Popper. The relativity physicists and philosophers Hans Reichenbach, Adolf Grünbaum and Werner Heisenberg analyzed Kant's space-time concept in detail in their works and modified it with improvements.

Kant's significance for the philosophy of science has been discussed in the last century primarily with regard to Newtonian physics or classical mechanics, especially among German Neo-Kantians, who claimed that Kant had endeavoured intensively to deepen Newtonian principles of mechanics through epistemological principles in order to elaborate a metaphysics as a theory of science. Kant, namely claimed in the preface to the second edition of the *Critique of Pure Reason*, that natural science had found its highway with Newton's discovery of the laws of motions (*axiomata, sive leges motus*).

In this context, Kant praises Francis Bacon as the "first and greatest natural scientist of modern times [...] [who] drew attention to the importance and indispensability of observations and experiments for the discovery of truth" (AA 9:32).

In his pre-critical phase, Kant had already chosen Newton's scientific method as the best and most reliable method of argumentation in his treatise "Enquiry Concerning the Clarity of the Principles of Natural Theology and Ethics." (1763). Human reason, Kant claims, has discovered the laws by means of which natural phenomena can be plausibly interpreted and explained: "The true method of metaphysics is basically the same as that introduced by Newton into natural science and which has been of such benefit to it." (Kant AA2; 1912 [1763], 286) In this treatise, Kant claimed that the unboundedness of hypotheses can be brought into a safe procedure with the help of experience and the geometric method. Although Newton's physics had a decisive influence on Kant's pre-critical development, Newton's influence on Kant increased in the critical epoch. Stephen Toulmin has, e.g., characterised Kant's *Critique of Pure Reason* as a hermeneutic of Newtonian

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physics as set out in his work *Philosophiae Naturalis Principia Mathematica*, 1687 (Toulmin, 2002).

Kant's new transcendental method proved to be a more radical implementation of Newton's scientific method in the field of metaphysics; the new, critical metaphysics was to be modelled on Newton's physics. Due to Kant, Newton's method has become the model of safe and reliable reasoning in philosophy. For Kant's epistemology, the rule applies that the *mundus sensibilis* is governed by the principles of pure understanding (Verstand) and, building on this, by Newtonian physics. Following Newton, Kant recognized that scientific knowledge about our world is possible because natural phenomena are ordered by concepts and principles of the human mind. It is the discovered laws of nature whose necessity is based on principles that Kant called "a priori." Kant tried to establish philosophically what Newton proved empirically.

With regard to the influence of Kant's philosophy of science, the American philosopher of science Philip Kitcher claims that all attempts at a unifying explanation of the world according to the model of covering-law use the language of Newton's scientific methodology and Kant's systematic scientific argumentation. According to Kitcher, Kant elaborated this in the *Critique of Pure Reason*, more precisely in the appendix to the transcendental dialectic. It is, in fact, philosophy of science understood as a form of unification: "The idea that explanation is connected with unification has had some important advocates in the history of philosophy of science. It appears to underlie Kant's claim about scientific method and its surfaces in classic works in the logical empiricist tradition" (Kitcher, 1989).

According to Kitcher, Kant's idea of the systematic unification of science from the appendix of *Critique of Pure Reason* (CPR A646-47/B674-75) sounds like a representative of the hypothetico-deductivist orthodoxy of 20th-century philosophy of science: we support our versions of theory by testing their observational consequences. These are, as W. C. Salmon has pointed out, in fact, "Nomic patterns" in the philosophy of science, which is to be seen as the legacy of Newton's and Kant's search for the unity of science: "the explanation of events consists of fitting them into the patterns that exist in the objective world" (Salmon 1989, 121).

Referring to Kant, Michael Friedman claims, e.g., that a multitude of phenomena should be explained by reducing them to law-like sentences or by a unified worldview. By unifying our knowledge, we reduce the multitude of phenomena or regularities to a few laws. (Friedman, 1974, 5–19.)

In the Analytic of Principles (Analytik der Grundsätze) of the *Critique of Pure Reason*, Kant addresses the power of judgement as a third faculty of knowledge, namely as the ability to subsume under rules (concepts of understanding) or "to distinguish whether something is under a given rule

(casus datae legis) or not" (CPR B 171). The power of judgement is also assigned the applicative dimension, because it is supposed to determine whether categories as pure concepts of understanding are applicable to phenomena or not (cf. CPR B 170). Accordingly, in Kant the complex relationship between the particular and the general is fathomed by the power of judgement.

On the one hand, the "Principles of Pure Understanding" set out in the *Metaphysical Foundations of Natural Science* (1786) form the basis for Kant's metaphysics of nature as the final part of transcendental analysis. Principles of pure reason also function as structural principles of scientific research. They prove to be the principle of judgement for scientific research, and scientific practice is guided by them.

Kant paradoxically concludes his Elementary Doctrine in the *Critique of Pure Reason* in an appendix to the transcendental dialectic, thereby completing his critical work of reason in the theoretical realm (CPR B 698). The knowledge of experience is extended here through the use of ideas with regard to "systematic unity" (CPR, B 699). The unity of reason should be spread "over all possible cognitions of experience" (CPR, B 707).

Kant claims that "all human knowledge begins with perceptions", "goes from there to concepts [categories as pure concepts of understanding] and ends with ideas" (CPR, B 730). This important quotation from the first Critique is proof of how Kant's epistemology remains connected to his philosophy of science. Kant explores the question of how philosophy as metaphysics is possible as a natural science. In other words, Kant characterizes the ability of reason to form a system from the diversity of knowledge as the criterion of scientificity. In the chapter "Architectonics of Reason", Kant says: "Because systematic unity is that which makes common knowledge a science in the first place, i.e. makes a system out of a mere aggregate of it, architectonics is the doctrine of the scientific in our knowledge in general, and it therefore necessarily belongs to the doctrine of method." ("die Lehre des Szientifischen in unserer Erkenntnis überhaupt") (CPR, A 832/B 860).

If one considers Kant's philosophy of science solely as an attempt to unify experience from the standpoint of the *Critique of Pure Reason* and the *Metaphysical Foundations of Natural Science*—as is the case in interpretations by Neo-Kantian thinkers, or such as Kitcher and Friedman—then I would argue that this approach needs to be supplemented. Kant's philosophy of knowledge and science should also be examined from the perspective of his *Critique of Judgment*. In this work (1790), Kant acknowledges that life in nature cannot be fully explained by the categories as pure concepts of understanding. Therefore, he seeks to explore the purposiveness of nature through reflective judgment.

Kant's enormous philosophical merit lies in the fact that, in the *Critique of Judgment*, he made the power of judgment a philosophical theme for the first time by treating it as an independent cognitive faculty.

In this article, I aim to show why Kant's analysis of reflective judgment is potentially relevant to the philosophy of science. In the *Critique of Judgment* (1790), instead of the "totality of experience"—a central theme in the *Critique of Pure Reason*—Kant introduces the already given unity of natural formations (*Naturgebilde*), which serve as the starting point for reflective judgment. This shift in the third critique—from the idea of the unity of reason to the reflexive power of judgment—was made because more could be achieved through the teleology of nature than through its mechanistic explanation. In the *Critique of Judgment*, Kant analyzes concrete cases with sensitivity and attentiveness, considering them within their holistic context through the lens of reflective judgment. In order to adequately subsume concrete cases, reflective judgment must first discover the appropriate rules, which are then tested for their applicability. Through Kant's explication of reflective judgment, the heuristic method—particularly important in scientific theory—comes to the fore.

Kant's metaphor of the judge, which was a favourite topic of his philosophy, is very important for understanding reflexive judgment (Kant 1787, CPR, BXIII; AA3, 10). It is a vivid example of how the human capacity for criticism and judgment can be integrated into the scientific understanding and explanation of phenomena in the context of the laws of nature. This ability to judge should be practiced and constantly improved, both as an applicative activity of the existing laws to concrete cases and as a reflective power of judgment in which the appropriate law is investigated.

Jaakko Hintikka believes that Kant's exploration of nature according to the kind of dialog that an expert judge has with nature could be taken as a good model of the methodology of natural sciences, after the disaster caused by Kuhn's "paradigm shift" because it "amounts to modelling all research as a questioning process." (Hintikka, 2007, 71). Hintikka saw Kant's exploration of nature in the manner of an experienced and competent judge as a continuation of Socrates' elenchus—the critical search for truth and the rejection of unacceptable hypotheses and assumptions.

In his *Critique of Judgment*, Kant recognized that the scientific-philosophical dialogue with nature is far more complex than what a purely mechanistic explanation can offer. Life, in its richness and complex purposiveness (*Zweckmäßigkeit*), cannot be explained by mechanistic laws and principles alone; as Kant famously stated, there will never be a "Newton of the blade of grass" (AA V, §75, 400). Organic life in nature can only be understood through a "causality according to purposes", and never solely through the mechanisms of nature. Consequently, the fundamental question

posed in the *Critique of Pure Reason*—the conditions of the possibility of experience—must also be further developed from the perspective of reflective judgment. The organic world with its inner purposefulness cannot be made plausible on the basis of mechanical laws, but is investigated by the reflective power of judgment. Biological purposefulness remains the pivot of reflective judgement, which, on the one hand, implies the scientific practice of research into the final cause, and, on the other, brings the understanding of the world of life, the crown of which remains man with his moral dignity.

In the *Critique of Judgment*, Kant analyses concrete cases sensitively and attentively in their holistic context with the help of reflective judgment. In order to adequately subsume concrete cases, the reflective judgment must first find the rules or laws that are tested for their applicability. Through Kant's explication of reflective judgment, the heuristic method, which is particularly important for scientific theory, comes to the fore. However, if we take Kant's reflections from the *Critique of Judgment* into account, new possibilities for scientific interpretation begin to emerge. When the reflective power of judgment seeks a nomothetic explanation of natural phenomena, the resulting solutions take on a normative character. This is a heuristic process of research and investigation—one that is continually revised and improved. Kant's concept of teleology from the *Critique of Judgment* has experienced a remarkable renaissance in contemporary philosophy of biology (see A. Breitenbach, M. Massimi). This form of inquiry suggests that the investigation of nature should be conducted according to the model of an "appointed judge" (*Critique of Pure Reason*, B XIII)—that is, through the power of judgment cultivated in dialogue with experts.

A competent assessment of nature as a demanding *interpretandum* requires both subject-matter knowledge and the assessor's ability to analyze it thoroughly. In the *Critique of Judgment*, Kant opened a new chapter in the discourse of scientific theory by asserting that the living processes of nature and our life-world cannot be adequately explained in purely mechanistic, causal terms.

Already in the theory of schematism in the *Critique of Pure Reason*, the power of judgment is analyzed as a link between two branches of knowledge: cognition and perception. It should be noted that the interpretation of schematism must be supplemented by the elaboration of the power of judgment in Kant's *Critique of Judgment*, where it now functions as a link between theoretical and practical domains. The real issue with the transcendental doctrine of judgment in the *Critique of Pure Reason* is that judgment is only thematized as the determining power of judgment—that is, the ability to subsume under a rule. The reflective power of judgment, which seeks the general in what is not already known, is only analyzed in the *Critique of*

Judgment. This is why the heuristic dimension of science (*Wissenschaft*) is not addressed in the *Critique of Pure Reason*.

Kant's enormous philosophical merit lies, among other things, in his emphasis on the philosophical significance of the power of judgment—an aspect that has unfortunately been largely sidelined in the discourse of the philosophy of science. The most important role Kant attributes to the power of judgment is its function as a bridge between the theoretical approach and practical application. With the motto "critique instead of theory" (*Kant, AA, V, 170*), Kant anticipated the later critique of theory-ladenness in the philosophy of science.

Kant sought to highlight the immense significance of the heuristic dimension of judgment, which investigates and explores the realm of our lived world. As living beings who hermeneutically interpret ourselves within our lifeworld—particularly in the context of scientific and technological progress—we are also guided by the questions addressed by the reflective power of judgment, which evaluates our lifeworld according to the "causality of ends." According to Kant, the human being is an "organized being" who possesses the "power to form within himself" and bears responsibility for the world in which he lives (Kant, AA V, 374). Kant maintains that the power of judgment presupposes a system of nature governed by empirical laws. It is important to characterize the structure of nature, as Kant describes it, by its divisions into genera and species—"which makes it possible for our power of judgment to find consensus in the comparison of natural forms and to arrive at empirical concepts" (Kant, AA XX, 230).

The organic world, with its inherent purposiveness, cannot be fully explained by mechanical laws alone; rather, it is investigated by the reflective power of judgment. Biological purposiveness remains the central focus of reflective judgment, which, on the one hand, underpins the scientific practice of inquiry into final causes, and, on the other, contributes to our understanding of the world of life—at the pinnacle of which stands the human being, endowed with moral dignity.

With reflective judgment, new dimensions can be uncovered within the field of the philosophy of science. All research and problem-solving within a scientific paradigm or an established scientific theory occur according to the model of the power of judgment—whether determining or reflective. The unification of heuristic maxims takes place and becomes evident in scientific research practice. Reflective judgment can be understood not only as a heuristic principle but also as a means of critically examining existing forms of scientific theory. Scientific breakthroughs and the discovery of novelty are often enabled by reflective judgment, which in turn leads to the reshaping of existing theories or shifts in scientific paradigms.

The teleological power of judgment opens up a scientific-theoretical discussion on the necessity and nature of supplementing mechanistic scientific explanations with teleological heuristics. Through the reflective teleological power of judgment, Kant provides a key to a theory of the organism.

Wolfgang Bartuschat, in his article "On the Power of Judgment" written for Willaschek's *Kant-Lexikon*, argues that Kant's teleological theory of nature has left scarcely any trace in biological theory. Instead, efforts have been made to render it fruitful for critical discussions about the status of hypotheses in the natural sciences, specifically through its association with a merely reflective power of judgment.

With regard to the application of Kant's concept of judgment to hypothesis testing, Pierre Duhem asserts that in choosing a scientific hypothesis, it is not the spirit of logic and geometrical precision that plays the decisive role, but rather the spirit of refinement (*l'esprit de finesse*) and elegance—that is, prudent judgment (*bon sens*): "in order to estimate correctly the agreement of a physical theory with the facts, it is not enough to be a good mathematician and skillful experimenter; one must also be an impartial and faithful judge" (Duhem, 1906/1991, 218).

Kant explicitly emphasizes in his 1793 essay *On the Saying: "That May Be Correct in Theory, But Is of No Use in Practice"* that the applicability of theoretical knowledge in practice depends precisely on the ability to judge concrete situations. This is because, as he notes, "there are no rules by which the capacity of judgment (Urteilskraft) can be governed" (I. Kant, AA 8, p. 275).

Kant argues that the gap between theory and practice can be bridged through the use of reflective judgment. Reflective judgment enables us to determine whether a concrete case can be subsumed under a given rule or law. This form of judgment is particularly relevant to the work of doctors, judges, and politicians, who must strive to resolve concrete cases and situations in the most appropriate way.

Kant's reflective power of judgment explores natural phenomena in terms of their functionality and purposiveness (*Zweckmäßigkeit*). It is, in essence, a heuristic mode of inquiry—an *ars inveniendi*—whose aim is to facilitate the discovery of previously unknown truths. Without the activity of reflective judgment, the scientific process would remain a mere mechanical act of subsumption (cf. Kant, AA V, 411; cf. AA XX, 208 ff).

This implies that natural phenomena should not only be examined from a mechanistic perspective but also from the standpoint of teleological observation. In the *Critique of Judgment*, Kant recognized that the richness and vitality of nature cannot be fully grasped through the use of categories (*reine Verstandesbegriffe*) alone. For this reason, he assigns this complex interpretive task to reflective judgment in his third critique.

Reflective judgment represents a subtle form of inquiry in which the general is not merely inferred in a mechanical manner, but instead involves careful and thorough consideration of whether—and to what extent—a superordinate generalization adequately accounts for the empirical diversity of the given. In this process, reflective judgment critically examines and explores existing forms of connection. Advancements in scientifically recognized knowledge can be achieved through the innovative inquiry of reflective judgment, whose genuine aim is to expand understanding. As an effort to clarify particular cases, reflective judgment has often led to new discoveries.

In this context, it is important to bear in mind, as Kant emphasized, that "there are no rules by which the power of judgment can be regulated" (I. Kant, AA 8, p. 275). It is a hallmark of our autonomy that we are always able to consider the judgments of competent individuals and consult their expertise as authoritative.

The discoveries of Nobel Prize winners John Robin Warren and Barry James Marshall serve as a clear example of how the power of judgment operates. Warren and Marshall demonstrated that the bacterium *Helicobacter pylori* is not a consequence of gastritis and duodenal ulcers, but rather their actual causative agent. The revolutionary aspect of this discovery was that the treatment of gastric and duodenal ulcers shifted from invasive surgical procedures to antibiotic therapy.

This groundbreaking medical discovery came about when Marshall ingested a large quantity of the bacterium, which he had previously cultured in the laboratory, and subsequently developed severe gastritis. By taking antibiotics regularly, Marshall successfully cured his self-induced condition.

One of the accidental discoveries of epochal importance for the development of technology through applied science was Hans Christian Oersted's experiment in 1820, when he observed that a magnetic needle rotates when a current-carrying conductor is placed next to it. Building on Oersted's discovery, Michael Faraday was the first scientist to demonstrate the principles of converting electrical energy into mechanical energy. Similarly, in 1831, Faraday was the first to prove that the movement of a conductor in a magnetic field can generate electricity. These two discoveries formed the foundation for the development of electric generators and motors.

The cognitive achievements that lead to the discovery of new issues in the sciences are, in most cases, the result of reflective judgment—not bound by established theories and rules, but rather marked by a form of ingenious insight that significantly deviates from conventional scientific methodology. From this perspective, it is plausible to suggest that such judgment involves expanding or modifying our knowledge within the domain of empirical cognition, all within the framework of existing theories. In this regard, what Kant described as a heuristic research project remains essential: "to

investigate the particular laws of nature" (AA V, 411; cf. AA XX, 208ff.). In this context, Heiner Klemme aptly refers to the *Critique of Teleological Judgment* as a "heuristic of natural science." (Klemme, 2009).

Scientific research is primarily concerned with the application of what T. S. Kuhn called "normal science." The outcome and success of such research depend on our ability to exercise the power of judgment. The judgment of experts remains an integral part of scientific reasoning—that is, Kuhnian "normal science." The acceptance of a paradigm presupposes judgment as a condition for its successful application. When anomalies arise within a scientific paradigm, they call for reflective judgment—an evaluation that seeks better options for new theoretical explanations. Whether this leads to a scientific revolution, a paradigm shift, or merely a transformation of the existing paradigm ultimately depends on the judgment of the scientific community. None of this is possible without reflective judgment—what Kant referred to as *reflektierende Urteilskraft*.

As living beings who hermeneutically interpret ourselves within our lifeworld—especially in the context of scientific and technological progress—we are also guided by the kinds of questions that the reflective power of judgment analyzes, in order to evaluate our lifeworld according to the "causality of purposes". According to Kant, the human being is an "organized being" who possesses the "power to form within himself" and bears responsibility for the world in which he lives (AA V, 374). In his *Critique of Judgment*, Kant convincingly argues that judgment is central not only to human rationality but also to scientific research and inquiry. It serves the purpose of improving our lifeworld by helping us understand the integrated functioning of our natural and intellectual capacities in the production of human experience, knowledge, understanding, and action as a whole. Science, scientific research, and investigation must never be directed against human dignity.

The primary tasks of philosophy in modern society should be to cultivate our mind and strengthen our ability of judgment. Successful cultivation of our judgment implies professional competence and the ability of reflexive analysis of everything that represents the creativity of the human spirit, cultural and intellectual heritage as well as the scientific achievements. In my opinion, philosophy of science should be conceived as critique in a Kantian sense, based on the foundation of judgment. It should analyze the *interpretandum* and test existing scientific theories and current paradigms under the truth content (*sub ratione veritatis*). In other words, it means that philosophy of science cannot be satisfied with a merely descriptive understanding of what exists, or with the reconstruction of thought of some philosopher, but rather must analyse the *interpretandum under the aspect of truth value, just as philosophy according to its inner determination requires that it tend toward progress, through correction of existing irregularities.*

The President of the German Research Foundation (DFG), Peter Strohschneider, in his speech at the ceremonial event held during the 2018 DFG Annual Meeting, acknowledged the importance of scientific judgment (*wissenschaftliche Urteilskraft*):

> Wir sind auf wissenschaftliche Urteilskraft nicht nur angewiesen, um irgendwie zu vertretbaren Entscheidungen bei der Verteilung von Projektmitteln zu kommen. Das freilich auch. Weit darüber hinaus kommt es indes auf diese vernünftige Urteilskraft an, weil wir ohne sie das Wissenswerte keineswegs unterscheiden könnten vom unabgrenzbaren Gemenge dessen, was man überhaupt zu wissen meinen kann. Wir wären ohne Urteilskraft ganz außerstande, darüber Rechenschaft abzulegen, was wir womöglich wissenschaftlich und technologisch tun können und was wir keinesfalls tun dürften oder tun sollten. [...] Moderne Wissenschaft hätte ohne sie gar keine Zukunft. Denn Urteilskraft ist jenes Band, dass die Wissenschaften in Beziehung hält mit einem aufgeklärten Wissen von den Umständen des menschlichen In-der-Welt-Seins und einer freien Gesellschaft. (Strohschneider, 2018, pp. 8sq).[1]

The fact that Kant aimed to systematize the elements of knowledge—arising from the activity of the power of judgment—into a coherent, organic whole of science with particular relevance is also attested to in his *Opus Postumum*. The idea of a unifying science remains at the forefront of Kant's final intellectual endeavors "Das Fortschreiten in einer Erkenntnis als Wissenschaft überhaupt (...) fängt davon an die *Elemente* derselben aufzufinden und dann die *Art, wie sie zusammengeordnet werden sollen (systematisch) zu verknüpfen* da dann die Eintheilung dieses Geschäftes in Elementarlehre und Methodenlehre die oberste Einteilung ausmacht, wovon jene die Begriffe, diese die Anordnung derselben, um ein Ganzes der Wissenschaft zu begründen vorstellig macht" (AA XXI, 386).

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[1]We rely on scientific judgment not only to arrive at reasonably justifiable decisions regarding the allocation of project funding—though that, of course, as well. But far beyond that, this rational judgment [*vernünftige Urteilskraft*] is essential, because without it, we could not possibly distinguish what is worth knowing from the indistinct mass of what one might merely *think* they know. Without judgment, we would be entirely incapable of accounting for what we may possibly be able to do scientifically and technologically—and what we, under no circumstances, should or ought to do [...] Modern science would have no future at all without it. For judgment is the very bond that connects the sciences with an enlightened understanding of the conditions of human existence in the world and with a free society.

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