Comptes Rendus de l'Academie Internationale de Philosophie des Sciences

Tome I

Science's Voice of Reflection

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The two cultures—old and new debates on philosophy and the sciences

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Abstract. The Neo-Kantian distinctions between science and the humanities (or cultural sciences), discussed around 1900, are instructive up to the present day. The philosophers then saw the distinguishing marks of the different sciences mainly in methodological aspects. The paper focuses on Windelband's distinction in terms of the nomothetic vs. idiographic method, Dilthey's criticism of it, and its further differentiations by Rickert and Max Weber. Rickert emphasised the significance of values in cultural science, whereas Weber bridged the methodological gap between the sciences in terms of ideal-typical explanations. The debates on the "two cultures" of the recent decades are still partially rooted in the old debates, and as far as they are not, striking similarities between the new and the old debates can be shown. Concerning the usefulness of the old debates for current philosophy of science, in particular Weber's approach sheds light on the role of idealizations and models in the sciences up to the present day.

1 Introduction

Philosophy of science has a long tradition as a meta-discipline that reflects on the conceptual foundations, methods, and contents of the sciences, as well as their significance for understanding nature and the place of human beings in nature. Considered a scientific discipline in its own right, philosophy belongs to the humanities, and so does its reflection on the sciences. In the late 19th century this reflection was subject to a philosophical debate between the Neo-Kantians and Dilthey that is instructive up to the present day, since it focuses on methodological aspects of the sciences. The starting point was Wilhelm Windelband's distinction between the exact sciences and the humanities in terms of the *nomothetic* and the *idiographic* method, its end point is marked by Max Weber's conception of *ideal-typical explanations.*[1] The scientific revolution in physics from 1900 onwards contributed to the decline of Neo-Kantianism and the rise of empiricist philosophy of science. 20th century history until the Second World War did the rest, and when the different cultures of the natural sciences and the humanities returned to the focus of philosophical debates in the 1960s, the Neo-Kantian tradition was forgotten.

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[1]My sketch of the views of Cohen, Windelband, Rickert and Weber in this paper is based on Falkenburg 2020.

In the following, I briefly sketch the background of that debate which arose in the 1890s when Dilthey sharply criticised Windelband's distinction between science and the humanities (§ 2). Rickert differentiated Windelband's distinction by emphasising the significance of values in the cultural sciences (§ 3). Finally, Max Weber bridged the methodological gap between natural and cultural science in terms of ideal-typical explanations (§ 4). The recent debates on the "two cultures" and the relation between philosophy and the sciences show continuities in content with the debates around 1900, even when there is no direct historical impact (§ 5). Finally, I attempt to give an outlook concerning the relevance of the Neo-Kantian approaches for current philosophy of science (§ 6).

2   The old debate: philosophy between naturalism and historicism

The distinction between the "two cultures", understood as different epistemic cultures of the exact sciences (or science) on the one hand and the human and/or cultural sciences (or humanities) on the other, came up in the late 19th century. The first half of the 19th century was marked by the opposition between post-Kantian German idealism from Fichte to Hegel and positivism in Comte's tradition, which spread with the progress of the natural sciences. The development of physics, chemistry, and biology lay the grounds for electrodynamics, thermodynamics, electrodynamics, atomism, and the theory of evolution. In parallel, the humanities underwent an enormous rise and led to the emergence of historicism as a counter-movement to positivism. In the second half of the 19th century, on the side of positivism, materialism and naturalism became influential, with Neo-Kantianism as a counter-movement. Later, the philosophy of life (*Lebensphilosophie*), in Germany represented in particular by Dilthey, added to these philosophical main streams.

The debate on science and the humanities which arose between Dilthey and Windelband in the 1890s resulted from the science wars of the late 19th century, one may say. These science wars had several fronts. They concerned the demarcations between philosophy, natural science, and the humanities; the opposition between naturalism and historicism; the status of psychology as well as social science between science and the humanities; and finally, the debates within social science (economics, law, and sociology) to which Weber contributed. Concerning the rise of psychology as a natural science, they were in particular fought as faculty disputes regarding the appointment of psychologists to philosophy chairs, around 1900 (Gundlach 2017). The case of sociology was to a certain extent similar to that of psychology, insofar as sociology was established at the universities as a new scientific discipline which employed mathematical methods, in the tradition of Comte's "social physics".

Dilthey and the Neo-Kantians had common grounds in their Kantian background and in their common opposition to positivism, materialism, and naturalism. Their efforts to demarcate the humanities against natural science were in particular connected with their attempts to counter (Dilthey) or combine (Windelband) the understanding of psychology as a natural science with an anti-naturalistic conception of the human mind. To the rise of psychology as a natural science, above all Helmholtz contributed with his research on the physiological foundations of human consciousness. He interpreted Kant's principle of causality as a structure of consciousness that is based on physiological processes and can be investigated by means of empirical psychology, based on experiments. The Neo-Kantians sharply criticized this program of naturalizing the human mind, and so did Dilthey.

Apart from these common grounds, the approaches of Dilthey and the Neo-Kantians substantially differed. Dilthey carried on Schleiermacher's foundation of hermeneutics and distinguished himself from Kant's transcendental philosophy by working out a historical account of reason, intended as a "critique of historical reason" opposed to Kant's *Critique of Pure Reason*. The Neo-Kantians of the Marburg and the Southwest schools carried on Kant's philosophy in different ways. In contrast to Dilthey, both schools relied on what Kant had called rational cognition, i.e., the program of giving foundations a priori to human cognition. A main difference between them was that Hermann Cohen, founder of the Marburg school, aimed at giving conceptual foundations to the exact sciences, whereas Windelband wanted to justify the principles of philosophy in terms of values. Being aware that the sciences and philosophy change with time, they could not avoid that their views about the rational foundations and the historical dimension of these disciplines were in a certain tension, which they attempted to resolve through opposing approaches.

Cohen (1914) tended towards constructivism and logicism in the sense of his logic of pure cognition (1902), even though he conceded that the "fact of science", in particular the well-established theories of physics, is subject to historical change. Cohen's constructivism was directed against the sensualistic conception of facts advanced by the empiricists of his day. Natorp (1910, 18) elaborated the genetic aspect of Cohen's constructivist approach, emphasising that scientific facts are not "given" (*gegeben*), but rather "posed as a task" (*aufgegeben*). Windelband (1882; 1883), on the other hand, marked a sharp distinction between contingent historical facts and universally valid values and focused on the validity of philosophical principles. In view of the many historical faces of philosophy, however, his approach tended towards a predominance of the historical elements of cognition. In a scale ranging from logicism (i.e., conceptualism concerning the foundations of theories) to historicism (i.e., empiricism concerning the

historical facts), Cohen was obviously closer to the extreme of logicism, or constructivism, and Windelband closer to the extreme of historicism, or empiricism. Neither of them convincingly succeeded in integrating the logical and the empirical aspects of science and philosophy in a comprehensive account. Nor can they be blamed for this, considering that Kant did not succeed either (as the philosophical debates on Kant's critical metaphysics of nature show up to the present day).

Dilthey's historical account of human reason accented the rational and the empirical elements of human cognition in a different way, claiming that contingent historical facts can only be understood by subsuming them under general concepts (Dilthey 1895/95). This claim was one of the reasons for his sharp criticism of Windelband's distinction of natural science and history, together with the fact that Windelband ranked psychology under the natural sciences, taking into account the rise of experimental psychology at the universities in a descriptive approach.

3   The nomothetic and the idiographic method

The debate began with Windelband's distinction between *nomothetic* and *idiographic* disciplines (1894). Windelband explained his distinction between the "idiographic" and the "nomothetic" method of the empirical sciences in his famous presidential address of 1894, *History and Natural Science.* The distinction belongs to the philosophy of science, he considers it "a theme from logic, especially from methodology, from the theory of science" (Windelband 1894, 138).[2] For him logic is an applied discipline employed in the practice of the sciences, which range from the "rational" disciplines philosophy and mathematics to the "empirical sciences" (ibid. 141). Windelband emphasizes that the empirical sciences should not be distinguished according to their objects 'nature' and 'mind', as the traditional distinction between natural science (Naturwissenschaft) and human science (Geisteswissenschaft) indicates. Psychology in particular falls short of this distinction, as a science that has the mind as its object but investigates it with the methods of natural science (ibid. 142). Instead, he suggests to classify the sciences according to their methods, distinguishing the "nomothetic" from the "idiographic" method. The "idiographic" method is historical and focuses on the description of individual facts. It comes close to what he called the "genetic" method as opposed to the "critical" method of philosophy (Windelband 1883). In contrast, the "nomothetic" method of natural science is nomological, it aims at establishing general laws:

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[2]My translation. The English translation of History and Natural Science by Guy Oakes in Luft (2015, 287–298) is very instructive, but not sufficiently precise in detail with regard to Windelband's philosophical terminology. Here and in the next quotation I suggest a translation that is as literal as possible.

Here we now have before us a purely methodological classification of the empirical sciences, which is to be based on reliable logical terms. The principle of classification is the formal character of their cognitive goals. Some of them search for general laws, others for specific historical facts. [...].

Thus we may say: The empirical sciences search in the cognition of reality either for the universal in the form of natural law or for the individual in the historically specified formation (*Gestalt*); in part they consider the always invariable form; in part the individual, in itself specified content of the actual events. The former are sciences of laws, the latter are sciences of events; the former teach what always is, the latter what once was. Scientific thinking is—if one is allowed to introduce new artificial expressions—in the one case *nomothetic*, in the other *idiographic*. If we want to keep to the customary expressions, we may further speak in this sense of the contrast between natural sciences and historical disciplines. (Windelband 1894, 144–145; my translation).

Windelband distinguishes between both methods according to their cognitive goals of capturing the logical subjects of universal judgments about the general and invariable laws of nature, on the one hand, and singular judgments about individual historical facts or events, on the other. He emphasizes that the respective distinction between natural sciences and historical disciplines is not strict, as the example of psychology shows, and that there are scientific disciplines that combine both methods, in particular, evolutionary biology.

A decade before Windelband's presidential address with this distinction, the first volume of Dilthey's *Introduction into the Human Sciences* (1883) had appeared. Based on his own account of understanding in the human sciences and on his way to developing hermeneutics as the appropriate method of understanding in the humanities, Dilthey strongly opposed Windelband. He had three main objections: to the distinction as such, given that there are natural sciences with idiographic elements and human sciences with nomothetic goals; to the claim that psychology belongs to the nomothetic disciplines; and finally, to the view that singular historical facts may be understood as such, without embedding them in any general conceptual framework (Dilthey 1895/96). The first objection misses the approach, given that Windelband himself admitted that the distinction is not sharp and does not give rise to an unambiguous classification of the sciences. The second objection makes a more substantial point, namely that Windelband, with all his emphasis on the autonomy of historical methods, in relation to psychology was not free from contemporary positivism (just like Cohen in relation to mathematical physics as the predominant "fact of science"). But we may concede that his approach is descriptive, ranking psychology

among the natural sciences in face of the emergence of quantitative experimental psychology at the universities. From the point of view of philosophy of science, the third objection is much more substantial. Only Weber's later conception of ideal-typical explanations could counter it.[3]

Rickert presented a refined classification of the empirical sciences in *The Limits of Concept Formation in Natural Science* (1896/1902) and *Science and History* (1899), differentiating Windelband's distinction of the nomothetic and the idiographic method as follows. According to Rickert, the *subjects* of investigation should not be omitted in an adequate classification of the empirical sciences. Therefore, he adds them to Windelband's purely methodological distinction. With regard to the objects, he proposes to distinguish the natural sciences from the cultural (rather than human) sciences and to define the subjects of the cultural sciences in terms of values, following to a certain extent Windelband's distinction between the "critical" and the "genetic" method (Windelband 1883). He adopts Windelband's idiographic method with regard to the investigation of individual facts or events, calling it the "historical" method of. In this way, his approach results in distinguishing natural and cultural science in terms of the subjects of aswell as methods of investigation. Natural science refers to the phenomena of nature, and employs the nomothetic method to investigate them in search of universal laws of nature. Cultural science refers to values and employs the historical method to investigate their role in culture and society. Like Windelband, he stresses that these distinctions do not give rise to a sharp demarcation between the natural and the cultural sciences. On the one hand, many facts can be investigated from a nomothetic as well as a historical point of view. On the other hand, there are natural sciences such as evolutionary biology (Rickert 1896/1902, 280–282; 1899, 101–103) which proceed historically. For him, the empirical sciences are located in a continuum between the extremes of classical mechanics as the prototype of mathematical physics, and individual history as the prototype of a discipline focusing on facts only. These extremes meet in astronomy, which makes the individual celestial bodies subject to Newton's theory of universal gravitation (1896/1902, 285 and 444–448). In addition, he did not preclude that history also may become subject to relatively general laws, as far as the individual concepts applying to historical facts can be generalised (ibid. 490–492).

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[3]For detailed accounts of the debate between Dilthey and the Neo-Kantians, cf. Makkreel and Luft 2010; Luft 2016; Makkreel 2021. For Dilthey's views about the natural sciences, cf. Pulte 2016 and Kühne-Bertram 2016. For Rickert and Dilthey, cf. Kinzel 2020; for Rickert and Weber, cf. Oaks 1990, Wagner and Härpfner 2015, Staiti 2018.

4   Ideal-typical explanations and the status of social science

For Rickert, the explanation of individual historical processes by general principles remained a vague possibility. Weber clarified this possibility. His conception of ideal-types aims at bridging the gap between historical descriptions and nomothetic explanations by means of a causal account of historical processes. In order to establish the objectivity of the social sciences, he considered social science as methodological hybrid between natural science and the humanities. On the one hand, he insisted that interpretive understanding is better suited to the subjects of the social sciences than capturing them with mathematical methods. One the other hand, he established the famous postulate of value neutrality, taking position against the normativity of sociology or economics.

Weber agreed with Rickert that values belong to the objects of cultural and social science, but that their scientific investigation should be value neutral. In addition, Weber agreed with Dilthey that historical facts and events cannot be understood without embedding them in an interpretative framework of regularities. In the extensive essay *"Objectivity" in Social Science and Social Policy* (Weber 1904), he starts to explain his conception of ideal-types and ideal-typical explanations for the economic concept of the market:

> We have in abstract economic theory an illustration of those synthetic constructs which have been designated as "ideas" of historical phenomena. It offers us an ideal picture of events on the commodity-market under conditions of a society organized on the principles of an exchange economy, free competition and rigorously rational conduct. This conceptual development brings together certain relationships and events of historical life into a complex, which is conceived as an internally consistent system. (89–90)

According to this explanation, the market as a historical phenomenon of which economics has an idealized typified conception, the ideal type. The ideal-type of the market is an "ideal picture", or model, of social actions under certain social conditions. This model is a "synthetic construct" of the dynamics of social life as an "internally consistent system" of social relations, i.e., an idealized model of the dynamics which occurs in a market under certain conditions, such as "the principles of an exchange economy, free competition and rigorously rational conduct". He continues:

> Substantively, this construct in itself is like a *utopia* which has been arrived at by the analytical (*gedankliche*) accentuation of certain elements of reality. Its relationship to the empirical data consists solely in the fact that where market-conditioned relationships of the type

referred to by the abstract construct are discovered or suspected to
exist in reality to some extent, we can make the *characteristic* fea-
tures of this relationship pragmatically clear and *understandable* by
reference to an *ideal-type.* (90)

The idealized model of the market is obtained by theoretical "accentua-
tion", picking out certain elements of reality and neglecting others, just as
the physicists do in their models of classical point mechanics or of an ideal
gas. The relation of such a model to empirical reality is the assumption that
the model relations, or "characteristic features" of the "ideal-type", refer "to
some extent" to the relationships which are "discovered or suspected to ex-
ist" in empirical reality. The model or "ideal-type" is a heuristic tool for
developing hypotheses:

> This procedure can be indispensable for heuristic as well as expository
> purposes. The ideal typical concept will help to develop our skill in
> interpretation in *research*: it is no 'hypothesis' but it offers guidance
> to the construction of hypotheses. It is not a *description* of reality but
> it aims to give unambiguous means of expression to such a description.
> (Ibid.)

Weber then passes from the example of exchange economy in modern
society to another case of an ideal-type, the economic model of a medieval
city, emphasising that such a model does not refer to average data but
only to certain ideal features of its object. The ideal type does not aim
at generating a statistical model of social phenomena. It takes up many
individual phenomena and condenses them into an ideal, abstract picture
of a cognitive object which as such does not exist in empirical reality. The
ideal-type is a "utopia", in the literal sense of something that exists nowhere:

> An ideal type is formed by the one-sided accentuation of one or more
> points of view and by the synthesis of a great many diffuse, discrete,
> more or less present and occasionally absent *concrete individual* phe-
> nomena, which are arranged according to those one-sidedly empha-
> sized viewpoints into a unified *analytical* construct (*Gedankenbild*).
> In its conceptual purity, this mental construct (*Gedankenbild*) cannot
> be found empirically anywhere in reality. It is a utopia. (Ibid.)

Finally, Weber emphasises the dynamic character of the relation between
model and empirical reality. The model has to be compared with the data,
i.e., the individual historical phenomena to which it refers. The comparison
works in two directions, going back and forth between the individual phe-
nomena themselves and the idealized assumptions of the model. The model
helps to select the phenomena to which it applies, and the phenomena in
turn help to improve the model assumptions. In this way, the historical data

serve to modify the ideal-type in order to capture the structure of empirical reality more adequately (ibid.).

Furthermore, he adds a *causal* aspect to his conception of an ideal-type (Weber 1904, 93–110). To understand the historical dimension of social phenomena, he introduces genetic concepts which concern the predominant ideas, thoughts, or ideals of an epoch and their causal influence on the evolution of social phenomena, such as the church, the state, etc. An *ideal-typical explanation* then combines the ideal type of a historical constellation with a causal explanation. It reconstructs the causal process in which a specific social structure may have emerged under certain social conditions, such as the rise of capitalism in Western Europe under the condition of protestant ethics (Weber 1904-05).

Weber's ideal-typical explanations combine elements of Windelband's "nomothetic" and Rickert's "historical" method in the following way. An idealized model of a specific social phenomenon or historical constellation is constructed, which captures the *causally relevant factors* for the formation of that phenomenon or constellation. The model is *compared* with the empirical data from social reality, and it can be *modified* by adapting it to new data.[4]

5   The new debates: continuities and discontinuities

So far the old debates on science and the humanities and/or cultural sciences. In the 1920s, Neo-Kantianism lost importance. The philosophical debate on the sciences substantially shifted in face of the scientific revolutions of physics and the rise of logical empiricism. In Dilthey's tradition, Husserl's phenomenology became influential, upholding however the logical ideal of philosophy as a rigorous science. Cassirer transformed the approach of the Marburg school into his philosophy of symbolic forms, and Heidegger's Sein und Zeit appeared. The Davos dispute of 1929 between Cassirer and Heidegger, with Carnap in the audience, was as much an endpoint of the earlier philosophical debates as a milestone demarcating the diverging new traditions of 20th century philosophy.[5]

From 1933 onwards, the neo-Kantian tradition was completely cut off when Cassirer and other leading neo-Kantians lost their chairs and had to emigrate.[6] Only Weber continued to be discussed in sociology. In the philosophy of science, Carnap's logical empiricism dominated after the Second World War, competing with Popper's critical rationalism. The new debates

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[4]For criticism of Weber's approach see Watkins 1952; for defence, Aronovitch2012 and Swedberg 2017.

[5]See Friedman 2000 and Gordon 2010.

[6]In particular, Richard Hönigswald lost his chair in Munich due to Heidegger's defamatory report (Schorcht 1990, 161).

on science, philosophy, and the humanities (or the cultural sciences) began in the 1960s. In our context, four of these debates are particularly relevant.

1. The positivism dispute between Adorno and Popper (Adorno et al. 1972) directly continued the old debates.[7] It began with Popper's talk and Adorno's comment at a conference of the German Sociological Association in 1961. The dispute concerned the methodology of sociology, took up the sociological debate on value neutrality to which Weber had contributed, and was carried out in the German-speaking world. Adorno did not distinguish between Popper's position of critical rationalism and the views of logical positivism and subsumed both under what Horkheimer (1937) called "traditional" theory, in contrast to the "critical" theory of the Frankfurt school. Horkheimer (1947) attacked the purely instrumental use of reason of the "traditional" theory, which he associated with Weber's account of purpose rationality and value neutrality.

2. The debate about the "two cultures" traces back to Snow's Lecture *The Two Cultures* (1959, 1963), which influenced the public discourse in the English-speaking world and far beyond. According to Snow, modern society is irremediably split into the cultures of literary intellectuals taking the attitude of backward-looking Luddites, on the one hand, and the scientists taking a forward-looking optimist attitude, convinced that any problem can be resolved by adequate means of science and technology, on the other hand. Snow took a crucial methodological point of the old debate up, without referring to it (and probably without knowing it, given that his background is the English intellectual culture, not the German philosophical tradition). Apart from the polemical connotations of labelling the scientific culture as progressive and the literary culture as regressive, it is justified to characterise the two cultures as future-oriented or backward-looking, respectively, insofar as science and technology aim at technical innovations and the humanities aim at understanding historical events, processes, theories, and works. This had precisely been the starting point for Dilthey's and Windelband's attempts to characterise the humanities as opposed to natural science.

Snow's lecture provoked polemical debate and his dictum of the "two cultures" began a life on its own, as can be seen from the German re-edition of Snow's essay (Kreuzer 1987), in a collection of articles with an enlarged scope of the discussion including the topic of science and responsibility. Today, strikingly many people are talking of the "two cultures" without having read a single line of Snow's many-faceted essay. This independence is mainly due to two further influential discussions that followed from the 1970s onwards and have very different topics. The related views

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[7]Frisby (1972) discusses how the dispute relates to Weber's and Windelband's approaches.

have gained increasing influence on science policy in the last decades. One of them concerns science and responsibility, the other the relation between philosophy and history of science.

3. The discussion on science and responsibility had been opened after the Second World War, in view of the atomic bombs dropped on Hiroshima and Nagasaki. In the 1970s, the call for moral responsibility concerning science took new shape. The topics of the debate shifted towards the *Limits of Growth* (Club of Rome, 1972) and the environmental and related ethical problems posed by the use of science and technology. They were above all addressed in Jonas's *The Imperative of Responsibility* (1979). The very title of the book refers to Kant's categorical imperative. Indeed, when Jonas appeals to the responsibility of scientists in the face of the technical achievements made possible by their scientific work, he does not only emphasise that the problems created by technology have no technical solution. Moreover, he points out that ethical standards cannot be naturalised. In this respect, he is also in the tradition of Rickert, who saw the specificity of the cultural sciences in focusing on values.—The demand for responsibility resulted in claiming a new importance for the humanities as an ethical authority in a world dominated by science and technology. In German philosophy, Mittelstrass (1992) coined the dictum of the "Leonardo world" of science and technology, and he gave the call for responsibility a turn towards science policy, emphasizing the indispensability of the humanities for society. He distinguished between two complementary kinds of knowledge, the knowledge of disposal (*Verfügungswissen*), which serves the technical mastery of nature and is provided by science, and the knowledge of orientation (*Orientierungswissen*), which develops the guidelines for purposes and is owed to the humanities. These complementary kinds of knowledge refer to what there is and what ought to be, respectively. It obviously traces back to Kant's distinction between theoretical and practical reason. In addition, it recalls the neo-Kantian distinction between facts and values—and Weber's postulate of value neutrality which reminds us not to blur this distinction, for the sake of scientific objectivity.

4. Parallel to the debate on Snow's *Two Cultures*, Kuhn's book *The Structure of Scientific Revolutions* (1962, 1970) introduced history into the philosophy of science. Together with Feyerabend's *Against Method* (1975), it initiated the cultural turn of the philosophy of science and the humanities in general. Kuhn and Feyerabend challenged the sharp division between the two cultures by claiming that the development of science depends on human interests and social factors, just like any other human activity. Their work ushered in an era of anti-realism in the philosophy of science. Scientific realism was countered by social constructivism, scientific facts were seen as generated by the scientific community rather than as given in nature and

discovered by scientists. In this way social epistemology emerged, studying the external social factors of scientific practice and theory formation, and in particular the dependence of scientific practice on values in a given social context. The emergence of social epistemology led to a very special new clash of the two cultures, the new science wars (Sokal and Bricmont 1997; Carrier et al. 2004). This was certainly a fin de siècle phenomenon; in between, the debate has calmed down. Within philosophy of science, social epistemology has finally been established as a new field of research that investigates the impact of values on scientific research, meeting the field of science policy opened by the discussion about science and responsibility. Together with it, historical epistemology emerged focusing on the socio-cultural context of the evolution of the sciences since the end of the 19th century. Historical epistemology aims at reflecting the historical conditions under which scientific knowledge emerges by working through the traditions from the end of the 19th century to today's debates about the epistemic culture(s) of science (Rheinberger 2007).

Leaving the positivism dispute between Popper and Adorno aside, in the above accounts we encounter three completely different views of the relations between science and the humanities. According to Snow, science on the one hand and the humanities on the other constitute competing world views. According to Jonas and Mittelstrass, science and the humanities are complementary and both kinds of knowledge acquisition are indispensable for society. According to Kuhn, Feyerabend, and their followers, the distinctions between science and the humanities are blurred. We also encounter three different views about the role of philosophy as one of the humanities. In Snow's essay, philosophy is not present, or comes down to a general intellectual approach or attitude. For the followers of Kuhn and Feyerabend, philosophy of science amounts to social epistemology, complemented by historical epistemology. For Jonas and Mittelstrass, on the other hand, philosophy understood as ethics becomes the leading discipline of the humanities, whereas the function of the other humanities is not so clear. Needless to say, none of these approaches can capture the complex relationships between the natural sciences, humanities, and the social sciences in such a comprehensive a way as the works of the Neo-Kantians did, when taken together.

6   An outlook

The Neo-Kantian approaches to philosophy and the sciences in the Marburg and the Southwest School have one feature in common, notwithstanding all differences between Cohen, Natorp, and Cassirer on the one hand, Windelband, Rickert, and Weber (as far as we may consider him as a Neo-Kantian) on the other. All of them struggle with finding the balance between the

rational and the empirical or historical elements of scientific cognition, between general laws or principles and individual facts or events, between Kant's principles *a priori* reflecting the structure of Newtonian science and the historical stage of the empirical sciences.

From today's perspective, this conflict has not been resolved, but rather intensified, insofar as today's natural sciences have to deal more than ever with the theory-ladenness of empirical data. This is particularly true in the age of big data, in view of the methods of machine learning employed, e.g., in the data analysis of the experiments and measurements of particle physics, astrophysics, or astroparticle physics. Here, to a certain extent the considerations of the Neo-Kantians from the Marburg school from Cohen to Cassirer come to bear, as a version of constructivism that does more justice to the methods of the sciences than recent social constructivism did.

Concerning the humanities, Windelband's account of the "idiographic" method has long been abandoned in favour of Dilthey's distinction between explaining and understanding, which Weber took at least partially into account in his conception of ideal-typical explanations. Indeed, Dilthey's distinction is influential in the humanities up to the present days, not least thanks to von Wright's *Explanation and Understanding* (1971).

Windelband's account of the "nomothetic" method is obviously close to the later deductive-nomological (DN) model of explanation (Hempel 1965), which is however much more precise. But the DN model of explanation, notwithstanding its elaborations (Woodward and Ross 2021), was challenged in more recent philosophy of science in two regards. On the one hand, Cartwright (1983) argued that even the laws of physics from Newton's theory of gravitation to quantum mechanics lack universality. On the other hand, Morrison and Morgan (1999) showed that modelling in physics has much more in common with the models of economics than usually acknowledged.

Indeed, Weber's conception of ideal-typical explanations is very close to this approach. Weber's ideal types are indeed models as mediators in the sense of recent philosophy of science. They make it possible to go back and forth between data and theories in order to develop more differentiated models. His ideal-typical explanations aim at an idealized reconstruction of historical phenomena and the way in which they arise, rather than at a naturalization of social phenomena in terms of the statistical behaviour of social agents. His conception of ideal-typical explanations anticipates the insight of recent philosophy of science that models are instruments to investigate empirical reality rather than giving true descriptions of it (Morgan and Morrison 1999). Models mediate between the phenomena and abstract theories, making it possible to go back and forth between the poles of the phenomena (empirical data) and rational cognition (theory), in order to im-

prove the models and their theoretical foundations. To my view, Weber's ideal-typical explanations deserve much more attention in current philosophy of science and the humanities.

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