



Pluralism and the unity of science: physics and political epistemology in Cassirer's phenomenology of knowledge

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Abstract

In this article, we analyse how Ernst Cassirer's approach of a phenomenology of knowledge deals with the general question of disunity in science and society. By elaborating on the concept of functional unity, which presupposes difference, Cassirer's work helps to revise foundational concepts of modern science and society, such as pluralism and truth. Relating Cassirer's approach to the current interest in political epistemology, we show the implications of Cassirer's theory of knowledge and analyses of modern science, particularly physics. In these analyses, Cassirer carves out the relational logic of scientific knowledge and its consequences on epistemological and ethico-political levels. While this logic of relations relativises absolute claims on either level, it entails its distinct normative criteria as elements of the scientific ideal. Cassirer's project defends this ideal and thus can simultaneously defend plurality *in* science (including the humanities) in terms of methods, perspectives and aims, and preserve the unity *of* science as a normative ideal and symbolic form in constant interaction with other forms. Thus, Cassirer's pluralism must be distinguished from mere historicist or relativist conceptions.

Keywords Philosophy of science · Phenomenology of knowledge · Pluralism · Unity of science · Truth · Political epistemology · Physics · Ernst Cassirer

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1 Introduction: truth in science and society

*Because natural science is the art
of shaping a democratic reality...*

Ludwik Fleck

In a world of increasingly diverging scientific and socio-cultural forms, particularly concerning the relationship between science and society, normative reconciliation, fundamental ideals, and frames of societal communication are at stake. Current debates of political epistemology especially focus on the ideal of truth in science and society. At stake are not only questions of consensus but time-honoured ideals such as the *unity of science*.¹ Often debates are framed in terms of either-or: either homogenous truth or heterogenous plurality—as if there were no alternatives. The same goes for the widespread contemporary rejection of ready-made unifying principles such as hegemonic devices, which leave open the question of reconciliation on a pluralist basis.

In this article, we demonstrate that the *political epistemology* within Ernst Cassirer's theory of knowledge provides a profound and practical answer to that question. Our central thesis is that Cassirer's reconstruction of the dynamics of scientific knowledge is able to grasp *functional unity* while preserving the *plurality* of different perspectives. Thus, it overcomes a simple universalism without falling into mere relativism and is applied by Cassirer in terms of different scientific and cultural *forms*. Instead of taking the concept of unity for granted from the outset, this perspective tries to acknowledge the developing, immanent logic of relations and exchanges across different fields. Cassirer's approach to the theory of functional unity takes its principle from the dynamics of knowledge, particularly that of science, and thus pursues an integrational task.²

Concerning this task, "science" is not a mere collection of results or a guarantor of truth and factual knowledge as interpreted in recent debates on "trust in science." For Cassirer, science is to be understood as a "symbolic form" among others, that is, first and foremost, a human activity. The distinguishing mark of science among the symbolic forms is its commitment to the very task of integrating different forms into multi-perspectival knowledge. On the one hand, this is different from how we usually systematically see science and its procedures today. Therefore, we would like to draw on the historical context of Cassirer's philosophy to understand the charged conception of science in the specific relation of physics, politics, and philosophy of his time. As a focus, we take the exceptional year of 1929.

On the other hand, this broad conception of science, comprising its cultural and societal function, paradoxically still has its grounds in the *tacit* expectations towards science in modern societies: Today, the disunity of science is emphasised not only in

¹ For a good overview see Cat (2024).

² In this respect, discourse ethics and inferentialism might want to acknowledge Cassirer as a forerunner. However, we claim that the impact of Cassirer could be most fruitful in philosophy of science, especially where it concerns political epistemology. In particular the debates of "scientific pluralism" and "scientific perspectivism" could build on Cassirer's insights (for the former see Kellert, Longino and Water (2006); and Giere (2006) for the latter).

the scientific disciplines but also in fundamental terms of methods, infrastructures, technological development, and economic interests. Nevertheless, the expectation towards science in its societal role is still a general one, especially in the era of the Anthropocene. In his book *The Evolution of Knowledge: Rethinking Science for the Anthropocene*³, Jürgen Renn, director at the Max Planck Institute for the History of Science in Berlin, writes:

While scientific and technical knowledge dominates our daily life, and while the survival of humanity in the Anthropocene depends on a thoughtful application of science-based solutions, the current mainstream of the history of science rarely contributes to these discussions. How can we change that? What kind of approach could do justice to a conception of science as a human practice involving, in an irreducible way, mental, material, and social dimensions? How can one conceive knowledge as being constrained, but not determined, by local and by larger political and economic structures? Moreover, what historical and political epistemology could help to reconstitute moral responsibility to the quest of science for knowledge?⁴

In the sense of these contemporary questions, the following analysis of Cassirer's historical approach aims to contribute to the debates in the history and philosophy of science to realise the relation between theoretical and political conceptions of knowledge.

Renn suggests inquiries into the nature of the relationship between the representation of knowledge and the substance of knowledge itself. It brings to light important questions about the forces that drive the advancement of scientific fields and the potential for the philosophy of science and science and technology studies to contribute to a deeper understanding of these forces. Here, the ongoing rift between thought styles in general and the “two cultures”⁵ (science and humanities) in particular, is still an obstacle. In philosophy as an academic discipline, the “two cultures” issue has been identified in the split between “continental” and “analytic” styles. Despite this development, the call for an approach that considers contemporary scientific advancements while preserving a focus on *agency* in knowledge dynamics resonates widely.

Renn's questions also point in that direction and not only suggest a general revision of our understanding of the social orientation of science but also pertain to more specific disciplinary tasks, such as the role of physics within the context of the Anthropocene. Historically, physics as an “exact science” had long been the paradigmatic example for science [*Wissenschaft*] as such and often became a model (or a contrasting foil)⁶ for different sciences. That role slowly shifted in the 20th century to

³ Renn (2020).

⁴ Ibid. (2020, p. 33).

⁵ See Snow (1959).

⁶ This function is apparent in the turn of the century discussions about the autonomy of the cultural or historical sciences, especially in the neo-Kantian context of German Philosophy (e.g. of the Baden school of Windelband, Rickert, and Max Weber but also in Dilthey).

the “life sciences,” and now “earth sciences” are in focus like never before. Epistemic questions today in highly differentiated and specialised fields ask for the possibility of integration into broader scientific theories and how unification is possible. Do we want to question the concept of science to emphasise a more general unity regarding the scientific ideal based on which different disciplines can operate? Could that be a model for public discourse as well? Would such a universal concept of unity not be another kind of hegemonic entity? Our article focuses on Cassirer’s understanding of this central relation of truth in science and society and points to its political relevance.

We can understand this relation better if one considers the historical and systematic context of Cassirer’s conception. It was a time when philosophers and physicists still stood in direct exchange about the broader implications of the changes in their fields. These debates were also widely received by the general public. Therefore, we take physics as an example of the interplay between scientific and political concerns. Physics played a pivotal role in the emergence of modern science. In its light, Cassirer developed his philosophy of science. The “crisis” in physics, even though it was related to the disciplinary revolutions of quantum mechanics and general relativity, was received as relating to a more general crisis of the scientific “worldview.”

Even though physics has partly lost its paradigmatic status today, it still plays a central role in debates about science as such. The role of science in providing more encompassing explanations of the world is criticised today but still discussed concerning physics. For instance, if “the laws of physics lie” in any way,⁷ the inquiry must be directed towards the very notion of lawfulness itself. Such a redirection engages directly with the fundamental issues Cassirer addressed related to his understanding of the concept of natural laws.

Cassirer rejected one-sided conceptions of explaining the world, which are based only on the “logic” of one field or just one discipline and its methods. In this regard, he criticised, for instance, Carnap’s physicalism. Nevertheless, at least from the 1930s onwards, Cassirer was aware of the “cultural” need programmatically expressed by the Vienna Circle: to defend the scientific ideal in society. Therefore, the rejection on the methodological level (physics as the primary or paradigmatic form of knowledge-making) did not mean rejecting the ethico-political motivation behind the “unity of science movement”⁸ instigated by the Vienna Circle.

In Cassirer’s later work, mainly as discussed in *The Myth of the State*⁹, the analysis of the tension between the rationality of science and the irrationality in the domain of politics emerges as a crucial task of philosophy. He highlights a striking disconnection between these two realms in cultural life, which amounts to a structural schizophrenia of modern societies. Cassirer notes that regarding political action, humans follow rules almost directly opposed to those recognized in those fields presented to them as paradigmatic in their upbringing and education. He states that while rational methods are always the goal in solving problems not only in theoretical realms but also in natural science or technology, in the sphere of social affairs, it seems that the defeat of reason is complete and

⁷ Cartwright (1983).

⁸ See Neurath (1938) and Neurath, Carnap, Morris (1944). For the political implications, see Uebel (2005).

⁹ Cassirer (1946).

irreversible: “In this domain, modern man is supposed to forget everything he has learned in the development of his intellectual life. He is admonished to return to the first rudimentary stages of human culture. Here, rational and scientific thought openly confess their breakdown; they surrender to their most dangerous enemy.”¹⁰ Also, the political crisis complex of the Weimar Republic and the related crisis of the worldview in the light of rapid scientific developments represent this rising disparity between cultural tendencies (see Sect. 2).

Even though this observation was rooted in the context of the rise of fascism, Cassirer articulates his explanation in a broader sense, thereby highlighting a central motivation of his philosophy: the critical revision of fundamental assumptions and concepts across diverse cultural spheres. As he put it in the introduction of his comprehensive history of the problem of knowledge (*Erkenntnisproblem*): understanding a specific form or ideal of knowledge (*Erkenntnisideal*) means putting it into a systemic relation with other sometimes distant contemporary forms and ideals.¹¹ This approach asks for the possibility of how diverging cultural forms can be understood in a pluralist conception.

Within physics as a discipline, pursuing a unified “theory of everything,” a final theory of all the natural sciences, has long been a goal.¹² Despite that, ongoing quests for unification, such as combining quantum and gravitational theories, remain unresolved. Therefore, further philosophical insight into concerns such as the validity of idealisations, the scope of theories, and reductionism, which question the feasibility of a truly unified physical theory, is essential. This need is underscored by the underlying aim to empirically provide a conception of “reality” or the “world,” suggesting that we can attain an “objective” concept of reality only through such a unified and coherent theory. The Cassirer-Heidegger debate at Davos in 1929 emerged as a pivotal moment in this discourse, highlighting the dynamic interplay between science and philosophy. Central to this debate was the contention regarding philosophy’s diminishing primacy in the realm of sciences, which Cassirer also highlights in the fourth volume of the problem of knowledge (*das Erkenntnisproblem*) (see Sect. 3).

Within the philosophical meta-context, the question of unity arises: What would constitute the coordinating principle between, e.g. physical cosmology and all other non-scientific and scientific domains?¹³ Given that increasingly divergent fields each possess unique systems of engaging with the world, the unity of science ultimately reflects a quest for the unity of reality and the unity of truth. Cassirer aims to show

¹⁰ Ibid., p. 7.

¹¹ Cassirer (1906, p.13). Michel Foucault took over this principle (almost verbatim) in his archaeology of modern “epistemes.” Cassirer also formulates the principle of critical philosophy, trying to avoid the fallacy of one-sided emphasis or reification: “[...] die metaphysische Formel muß sich uns in eine methodische wandeln” (ibid.).

¹² See the work of the research group “Historical Epistemology of the Final Theory Program” led by Alexander Blum at MPIWG Berlin. For the pluralism problem and the crisis in cosmology, see Adrien de Sutter’s work in the frame of this group.

¹³ “No single astronomical system, the Copernican as little as the Ptolemaic, can be taken as the expression of the ‘true’ cosmic order, but only the whole of these systems as they unfold continuously according to a definite connection.” Cassirer (1953, p. 322). See Cassirer (1923, p. 348). See also the comment of Mormann and Katz (2013, p. 250).

that even though old conceptions of truth have been cast into doubt, this does not necessarily mean rejecting the concept of truth altogether. In order to develop a more adequate concept, what is needed is a reconstruction of its functional history. An example of such an analysis we use his 1929 inaugural speech as a rector of the University of Hamburg on the forms of truth, *Formen und Formwandlungen des philosophischen Wahrheitsbegriffs*¹⁴ (see Sect. 4).

Cassirer asserts that there are many ways of world disclosure. Consequently, there are no universally given criteria of truth, reality or objectivity. Nevertheless, science as a symbolic form, i.e., a way of world disclosure, is distinguished by the way it strives for truth, although its results are fallible and revisable. The ideal of truth has been transformed into a “regulative ideal” in the Kantian sense. While this task manifests through different ways of “objectification,” the unity within and among these ways is not innately present but has to be actively produced by critical coordination of their claims. Hence, a deeper understanding of unity requires a critique of its constituting principles.

The scientific ideal, however, upholds methodological criteria for “objectification” and the generation of actual knowledge, essential for technological and political developments. Cassirer’s theory of the interrelation and tensions between different kinds of rationality, like those becoming apparent in scientific and political projects, represents an inherently ethical project, the principles of which he illustrates by drawing on the inner logic of science, e.g. physics (see Sect. 5).

Finally, we explain in more detail the mediating role as the task of the philosophy of symbolic forms as an attitude between politics and science (see Sect. 6).

2 1929 or the crisis of truth

In this section, we explore the historical context essential to understanding the problem of *unity* in Cassirer’s philosophy, particularly its connections to scientific advancements and political upheavals. In 1929, the year of the Wall Street crash and the end of the short-lived stability of the Weimar Republic, it was ten years ago that Sir Eddington’s expedition proved the correctness of the theory of general relativity. This event made Albert Einstein a public figure. Einstein’s actual *annus mirabilis* was in 1905 when he proposed the theory of special relativity. After his 1915 theory of general relativity, the globally proclaimed proof led to years of public interest and debate about the foundations of the physical universe. In 1929, Werner Heisenberg and Wolfgang Pauli also developed classical quantum mechanics into quantum electrodynamics.¹⁵ In founding modern quantum mechanics from 1925 onwards, the term “quantum physics” was first documented in Max Planck’s 1929 lecture *Das Weltbild der neuen Physik*.¹⁶ Both Einstein’s revolutionary theory on the macro level and the new physics of the microcosm led to fundamental epistemological debates about the progress of physics. From this time stems the image of physics as being immersed in

¹⁴ Cassirer (1929b).

¹⁵ Heisenberg and Pauli (1929).

¹⁶ Planck (1929).

basic research, which determines the newest “state-of-the-art” concerning scientific cosmology.¹⁷ Both the causal explanations and the revisability of former explanations and theories form essential elements of what was seen as “scientific worldview.” In the 1920s, the particular physical and epistemological discussions were intricately connected with the discussion of a “crisis of worldview” and the disunity of reality, resonating in artistic production and political discourse. The Great War had shaken the ideal of progress secured by scientific rationality, but this rationality was still seen to be involved on both epistemic and public levels. This position is also apparent in the work of the German diplomat and philosopher Kurt Riezler. In his 1928 essays *Die Krise des physikalischen Weltbegriffs und das Naturbild der Geschichte*¹⁸ and *Die Krise der Wirklichkeit*¹⁹, he argues that as individual sciences continue to differentiate and form their systems of concepts, they become increasingly distant from a unified description of an ideal absolute truth. One year later, in his essay *Zur Krise der “Wirklichkeit”* Ludwik Fleck, whose work came to inspire the history and philosophy of science in the second half of the 20th century, criticised the concept of such “absolute truth” and “ideal types.”²⁰ Fleck argues that each individual, while still a member of a particular group and society, has their own but collectively shared reality in which they live and according to which they orient themselves. Moreover, each person has multiple, sometimes conflicting realities: the reality of everyday life, a professional reality, a religious reality, a political reality, and a small scientific reality. For Fleck, science is an ongoing, synthetic, never-ending transformation process that, with all its uncertainties, has an orienting function for society since natural science embodies a democratic way of thought.²¹

The same idea of an immanent dynamic of scientific knowledge and its normativity was formulated independently by John Dewey, who, in his famous 1929 book *The Quest for Certainty*²², argued that while pursuing truth in terms of certainty and security has led to various forms of dogmatism, fundamentalism, and oppression, the inevitable uncertainty of science in the research process should be taken seriously. In this sense, he proposes a more flexible approach that continually revises beliefs in the

¹⁷ In his once famous and widely read book *Science and the Modern World*, Alfred North Whitehead, who also intervened in the discussions about Einstein’s theory, writes: “The eighteenth century opened with the quiet confidence that at last nonsense had been got rid of. Today, we are at the opposite pole of thought. Heaven knows what seeming nonsense may not tomorrow be demonstrated truth. We have recaptured some of the tone of the early nineteenth century, only on a higher imaginative level. The reason why we are on a higher imaginative level is not because we have finer imagination, but because we have better instruments. In science, the most important thing that has happened during the last forty years is the advance in instrumental design.” Whitehead (1926, p. 143).

¹⁸ Riezler (1928a).

¹⁹ Riezler (1928b).

²⁰ Fleck (1929).

²¹ Accordingly, Fleck comes to the following formula: “Natural science is the art of shaping a democratic reality and orientating oneself to it—in other words, being reshaped by it. It is an everlasting work, more synthetic than analytical, never to be finished, eternal, like the work of the river that forms its bed. This is the true, living science of nature. The creative-synthetic and social-historical aspects of it must not be forgotten.” Fleck (1929, p. 429, our translation).

²² Dewey (1929).

face of new knowledge and experiences. Thus, for Dewey, the complex of scientific and epistemological debates is directly related to the realm of political discussions.²³

In this historical context, it is thus not fortuitous that Cassirer presented the concept of a pluralism of cultural forms, which he would elaborate in his *magnum opus* of the philosophy of the symbolic forms, at the end of his book *Zur Einsteinschen Relativitätstheorie*²⁴ for the first time. This outlook resonated with distinct political undertones akin to those outlined above, showcasing Cassirer's innovative approach to the pluralism of cultural forms in his later masterpiece the *Philosophy of Symbolic Forms*.²⁵ In his analysis of the theory of relativity, Cassirer observed a novel approach to coordinating different systems of culture and science. This insight led him to reconsider the role of philosophy, shifting from the old notion of systematic unity based on a singular general principle:

It is the task of systematic philosophy, which extends far beyond the theory of knowledge, to free the idea of the world from this one-sidedness. It has to grasp the *whole system* of symbolic forms, the application of which produces for us the concept of an ordered reality, and by virtue of which subject and object, ego and world are separated and opposed to each other in definite form, and it must refer each individual in this totality to its fixed place. If we assume this problem solved, then the rights would be assured, and the limits fixed, of each of the particular forms of the concept and of knowledge as well as of the general forms of the theoretical, ethical, aesthetic and religious understanding of the world. Each particular form would be 'relativised' with regard to the others, but since this 'relativisation' is throughout reciprocal and since no single form but only the systematic totality can serve as the expression of 'truth' and 'reality,' the limit that results appears as a thoroughly immanent limit, as one that is removed as soon as we again relate the individual to the system of the whole.²⁶

In this novel approach, Einstein's theory of relativity replaces the concreteness of space and time with functional concepts. Where the old theory of classical mechanics operates with absolute space-time points, length and simultaneity lose their absolute significance in relativity. The theory of general relativity treats all coordinate systems as equivalent and replaces rigid spatial measurements with variable, point-to-point environments. Additionally, Cassirer argues that the development of the theory of

²³ Dewey also made this explicit in his article for the *International Encyclopedia of Unified Science*. He upheld a similar view to Cassirer (see also Freyberg and Niklas (2019) in his critique of reductionism and his defense of the ideal of science. Nonetheless, as the debates with his friend and opponent Morris R. Cohen show, this position was unclear to his contemporaries. Cohen, who was the teacher of Ernest Nagel and can be seen as a bridge between the American and the Central European discussions, blamed Dewey and other pragmatists for opening the door for life philosophy's rejection of science tout court on the one and behaviourist reductions on the other hand. His main work, *Reason and Nature: The Meaning of the Scientific Method*, was in many respects an answer to Dewey's *Experience and Nature* (see Cohen (1931) and Dewey (1925)).

²⁴ Cassirer (1921).

²⁵ Cassirer (1923), Cassirer (1925), Cassirer (1929a). English translation in Cassirer (2020).

²⁶ Cassirer (1921, pp. 111–112). English translation in Cassirer (1953, p. 447).

relativity is an example of how the object concepts in mathematical sciences change over time.

As another revolutionary theory of this time, quantum mechanics, developed by Heisenberg and Schrödinger in 1925, is a significant departure from classical mechanics. Whereas previously, the position and momentum of physical objects could be determined with precision, the uncertainty principle limits the precision of their simultaneous knowledge. Physical objects are no longer determined by definite coordinates but by probability densities described by wave equations. Cassirer's contribution to the debate on quantum mechanics, as outlined in his work *Determinismus und Indeterminismus in der neuen Physik*²⁷, centres on the idea that causality in physics should not be understood as absolute predictability (as in Laplace's Demon) but rather as general describability and conformity under a natural law. He emphasises that in quantum mechanics, the concept of an object is redefined, moving away from spatially and temporally localised entities to a functional description involving probability densities, thus reinterpreting the notions of causality and objectivity in physics.

Cassirer's engagement in philosophical discussions on recent advancements in physics, such as Einstein's theory of relativity and quantum mechanics, stemmed not only from his view of science, particularly physics, as a crucial knowledge domain. It has not been fully appreciated until now that his engagement was also by how these debates challenged basic philosophical concepts such as causality. Thus, generally speaking, participating in the debates over interpreting scientific changes involved addressing a more comprehensive array of questions, extending beyond mere theories of scientific observation or theoretical explanation.

3 Philosophy and the disunity of science: territory or process?

In order to focus on the philosophical context Cassirer was involved in, we point to the fact that the relationship between science and philosophy was an important topic during the famous Cassirer-Heidegger Davos debate in 1929.²⁸ This dispute centered on philosophy's seemingly eroding leading role among the sciences, as advocated by Heidegger. This section demonstrates that Cassirer opposed this view with a unified functional and plural approach to philosophy without relativism or philosophical fatalism.

During the famous meeting at Davos between Heidegger and Cassirer the former criticised the neo-Kantian concept of "philosophy as a science." He answered Cassirer's question about what he meant by Neo-Kantianism with the following words: "The common ground of Neo-Kantianism can only be understood from its origin. The genesis is the embarrassment of philosophy with regard to the question of what actually remains for it in the totality of knowledge. Around 1850, both the historical and the natural sciences came to occupy the totality of the knowable, so the question

²⁷ Cassirer (1937).

²⁸ Cassirer (1929d).

arises: what remains for philosophy when the totality of being is divided among the sciences? All that remains is the knowledge of science, not of being.”²⁹

Therefore, *philosophy as part of the scientific project* would withdraw until no field, territory, or place is left that is not treated by a particular discipline of the sciences. Of course, Heidegger wanted to draw on what he saw as the fundamental task of philosophy, namely, to regain the idea of being. At the same time, however, he presupposes a specific understanding of the relation of science, knowledge and the world by putting forth the idea of a *territorial* understanding of knowledge.

In contrast, Cassirer advocates a *functional* definition of knowledge for science and philosophy, not a substantial or territorial one. Knowledge is actively created, and philosophical analysis reconstructs these acts. Most importantly, science and philosophy are *human activities* that interact in various ways.

Concerning Heidegger’s critique of “philosophy as science,” Cassirer even claims that “the neo-Kantian philosopher” Heidegger is alluding to turns out to be Heidegger himself because his conception presupposes what he claims to criticise. Thus, in his characteristic manner, Cassirer suggests (without saying explicitly so) that Heidegger lacks a comprehensive understanding of modern science. Instead, Heidegger reiterates the popular narrative of a disenchanted world as suggested by Max Weber or life philosophy.

Contrary to this position, Cassirer tries to show that philosophically acknowledging the historical transformations in the sciences provides a better critique of the dichotomies against which Heidegger turns (e.g., in terms of Cartesian dualism). Whereas Heidegger’s critique, in the end, amounts to a regression before that dualism (as when we proclaim that “we have never been modern”) or a kind of fatalism given the hegemony of technology, modern science itself provides ways to think forward. This way is not a clear-cut division of labour as developed in the modern capitalist economy but a dialogue in the form of a conversation, even if the arguments can be fierce.

Cassirer approached this problem of diversification, complexity, and *disunity* of cultural forms throughout his whole oeuvre. However, as he stated in the introduction of the fourth volume of *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit*³⁰, he could treat the general development of the problem of knowledge (or *Erkenntnis*) in the first three volumes in a close connection with philosophy.³¹ While, as confirmed in the previous volumes, earlier epochs allowed for a unified epistemological view, this is no longer possible in the fourth volume, which treats the developments in the 19th and early 20th centuries. Cassirer observes that philosophy has lost its function as providing a systemic unified overview, which it had held for centuries. Neither do the different methods and aims call for such a view, nor do the sciences wish guidance by higher principles. This change has resulted in various particular theories of knowledge, each of which had been proposed as the

²⁹ Cassirer/Heidegger (1929, p. 274, our translation). See also Cassirer (1929d, pp. 108–119).

³⁰ Cassirer (1957). English translation in Cassirer (1950).

³¹ The Italian translation of this work accordingly bears the (slightly more shrewd) title *Storia della filosofia moderna* (4 voll., Torino, Einaudi, 1952–1958).

new unifying principle, such as “psychologism [...], a logical formalism, mathematicism, physicalism, biologism, a historicism.”³²

According to Cassirer, the relationship between philosophy and individual sciences has undergone this fundamental transformation due to the unstoppable specialisation of the sciences. He compares the determination of philosophy in ancient and medieval times to the great philosophical systems of the 17th and 18th centuries and attributes an independent, creative character to early philosophy. For example, the Platonic theory of knowledge directly led to innovations in geometry or astronomy. Although parts of Descartes’ and Leibniz’s natural philosophies have proven untenable, Cassirer argues that the spirit of their method, with its universalist orientation, has retained its productive power.³³ In Cassirer’s interpretation, Kant’s philosophy is less productive in that sense and more of an observational, analytical, and critical theory. He writes about Kant: “His transcendental method has to assume the ‘fact of sciences’ as given, and seeks only to understand the possibility of this fact, its logical conditions and principles.”³⁴ In contrast to Cassirer’s position, for Kant, there is no direct dependence of philosophy on the concrete object of knowledge of the sciences; instead, it is about the:

universal and essential *form* of knowledge, and that philosophy is called upon and qualified to discover this form and establish it with certainty. The critique of reason achieves this by reflective thought upon the function of knowledge instead of upon its content. It discovers this function in judgement, and to understand judgement in its universal structure and in its specification in different lines becomes one of the main problems of the critique. Here it is that Kant found the strictly unifying, systematic, and organising principle of knowledge.³⁵

As mentioned above, in the second half of the 19th century, such philosophical universalism would no longer have been possible due to more substantial dependencies on individual scientific theories, such as the theory of evolution, and “knowledge was no longer anchored to mere mathematics and natural science but to ethics and sociology [...]”³⁶ Cassirer notes that with this ongoing specialisation, the problem of knowledge has lost its previously firm basis. This development leads one to question whether there is such a thing as “knowledge” in general or whether each science has its distinct concept of knowledge and methodology. The overall unifying orientation of philosophy in recent centuries has been lost.

Despite this diagnosis, Cassirer does not succumb to relativism or philosophical fatalism. Instead, he suggests a change in perspective in which philosophy now reconstructs the guiding motives of each epoch that led to the results of individual philosophical developments rather than simply tracing them. “When the situation is looked at in this way, the problem of knowledge is clearly seen to have taken a

³² Cassirer (1957 p. 12). English translation in Cassirer (1950, p. 11).

³³ See *ibid.*, p. 13–16. English translation in Cassirer (1950, pp. 12–14).

³⁴ *Ibid.*, p. 16. English translation in Cassirer (1950, p. 14).

³⁵ *Ibid.*, p. 17. English translation in Cassirer (1950, p. 14).

³⁶ *Ibid.*, p. 17. English translation in Cassirer (1950, p. 15).

new turn and acquired a much more complex structure than in the earlier centuries. [...] From the richness as well as the divergence and conflict of individual tendencies and efforts, a unified and comprehensive tendency begins to disclose itself.”³⁷ This programme would only be possible through extensive engagement with individual disciplines’ specific work to recognise their fundamental questions and series of thoughts.³⁸

For an extensive unifying philosophical system, as mentioned before, Cassirer sees no future: “The era of the great constructive programs, in which philosophy might hope to systematise and organise all knowledge, is past and gone. However, the demand for synthesis and synopsis, for survey and comprehensive view, continues as before, and only by this sort of systematic review can a true historical understanding of the individual developments of knowledge be obtained.”³⁹

Although Cassirer now attributes a crisis of the *unified concept of truth* to the newer philosophy due to the divergence and specialisation of individual sciences, he proposes a new form of philosophy as a countermeasure. This form of philosophy operates according to the principle of a historical overview and *critical* review of developments within the sciences and the influence of these developments on philosophy.

4 Truth and the unity of the sciences: Cassirer’s inaugural address

In this section, we analyse the relation of unity of the sciences and truth using Cassirer’s inaugural speech *Formen und Formwandlungen des philosophischen Wahrheitsbegriffs*⁴⁰ as a rector of the University of Hamburg. From a historical perspective, in 1929, Ernst Cassirer also reached a significant milestone in his career by publishing the third and final volume of his philosophy of symbolic forms. This year held special meaning for Cassirer personally,⁴¹ as he became the first and only Jewish rector in the Weimar Republic at the University of Hamburg, taking office on November 7.⁴² On August 11, 1928, Cassirer had already given a speech on behalf of the city of Hamburg to celebrate the 10th anniversary of the Weimar Republic, titled *Die Idee der republikanischen Verfassung*.⁴³ During his time as rector, he strongly advocated for a celebration of the constitution in 1930, but this met with strong resistance, “which

³⁷ Ibid., p. 21. English translation in Cassirer (1950, p. 18).

³⁸ See *ibid.*, p. 21. English translation in Cassirer (1950, p. 18).

³⁹ Ibid., p. 21. English translation in Cassirer (1950, p. 18).

⁴⁰ Cassirer (1929b).

⁴¹ The year 1929 also saw the passing of Aby Warburg, whose library was a significant influence and source of inspiration for Ernst Cassirer’s philosophy of symbolic forms. Warburg held great importance for Cassirer and the University of Hamburg as embodying scientific integrity. As Cassirer wrote in his obituary for Warburg: “he belonged to the university not only as an honorary professor [...] but in him, in his personality and in his spirit, what is usually separated and divided by disciplinary boundaries came together in a unique and magnificent unity.” (Cassirer 1929c, p. 368, our translation).

⁴² Cassirer (2003, p. 184).

⁴³ Cassirer (1929e).

were already clear forerunners of the coming era [of National Socialism].”⁴⁴ Therefore, the completion of the philosophy of symbolic forms and Cassirer’s inaugural address as rector occurred during a period marked by intense political turbulence.

In his rector’s inaugural address, *Formen und Formwandlungen des philosophischen Wahrheitsbegriffs* Cassirer presented his proposed new approach to philosophy. With the general public as his audience in mind, he claims that with the increasing differentiation of the physical and general scientific worldview, philosophy can no longer provide a unified philosophical system in the same way as past systems such as idealism. Instead, it must outline the fundamental tendencies of scientific and philosophical development. In this way, philosophy must constantly interrogate itself in the context of its development and foundations. Cassirer uses this address to examine the central and historically changing concept of truth more closely in this sense.

This approach immediately brings up the question of relativism regarding the existence of only conditional relative truths. In a historical analysis, Cassirer identifies three distinct concepts of truth that have emerged in the history of philosophy, which he calls the *hierarchical*, *rationalist*, and *positivist* concepts of truth. Moreover, Cassirer reconstructs the transformations of this concept within the history of philosophy to answer the fundamental question of their *unity*.

The *hierarchical concept of truth* is based on a defined hierarchy of truth, starting from God to the spirit and finally to the material world. The hierarchical understanding of the concept of truth already operates regarding a “ultimate ground of unity.”⁴⁵

During the mathematical and scientific Renaissance, the *rationalist understanding of truth* began to take hold. The shift emphasises the method of knowledge rather than the object of knowledge as the ideal of truth.⁴⁶

For the *positivist ideal of truth*, factual truths precede purely rational truths. “The knowledge of ‘facts,’ of ‘matter of fact,’ is elevated as the motto of the new natural-scientific epoch,”⁴⁷ according to Cassirer. Here, all forms of knowledge were based on experience, with the form of knowledge no longer being created or preconceived by the mind but instead imposed and prescribed by reality and the entirety of the internal and external experience.⁴⁸

In his discourse, Cassirer chooses not to extensively examine the distinctions between various notions of truth within the sciences. Instead, it posits that there is a unified methodology in the progression of natural sciences, as previously articulated by Max Planck,⁴⁹ characterised by the removal of anthropomorphic perspectives in understanding the natural world.⁵⁰ By removing all human elements from the natural sciences and being independent of the specific observer, “[o]nly then is the unity of the natural-scientific world view achieved: the unity in relation to all places and

⁴⁴ Cassirer (2003, p. 184, our translation).

⁴⁵ Cassirer (1929b, p. 345).

⁴⁶ Ibid., p. 344.

⁴⁷ Ibid., p. 348.

⁴⁸ Ibid., p. 348.

⁴⁹ Planck (1958).

⁵⁰ Cassirer (1929b, p. 350).

times, and in relation to all researchers, all nations, and all cultures.”⁵¹ This quote shows how Cassirer’s text simultaneously integrates the epistemic and the (cosmo-) political dimensions on different levels. As illustrated in this example from the natural sciences, Cassirer now also transcends the mere discussion of the various *paradigms of truth*, none of which could encompass “any fixed point of unity of knowledge at all”⁵² within the historical whole.

Nevertheless, in what we have introduced in Sect. 2 as the crisis of truth, Cassirer does not want to give up a unified concept of truth but instead proposes a *change in perspective*, in which unity itself must be understood differently: “not just change its content, but its concept and principle.”⁵³ The common principle of the three concepts of truth is that they all go back to “a common *formal* presupposition. They postulate the *unity* of knowledge[.]”⁵⁴ The hierarchical concept of truth traces all knowledge back to a prime mover. The rationalist concept of truth is guaranteed by human reason, and the positivist concept of truth is based on sensory elements and perceptions. In all cases, unity or homogeneity is often considered a given per se by the object of knowledge itself. Despite that, one of Cassirer’s most essential principles is that the unity of the knowledge of a manifold is based on difference, statics based on dynamics, and not the other way around.

Cassirer consequently asks whether this homogeneity is necessary for a systematic connection of all knowledge. He concludes that the realm of knowledge can also be assumed to be non-homogeneous and that, therefore, various elements of a given manifold of objects of knowledge acquire their meaning through their functional-relational placement in the overall context:

the content that an individual cognition possesses cannot be determined and pronounced apart from its particular place in the whole, from the specific spiritual functions that build it up. Everything factual receives its clearly determined meaning only through the contexts of meaning in which it occurs and through the meaning categories that form it. There is no naked matter of the factual as such, to which these categories are added only afterwards, but it is them which, in their specification of meaning, first constitute the concrete particularity of the fact [*Faktum*].⁵⁵

In Cassirer’s *tertium datur* of unity, truth lies not solely in the object or solely in the subject but instead in the *activity* of the basic intellectual functions, “energies,” as Cassirer calls them. However, if one now saw science itself breaking down into a “piece in pieces,”⁵⁶ the unity and wholeness of the fields of knowledge would disappear along with the particularity of the individual sciences. On the other hand, Cassirer proposes the *functional ideal of truth* already introduced above. The standard

⁵¹ Ibid., p. 350.

⁵² Ibid., p. 354.

⁵³ Ibid., p. 354.

⁵⁴ Ibid., p. 354.

⁵⁵ Ibid., pp. 355–356.

⁵⁶ Ibid., p. 357.

of the validity of knowledge is no longer its extent but rather “clarity and the purity, the sharpness and the rigor of knowledge [which] constitutes its proper fundamental norm.”⁵⁷

Cassirer’s plea against the dilemma of the value-free, neutral, and purely rational nature of science versus the irrationality of politics is connected here. The task at hand is to establish concrete mediations and connections with specific delimited areas of validity. At the same time, a purely liberal position would defend the freedom of science based on its neutrality, ultimately speaking up for a technocratic interpretation of science. Instead, Cassirer’s approach to science can be interpreted in the sense of epistemic values and as the establishment of the ideal of scientificity itself. Moreover, this ideal also establishes the “ideal” unity in the “practical” multitude. In this sense, Cassirer’s answer to the truth crisis can be understood as a *dialectical* answer. In this functional-relational concept of unity, any specific position of a given manifold in the scientific complex refers to the whole. The scientificity of the position within the complex is given by both specific values and the ideal of science itself:

Wherever we truly grasp it [science], we always stand within it, place by place. For the individual researcher as well, the core question that is addressed to his veracity is no longer how small or large the total space is that he is able to oversee and master, but how strong, how clear, and how genuine the ideas of science and of truth are at all present in his work.⁵⁸

In that sense, Cassirer could mean that there is no science without values relating to the conscience and responsibility of the individual scientist. Consequently, he would have to reject the Weberian image of science as a neutral, disinterested endeavour. However, as a good Kantian, he is very reluctant to reject the ideal of science entirely. What he rejects is the concept of science as a *concrete* universal or adequate description. Hence, the question arises if philosophy could be a mediator in the quest for knowledge between the ideal of science and human interests.

The relationship of philosophy to the individual sciences, Cassirer explains, was that of a “torchbearer of science” for classical rationalism, whereas, in the positivist understanding, philosophy only followed science. Cassirer sets forth a new perspective: philosophy cannot, as in idealism:

set up a highest, absolutely certain metaphysical principle, in order to deduce from it the totality of knowledge according to form and content. And just as little can it be the task of philosophy to conciliate the inner struggles that break out time and again in science, and to silence them by drawing up rash attempts at solutions.⁵⁹

Therefore, philosophy should not aim for mere compromises or reconciliation attempts within the scientific disciplines but rather to make the inner contradictions

⁵⁷ Ibid., p. 357.

⁵⁸ Ibid., p. 358, our clarification.

⁵⁹ Ibid., p. 358.

visible to attain an understanding, which is needed to become an equal interlocutor regarding science on the one hand and society on the other.⁶⁰

5 The wave and the particle: Cassirer's analysis of the relationship between ethics and physics

After clarifying the discipline-internal relationship between divergent theories of physics, this section employs the last chapter of Cassirer's book *Determinismus und Indeterminismus in der modernen Physik*⁶¹ to shed light on the relationship between theoretical and practical philosophy. We show that Cassirer, in his discussion of the influence of physical on ethical discourse, denies a direct connection between the concept of determinacy and ethical freedom. Their functional unity is established transcendently as being mutual conditions, albeit on different planes.

In Cassirer's overall work, the central theme of sciences as cultural forms is pervasive. This theme emphasises their outstanding significance as a decisive theoretical self-awareness of modernity and as a leading thread to understand intellectual history in terms of the development of the problem of knowledge.⁶²

Between 1902 and 1907, at the beginning of his philosophical career, Cassirer presented the first three volumes of *Das Erkenntnisproblem*⁶³, a monumental history of science up to the 20th century. In his subsequent work, *Substanzbegriff und Funktionsbegriff*⁶⁴, he systematically developed his structural-relational theory of knowledge for the first time. *Zur Einsteinschen Relativitätstheorie*⁶⁵ from 1921 presents a lucid analysis of the philosophical implications of the new understanding of space-time. Therefore, it is possible to interpret Cassirer's work solely in terms of the history of science. Nonetheless, this overlooks the fact that he pursues a genuinely philosophical goal in these investigations.

As a famous example, with *Determinismus und Indeterminismus in der modernen Physik*⁶⁶ from 1936, Cassirer offers a detailed examination of philosophical questions in quantum physics. The relationship between Cassirer's philosophy of science and this work has been discussed extensively elsewhere.⁶⁷ Therefore, with our systematic goal in mind, our focus lies on the less-observed last chapter of the book. As discussed in the previous sections, Cassirer explores the 'internal' dynamics within scientific discourse, particularly physics. Nonetheless, he also analyses the related 'external' philosophical implications of scientific developments within the broader context of intellectual understanding.

⁶⁰ The basic conception of Cassirer's philosophy with its principle of difference as a relation is presented in Freyberg (2022) in terms of a "metamorphology."

⁶¹ Cassirer (1937).

⁶² Ferrari (2021).

⁶³ Cassirer (1906), Cassirer (1907), Cassirer (1920).

⁶⁴ Cassirer (1923).

⁶⁵ Cassirer (1921).

⁶⁶ Cassirer (1937).

⁶⁷ Ihmig (1998, 2001); Mormann (2015); Rigal (2001); Ryckman (2015, 2021).

In this concluding chapter, titled *Final Reflections and Ethical Conclusions*⁶⁸, Cassirer examines the relationship between ethics and physics. He poses the question of what relevance the changes in the physical worldview have for the totality and unity of philosophical knowledge. So, Cassirer transcends the purely *internal* scientific discourse and asks about the external implications of the scientific quest for unity. Using the example of ethics as an external field, he asks what the change in scientific concepts within physics means.

Generally speaking, this examination also elucidates the relationship between two fields of *knowledge of reality*. Is it possible to find a unified alphabet of physics and ethics, or is this approach doomed to failure per se? What does it mean for the concept of *freedom within ethics* if the seemingly related concept of *determinism within physics* changes with the new theory of quantum physics?

In the chapter, Cassirer's approach mirrors his earlier discussion in *Formen und Formwandlungen des philosophischen Wahrheitsbegriffs*. Instead of examining the changing theory of *truth* concerning science, Cassirer focuses on the relationship between physical determinism and ethical theory.

The example of the *determinism* of classical physics in contrast to the *indeterminism* of quantum physics can be understood as a clear divergence between physical theories. Do these different theories lead to different ethical concepts? Cassirer clearly denies it. He holds on to the Kantian distinction between theoretical and practical knowledge, albeit with adjustments. Physics and ethics do not share a common set of concepts of explanation or interpretation.⁶⁹ Thus, moral freedom is not a mere possibility overshadowed by physical knowledge. Freedom is not defined *ex negativo* by the absence of determinacy. Its concept requires positive principles for its justification. Cassirer's thesis is that this definition of freedom is generally not to be found within the scientific sphere, which is distinct. Instead of an *immediate unity*, the realm of freedom and the laws of nature are in a necessary *correlation*. The principles of freedom and physicalism mutually constitute the necessary conditions of human actions. Although actions *as events* are always bound to a physical representation and are determined in a temporal causality, their *meaning* is not given in this determinism. Moral action follows independent moral lawfulness, which might be philosophically or practically justified.

Cassirer undertakes a generalisation in that he does not see the philosophical problem as limited to nature and morality but merely as a case of a general question. Similar contradictions always appear where "different definitions and interpretations of meaning confront each other."⁷⁰

In order to illustrate this confrontation, Cassirer sketches a philosophical-historical outline. The approach is similar to the truth-theoretical one discussed above in that he presents three historical positions and synthesises them. Cassirer summons the positions of Plato, Spinoza, and Kant on the relationship between freedom and determinism and emphasizes that neither of the classic positions deny the causal theorem of actions nor understand freedom as mere causelessness.

⁶⁸ Original: "*Schlussbetrachtungen und ethische Schlussfolgerungen*," our translation.

⁶⁹ Cassirer (1937, p. 237).

⁷⁰ Cassirer (1937, p. 247, our translation).

Plato argues that the true cause of moral and free action cannot be found in current physical circumstances or what immediately precedes them but in understanding the world of ideas. Thus, in the *Phaedo*, Socrates recognises that his lack of freedom while being imprisoned is not due to the physical state of his body or what precedes his situation but to the Athenians' decision to convict him. Physical determination is therefore not relevant here, but freedom lies in the knowledge of ideas and the totality of things, a transcendence beyond everyday existence.

Cassirer's reading of the *Phaedo* again embodies his functional-relational understanding of concepts, here with a functional ideal of freedom. Freedom is not justified by the lack of causes or a given ontological configuration but by the knowledge of the totality conditioning the action.⁷¹

According to Spinoza, reason deals not with particular entities and events but with understanding the *whole* in terms of its form and essence, leading to a deeper form of moral will and behaviour. Cassirer proactively counters objections to Platonic transcendence by referring to Spinoza's purely naturalistic ethics. Although there is only one guiding concept of being for Spinoza, as an all-encompassing substance, his purely descriptive methodology cannot abolish a separate concept of freedom. Spinoza reconciles nature and freedom through the concept of law in the ethical sense of a "rational nature." According to Spinoza, while actions have causes, they are not entirely dictated or determined by natural laws. For Spinoza, freedom is, therefore, not the absence of determinations but *acting in accordance with the knowledge* of the whole of the law of reason.⁷²

Cassirer then presents Kant's distinction between phenomena and noumena as an attempt to reconcile determinism and free will. Kant's systematic approach seems similar to a Platonic understanding. Nonetheless, the distinction between the world of the senses and the world of understanding is not made in a metaphysical-dogmatic sense but in a transcendental sense. The contrast between phenomena and noumena is derived from principles of cognition with the specific form of practical judgement and practical knowledge, which require correlating sensory objects and objects of understanding. Actions always belong to a double context of being: On the one hand, they are part of a chain of causes and effects, i.e. of nature. On the other hand, they always belong to the realm of purposes in which they are judged. In the realm of nature, phenomena become experiences. In the realm of purposes, actions become fully intelligible, i.e. their reference to a moral subject only becomes apparent here. Thus, for Cassirer, in this double perspective, actions can be simultaneously understood as determined events in the natural world and as morally significant choices in the realm of human purposes.

In his view, Kant can maintain a strict empirical determinism and simultaneously recognise the autonomy of free will according to the moral law. However, this only succeeds in the form of the *critical-transcendental antithesis* rather than metaphysically. Instead of metaphysically determining being in general, the transcendental antithesis merely determines the *possibilities* of reality.⁷³

⁷¹ Ibid., p. 239.

⁷² Ibid., p. 241.

⁷³ Ibid., p. 243.

Cassirer's synthesis reveals a key insight as indicated above: none of the philosophers he discusses view indeterminacy as the basis of free will. For Plato, it is instead a form of determinability by pure intuition, general laws of reason for Spinoza, and the concept of the moral law for Kant, which expresses the autonomy of free will.⁷⁴ Cassirer removes the metaphysical accidentality of the individual positions and their time, so to speak, and extracts an epistemological core: freedom and causality are irreducibly rooted in all these theories. This thesis does not deny the existence of natural laws that determine freedom but considers them a necessary but not sufficient precondition of any free action.⁷⁵ "The question of free will must not be confused with the question of indeterminism in physics,"⁷⁶ Cassirer concludes.

Consequently, scientific indeterminism cannot solve the ethical problem of freedom. Although quantum mechanics is revolutionary for Cassirer, it is only a new version of the laws of nature that now operates with probabilities. The scientific change does not alter the basic idea of a natural law and its relationship to external forms, such as ethics. There is a clear distinction between the ethical and scientific spheres, as "the fundamental opposition between the physical world and the ethical world cannot be bridged."⁷⁷

How does Cassirer's assertion of a fundamental opposition between the physical and ethical worlds align with his reputation as a philosopher advocating unity? We must trust Cassirer's argumentation path and wait for his final synthesis to find *unity through disunity*. The clear distinction between forms is a necessary condition for their unity but with a modified concept of unity itself.

Thus, for Cassirer, the role of ethics in philosophy is to reveal that freedom and physical determinism do not conflict. Ethics operates in an entirely distinct category because fundamental problems would arise if freedom in ethics was associated with complete indeterminism. In his argumentation, Cassirer has Schiller appear, according to whose concept of *Freiheit* causality and freedom only jointly make constructing the theoretical and moral world possible.

In summary, Cassirer connects the concept of freedom and causality without simultaneously mixing their distinctive features. It is precisely this fundamental difference [*diaphora*] without which there cannot be a relation. As can be found in variations throughout Cassirer's work, *relation* becomes the actual a priori of knowledge. Consequently, if understanding commences from difference, one needs to overcome the problem as being rooted in an absolute ontological split. How such overcoming is possible is given in the dynamics of knowledge as Cassirer analysed it in terms of the change from substance to function. Ultimately, relational understanding takes its cue from the relation instead of the relata.

With this discussion, Cassirer again illustrates a general philosophical issue by providing insight from within the physical discourse. Bohr's atomic model describes the *how* of electron transitions with probabilities. Attributing "freedom" to the electron would have a purely metaphorical character because freedom always requires a

⁷⁴ Crucial is not freedom *from*, but freedom *to*.

⁷⁵ *Ibid.*, p. 243.

⁷⁶ *Ibid.*, p. 244, our translation.

⁷⁷ *Ibid.*, p. 245, our translation.

decision. Cassirer concludes that the compatibility of nature and causality leads to an irresolvable antinomy because the sphere of freedom would be completely closed if determinism was regarded as metaphysical fate—or it leads to acknowledging the *correlation* itself. In this way, the critical epistemological view of determinism avoids the metaphysical antinomy. Cassirer references Simmel's critique of social philosophies based on reifications of natural laws. These "laws," Cassirer agrees with Simmel, are not realities in themselves but *conditions of cognition*—they are not metaphysical entities but transcendental frames.

In conclusion, Cassirer draws on the wave-particle duality of physics to illustrate the "higher" unity he has in mind. For instance, depending on the experimental setting, a photon can be interpreted as consisting of either a wave or a particle. Both interpretations work but are mutually exclusive. Nonetheless, the wave and the particle equally correspond to reality. They are not mere constructions, so we must understand and acknowledge the differences before finding a unifying principle on a different plane.

Physics and ethics are connected because every action is linked to a physical manifestation and has a temporal causality. Physics, conversely, cannot say anything about the validity and meaning of actions. Both forms of cognition of reality are disparate but condition each other. This consideration points to the more general problem of different spheres of meaning. In this context, unity is not found in a shared object of cognition or the reducibility of the forms to one another. Art and religion can refer to scientific objects but always use their distinct categories and alphabets, which are fundamentally non-physical. The same is true for physics.

On the other hand, science, as the perspective charged with the task of integration, is the work of unifying different perspectives. Following Cassirer, physics is not a science because it is acknowledged as such or employs particular methods. Instead, it is as much a science as it helps us to connect different phenomena and to understand the world.

In Cassirer's words: "science strives to give us the comprehensive view."⁷⁸ This is the basic conception of his ideal of science. In this perspective, the task of science is seen as finding underlying principles hitherto undiscovered. Unity, therefore, is not substantive but constructed and maintained in the face of the interactions of *different* realms. Unity, as Cassirer stresses again, does not presuppose identity or homogeneity. It cannot be constituted ontologically within different disciplines, nor metaphysically between the individual symbolic forms, but only transcendently and epistemologically as a task or a functional ideal of unity as a mutual condition and correlation.

⁷⁸ Cassirer (1944, p. 225).

6 Conclusion: unity from disunity

In this article, we demonstrated that pluralism and difference are fundamental principles for Cassirer's philosophy of symbolic forms. They must be understood in a dialectic relation with his concern for unity in a *metamorphological* or interactional sense.

He demonstrated these principles in his engagement with the new developments in physics at the time. Cassirer defended the unity of the ideal of science and its relation to philosophy in a historical situation when it came under threat. It was not just an academic project but one that relates to the role of science in modern societies. Cassirer aimed to develop an integrating framework of a "phenomenology of knowledge" or a "prolegomena for a future philosophy of culture."⁷⁹ In the introduction of the third volume of the philosophy of symbolic forms about the *Phenomenology of Knowledge* Cassirer writes:

When I speak of a 'phenomenology of cognition,'⁸⁰ I do so not in its contemporary usage but am going back to the basic significance of 'phenomenology' as it was established and systematically grounded and justified by Hegel. For Hegel, phenomenology was the essential prerequisite of philosophical cognition because he insisted that philosophical cognition must encompass the totality of spiritual forms and because according to him this totality can be made visible only in the transitions from one form to another. The truth [*Wahreit Wahrheit*] is the 'whole'—this whole, however, cannot be given all at once but instead must be unfolded progressively by thought in its own independent movement and rhythm. This unfolding constitutes the being and the essence of science.⁸¹

This framework of a "phenomenology of knowledge" allows philosophy to mediate in the competing realms of culture or "modern cultural schizophrenia." The activity of critical reconciliation is the most basic gesture of Cassirer's philosophy. In this respect, he appears to follow up on Hegel's phenomenology.⁸²

We showed a primary concern in Cassirer's approach for concepts that claim validity in different realms. Although he denies the immediate effect of physics on ethics, he takes the task of clarifying equivocations seriously. Cassirer's concept of scientific philosophy also pertains to his style of presentation. Morris R. Cohen observed the evolving perspectives and demands of philosophical work: "The philosopher, whose primary interest is to attain as much truth as possible, must put aside as a snare the

⁷⁹ Cassirer (1938, p. 117).

⁸⁰ Steve Lofts' 2020 translation of the three volumes of the *Philosophy of Symbolic Forms* translates "Erkenntnis" with the more encompassing term "cognition" instead of "knowledge," see Cassirer (2020).

⁸¹ Cassirer (2020; volume 3, pp. xxxiii–xxxiv).

⁸² In the third volume of his *Erkenntnisproblem* (Cassirer, 1920, p. 314), Cassirer characterises Hegel's Phenomenology in the following way: "The Phenomenology is nothing else than the complete unfolding and presentation of *the problem of objectivity* in its new form given to it by Hegel. Hegel proceeded from the concept of *synthesis* as the unification and absolute identity of the disparate" (Cassirer's emphasis, our translation). For an analysis of the Hegelian heritage in Cassirer, see Endres (2020, pp. 59–74) and Endres (2022).

effort of originality. Indeed, it seems to me that the modern penchant for novelty in philosophy is symptomatic of restlessness or low intellectual vitality.”⁸³ In this respect, the most conciliatory approach is still the most radical. Mediating different spheres of knowledge-making without denying their validity or autonomy can become a political act in a world of reification, commodification, division of labour, and disciplinary specialisation.

Thus, Cassirer’s approach is political already through its systematic conception. The critical perspective is the fundamental insight of his phenomenology of knowledge: knowledge is a process, and there are different valid ways of knowledge-making with different aims and claims. For philosophy, as for science, this means that question and answer, as Leibniz put it, *theoria cum praxi*, are interrelated.⁸⁴ Cassirer’s “phenomenological” perspective is based on the view that genesis and validity are linked, as the Neo-Kantians put it.

In other words, the “activities of the spirit” are necessarily connected to their physical and cultural manifestations. This aspect is also apparent in Cassirer’s concern with Kant’s distinction between two different concepts of philosophy: the scholarly (purely theoretical) and the worldly (engaged and practical). Cassirer connected these poles in his work, maintaining the idea of philosophy as a science. However, he also acknowledged that the worldly conception of philosophy was left implicit in his main works.⁸⁵ The task of our article, therefore, was to shed light on the normative implications of his analysis of science, in particular of physics. Cassirer’s integrated concept of philosophy, which blends the ideal of science with that of philosophy, inevitably creates tensions. Cassirer’s approach to philosophy as an integrating device based on relational logic has limits. Nonetheless, the potential of Cassirer’s conception has to be realised in terms of overcoming the “split of rationality.”⁸⁶ This conception is profoundly *critical* and not a positivist one. Already, Hermann Cohen proclaimed that the task of philosophy should not be a mere theory of cognition and knowledge but a critical inquiry into how they work and come about (not *Erkenntnistheorie*, but *Erkenntniskritik*).⁸⁷

Cassirer pursued this neo-Kantian line but connected it with the critical concern in a political pluralist sense. In this regard, his philosophy already includes a radical or subversive element when it tries to keep criteria transparent and does not exclude or invalidate whole “worlds” or “realities” from the beginning. In contrast, one of its

⁸³ Cohen (1931, p. 13).

⁸⁴ The question of the primacy of ideal and theoretical or material and practical aspects in the dynamics of knowledge was one of the most debated in the history of science in the 20th century (the so-called internalism versus externalism debate). This issue has produced a significant blind spot in HPS, hiding more important distinguishing criteria, e.g., that approaches take the interrelation more seriously than others. This could be called an instance of the *fallacy of primacy* issue since interrelation and its analysis prove decisive.

⁸⁵ Cassirer (1935, p. 60). Cassirer states there: “I am convinced that the question [...] of the connection of all knowledge to the essential aim of human reason itself arises today more urgently and imperatively than ever before [...]”

⁸⁶ Engler and Renn (2018).

⁸⁷ Cohen (1883, p. 3).

essential working postulates is that unified forms are *products of manifolds*. Thus, difference is needed to perform unification in the first place.

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References

- Cartwright, Nancy. 1983. *How the laws of Physics Lie*. Oxford: Oxford University Press.
- Cassirer, Ernst. 1998–2009. *Gesammelte Werke. Hamburger Ausgabe* (ECW 1–26), ed. Birgit Recki. Hamburg: Meiner.
- Cassirer, Ernst. 1995–2022. *Nachgelassene Manuskripte und Texte* (ECN 1–19), ed. John Michael Krois, Klaus Christian Köhnke, Oswald Schwemmer & Christian Möckel. Hamburg: Meiner.
- Cassirer, Ernst. 1906/1999. *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit. Erster Band*. In ECW 2.
- Cassirer, Ernst. 1907/1999. *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit. Zweiter Band*. In ECW 3.
- Cassirer, Ernst. 1920/2000. *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit. Dritter Band. Die nachkantischen Systeme*. In ECW 4.
- Cassirer, Ernst. 1921/2001. *Zur Einsteinschen Relativitätstheorie. Erkenntnistheoretische Betrachtungen*. In ECW 10.
- Cassirer, Ernst. 1923/2000. *Substanzbegriff und Funktionsbegriff. Untersuchungen über die Grundfragen der Erkenntniskritik*. In ECW 6.
- Cassirer, Ernst. 1923/2001. *Philosophie der symbolischen Formen. Erster Teil. Die Sprache*. In ECW 11.
- Cassirer, Ernst. 1925/2002. *Philosophie der symbolischen Formen. Zweiter Teil. Das mythische Denken*. In ECW 12.
- Cassirer, Ernst. 1929a/2002. *Philosophie der symbolischen Formen. Dritter Teil. Phänomenologie der Erkenntnis*. In ECW 13.
- Cassirer, Ernst. 1929b/2024. *Forms and Transformations of the Philosophical Concept of Truth*, transl. by Tobias Endres and Simon Truwant. *Continental Philosophy Review* 57(3), 342–359.
- Cassirer, Ernst. 1929c/2004. *Nachruf auf Aby Warburg*. In ECW 17: 368–374.
- Cassirer, Ernst. 1929d/2014. *Davoser Vorträge*. In ECN 17, 3–122.
- Cassirer, Ernst. 1929e/2004. *Die Idee der republikanischen Verfassung. Rede zur Verfassungsfeier am 11. August 1928*. In ECW 17, 29–307.
- Cassirer, Ernst. 1935/1979. *The Concept of Philosophy as a Philosophical Problem*. In *Symbol, Myth and Culture*, ed. D. Ph. Verene. New Haven, London: Yale University Press.
- Cassirer, Ernst. 1937/2004. *Determinismus und Indeterminismus in der modernen Physik. Historische und systematische Studien zum Kausalproblem*. In ECW 19.
- Cassirer, Ernst. 1938/2006. *Zur Logik des Symbolbegriffs*. In ECW 22, 112–139.
- Cassirer, Ernst. 1944/2006. *An Essay on Man. An Introduction to a Philosophy of Human Culture*. In ECW 23.
- Cassirer, Ernst. 1946/2007. *The Myth of the State*. In ECW 25.

- Cassirer, Ernst. 1950. *The Problem of Knowledge. Philosophy, Science, and History since Hegel*, transl. by W. Woglom and C. Hendel. New Haven: Yale University Press.
- Cassirer, Ernst. 1953. *Substance and Function and Einstein's Theory of Relativity*. New York: Dover, transl. by M. Swabey and W. Swabey. Originally published in 1923 by Open Court, Chicago.
- Cassirer, Ernst. 1957/2000. *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit. Vierter Band. Von Hegels Tod bis zur Gegenwart (1832–1932)*. In ECW 5.
- Cassirer, Ernst. 2020. *The Philosophy of Symbolic Forms. Three volumes*, transl. by S. G. Lofts. London: Routledge.
- Cassirer, Toni. 2003. *Mein Leben Mit Ernst Cassirer*. Hamburg: Felix Meiner.
- Cassirer, Ernst and Heidegger, Martin. 1929/1991. Davoser Disputation zwischen Ernst Cassirer und Martin Heidegger. In Martin Heidegger Gesamtausgabe, Abteilung I, Band 3: *Kant und das Problem der Metaphysik*, 274–296. Frankfurt am Main: Klostermann.
- Cat, Jordi. 2024. The Unity of Science. In *The Stanford Encyclopedia of Philosophy (Summer 2024 Edition)*, eds. Edward N. Zalta & Uri Nodelman.
- Cohen, Hermann. 1883. *Das Prinzip der Infinitesimal-Methode und seine Geschichte: Ein Kapitel Zur Grundlegung der Erkenntniskritik*. Harrwitz und Gossmann.
- Cohen, Morris Raphael. 1931. *Reason and Nature: An Essay on the Meaning of the Scientific Method*. San Diego: Harcourt, Brace & Co.
- Dewey, John. 1925. *Experience and Nature*. Chicago: Open Court.
- Dewey, John. 1929. *The Quest for Certainty*. New York: Minton Balch.
- Endres, Tobias. 2020. *Ernst Cassirers Phänomenologie der Wahrnehmungen*. Hamburg: Felix Meiner.
- Endres, Tobias. 2022. Negativity in Cassirer? – On the Scope and Limits of a Hegelian Reading of »The Philosophy of Symbolic Forms«. In *The Being of Negation in Post-Kantian Philosophy*, ed. Gregory S. Moss. 487–502. Berlin: Springer.
- Engler, Fynn Ole and Jürgen, Renn. 2018. *Gespaltene Vernunft. Vom Ende eines Dialogs zwischen Wissenschaft und Philosophie*. Berlin: Matthes & Seitz.
- Ferrari, Massimo. 2021. Science as a Symbolic Form: Ernst Cassirer's Culture of Reason. In *Interpreting Cassirer: Critical Essays*, ed. Simon Truwant. 72–88. Cambridge: Cambridge University Press. <https://doi.org/10.1017/9781108677806.006>
- Fleck, Ludwik. 1929. Zur Krise der "Wirklichkeit". *Naturwissenschaften*, 17(23): 425–430.
- Freyberg, Sascha and Niklas, Stefan. 2019. Rekonstruktive Synthesis: Zur Methodik der Kulturphilosophie bei Ernst Cassirer und John Dewey. In *Ernst Cassirer in systematischen Beziehungen: Zur kritisch-kommunikativen Bedeutung seiner Kulturphilosophie*, ed. Thiemo Breyer, and Stefan Niklas. 47–68. Berlin, Boston: De Gruyter. <https://doi.org/10.1515/9783110549478-004>
- Freyberg, Sascha. 2022. Metamorphologie. Ernst Cassirers Begriff der Wissenschaft in seiner Phänomenologie der Erkenntnis. In *Morphologie als Paradigma in den Wissenschaften*, ed. R. Müller, R. Becker, S. Freyberg, T. Reinhardt, M. van Vliet, and M. Wunsch. Stuttgart: Frommann-Holzboog.
- Giere, Ronald. 2006. *Scientific Perspectivism*. Chicago & London: University of Chicago Press.
- Heisenberg, Werner and Wolfgang Pauli. 1929. Zur Quantendynamik der Wellenfelder. *Zeitschrift für Physik* 56(1): 1–61.
- Ihmig, Karl Norbert. 1998. *Cassirers Invariantentheorie der Erfahrung und seine Rezeption des 'Erlanger Programms'*. Hamburg: Felix Meiner.
- Ihmig, Karl Norbert. 2001. *Grundzüge einer Philosophie der Wissenschaften bei Ernst Cassirer*. Darmstadt: Wissenschaftliche Buchgesellschaft.
- Kellert, Stephen H., C. Longino, Helen, Waters, and Kenneth. eds. 2006. *Scientific Pluralism*. Minneapolis & London: University of Minnesota Press.
- Mormann, Thomas and Katz, Mikhail. 2013. Infinitesimals as an issue of neo-kantian philosophy of Science. *HOPOS: The Journal of the International Society for the History of Philosophy of Science* 3(2): 236–280.
- Mormann, Thomas. 2015. From Mathematics to Quantum Mechanics – On the Conceptual Unity of Cassirer's Philosophy of Science (1907–1937). In *The Philosophy of Ernst Cassirer: A Novel Assessment*, ed. J. Tyler Friedman, and Sebastian Luft. 31–64. Berlin: De Gruyter. <https://doi.org/10.1515/9783110421811-003>
- Neurath, Otto. (Ed.). 1938. Zur Enzyklopädie der Einheitswissenschaft. *Einheitswissenschaft, Unified Science, Science Unitaire*. Heft 6. Van Stockum & Zoon.
- Neurath. 1944. Otto, Carnap, Rudolf, Morris, Charles. (Eds.). *International encyclopedia of unified science*. University of Chicago Press.

- Planck, Max. 1929. Das Weltbild der neuen Physik. *Monatshefte für Mathematik und Physik* 36: 387–410. <https://doi.org/10.1007/BF02307625>
- Planck, Max. 1958. Die Einheit des Physikalischen Weltbildes. In *Vorträge und Reden: Aus Anlass seines 100. Geburtstages (23. April 1958)*, ed. Max-Planck-Gesellschaft zur Förderung der Wissenschaften, 6–29. Berlin: De Gruyter. <https://doi.org/10.1515/9783112311622-004>
- Renn, Jürgen. 2020. *The Evolution of Knowledge: Rethinking Science in the Anthropocene*. Princeton: Princeton University Press.
- Riezler, Kurt. 1928a. Die Krise des physikalischen Weltbegriffs und das Naturbild der Geschichte. *Deutsche Vierteljahrsschrift für Literaturwissenschaft und Geistesgeschichte* 6(1): x–x.
- Riezler, Kurt. 1928b. Die Krise der “Wirklichkeit”. *Naturwissenschaften* 16(37): 705–712.
- Schmitz-Rigal, Christiane. 2001. *Die Kunst offenen Wissens: Ernst Cassirers Epistemologie und Deutung der modernen Physik*. Hamburg: Felix Meiner.
- Ryckman, Thomas. 2015. A Retrospective View of Determinism and Indeterminism in Modern Physics. In *The Philosophy of Ernst Cassirer: A Novel Assessment*, ed. J. Tyler Friedman, and Sebastian Luft. 65–102. Berlin: De Gruyter. <https://doi.org/10.1515/9783110421811-004>
- Ryckman, Thomas. 2021. Quantum Mechanics as the Ultimate Mode of Symbol Formation: The Final Stage of Cassirer’s Philosophy of Physical Science. In *Interpreting Cassirer: Critical Essays*, ed. Simon Truwant. 89–108. Cambridge: Cambridge University Press. <https://doi.org/10.1017/9781108677806.007>
- Snow, Charles Percy. 1959. *The Two Cultures and the Scientific Revolution*. Cambridge: Cambridge University Press.
- Uebel, Thomas. 2005. Political Philosophy of Science in Logical Empiricism: The Left Vienna Circle. *Studies in History and Philosophy of Science* 36: 754–773.
- Whitehead, Alfred North. 1926. *Science and the Modern World*. Cambridge: Cambridge University Press.

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