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Volume Introduction

Method, Science, and Mathematics: Neo-Kantianism and Analytic Philosophy

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There is an old story about the fate of Kantian philosophy at the beginning of the analytic tradition. Different threads of the story were first spun by different figures, including Gottlob Frege and Bertrand Russell, and by the middle of the twentieth century, if not earlier, those threads were drawn together into a powerful narrative about the obsolescence of Kant's philosophy. Here is Hans Reichenbach's version of that story from 1951:

> I do not wish to be irreverent to the philosopher of the Enlightenment. We are able to raise this criticism because we have seen physics enter a stage in which the Kantian frame of knowledge does break down. The axioms of Euclidean geometry, the principles of causality and substance are no longer recognized by the physicists of our day. We know that mathematics is analytic and that all applications of mathematics to physical reality, including physical geometry, are of an empirical validity and subject to correction by further experience; in other words, there is no synthetic a priori. But it is only now, after the physics of Newton and the geometry of Euclid have been superseded, that such knowledge is ours. (Reichenbach 1951, 48)

Kant maintained that mathematics and certain principles within natural science were synthetic *a priori*. These included the axioms of Euclidean geometry and the principle of causality. But the discovery of non-Euclidean geometries showed that geometry was not *a priori* after all. Frege's (and C. S. Peirce and O. H. Mitchell's) invention of the quantifiers, together with David Hilbert's formalist program in geometry and related advances in mathematics, showed that pure mathematics was not synthetic, but analytic. Further, the advent of Einstein's theories of special and general relativity showed that Euclidean geometry was not just not synthetic *a priori*, but actually *false* as a description of physical space. Quantum mechanics, with the fundamental uncertainty and indeterminacy it finds in the physical world, similarly falsified Kant's principle of causality. On this story, precisely during the period of analytic philosophy's origin, developments in logic, mathematics, and physics decisively overthrew the core of Kant's theoretical philosophy.

On this story, neo-Kantianism, the philosophical movement that dominated German-language philosophy from the 1870s to the 1920s, appears only as collateral damage. If Kant's philosophy had been decisively overthrown, then there wasn't much for analytic philosophers to learn from rear-guard Kant*ians*. So, the story goes, early analytic philosophers largely ignored this obsolete neo-Kantianism, and contemporary analytic philosophers can follow their example with confidence that they are missing little of philosophical interest.

Of course, this old story gets a lot right. To take just two examples, the axioms of Euclidean geometry and the principle of causality are *not* synthetic *a priori* truths in exactly the way Kant thought.

However, letting matters stand there leaves too much light unshed. The old story fails completely to recognize the rich and philosophically significant exchanges between the neo-Kantian and analytic traditions during precisely the period that advances in logic, mathematics, and physics were putting pressure on Kant's doctrines as he articulated them. From the 1870s to the 1920s, neo-Kantianism was in its ascendancy in German universities, and dominated the philosophy departments that young philosophers trained in—the young philosophers who went on to become many of analytic philosophy's major figures. Historians of early analytic philosophy have thus found that Marburg School neo-Kantians had an important influence on Rudolf Carnap (see, e.g., Richardson 1998, Friedman 1999), and that Reichenbach, despite what he would later write about

Kantian philosophy, had fundamentally Kantian commitments in his early philosophy of physics (Friedman 1999, 2001). Later in the analytic tradition, Carl Hempel's concern with explanation in history can be seen as a response to the unity of science debates within the neo-Kantian movement, and in particular, to Wilhelm Windelband's and Heinrich Rickert's Southwest School neo-Kantian philosophy of history. But the exchange between the traditions went both ways: recent scholarship suggests that Frege and Russell had a decisive influence on the late Marburg School neo-Kantian Ernst Cassirer's views of logic and mathematics (Heis 2010). Just as significantly, both neo-Kantians and early analytic philosophers responded self-consciously to the same developments in mathematics and natural science: the development of non-Euclidean geometry, developments in number theory, special and general relativity, and quantum mechanics.[1]

The present collection of essays aims to deepen our philosophical and historical understanding of the ongoing exchange between the neo-Kantian and analytic traditions from, roughly, the 1870s to the 1930s. Two figures are especially significant for an evaluation of neo-Kantian thought and its engagement with the beginnings of analytic philosophy: Cassirer, and Hermann von Helmholtz. Both had deep connections to neo-Kantian philosophy. However, both contributed to the developments that were to see neo-Kantianism, once dominant in German universities, give way to the analytic approach in England, Austria, and the United States. In *A Parting of the Ways*, Friedman argues that Cassirer's Marburg School, with its focus on mathematical natural science, was even one of the origins of the analytic approach to philosophy. Helmholtz's work was cited by Cassirer, and by his mentors Hermann Cohen and Paul Natorp, as a motivation, positive and negative, for the school's analysis of mathematical natural science. The essays here emphasize Cassirer's and Helmholtz's connections to philosophers such as the Vienna Circle founder Moritz Schlick, but even more so, mathematicians and physicists whose work motivated novel positions in analytic philosophy, such as Frege, the geometer Felix Klein, philosophically-minded mathematicians such as L. E. J. Brouwer, Henri Poincaré, and Richard Dedekind, and the physicists Paul Dirac and Grete Hermann.

Helmholtz's career illustrates the way neo-Kantian philosophy sits at the intersection of what were, in the late nineteenth century, ongoing debates about philosophy, mathematics, physics, and psychology. Helmholtz was in the first instance a physiologist, but he also made important contributions to physics. He was neither trained as a philosopher, nor conceived of himself as one (Patton 2014; Hatfield 2018). Yet his philosophical writings were of enormous consequence for the development of neo-Kantianism as a philosophical movement. His theory of perception was a direct inspiration for neo-Kantians such as F. A. Lange and Eduard Zeller, who wanted to reinterpret Kant's *a priori* in wholly physiological or psychological terms.[2] Helmholtz was thus an important target when some later neo-Kantians from the Marburg School and Southwest School defended strictly anti-psychologistic theories of knowledge (Edgar 2008, 2015). Helmholtz was likewise involved in the epistemological debates over the status of non-Euclidean geometry.

But beyond his influence within neo-Kantianism, Helmholtz was an important figure for the history of early analytic philosophy. He published regularly in early issues of *Mind*, and was cited by Russell, Reichenbach, and Schlick, among others. In

[1] For example, see Yap (2017) and Schiemer (2018) for accounts of the influence of Richard Dedekind on Ernst Cassirer. See Biagioli (2016, 2018) for an account of neo-Kantian responses to non-Euclidean geometry. See Banks (2018) and Ryckman (2018) for accounts of neo-Kantian responses to quantum mechanics.

[2] See Tracz (2018) for a detailed treatment of Helmholtz's theory of perception, and Hatfield (2018) and De Kock (2018) for accounts of the broader philosophical context of that theory of perception.

fact, in Russell's early work, the 1897 *An Essay on the Foundations of Geometry*, he defends a broadly Kantian position against Helmholtz's empiricist geometry (see Biagioli 2016, sec. 5.3.3). Even when those citations of Helmholtz are critical, they reflect his influence on philosophical debates about space and time, perception, physical theory, realism, and epistemology.

The breadth of Helmholtz's influence is reflected by the essays in this issue that focus on his work. Those essays illuminate the mutual influences in his work between philosophy and science, and between different traditions within philosophy and science. Most also make the case that the questions and issues Helmholtz raises are just as central to philosophical discussion today as they were in the nineteenth century. In his work, we find sustained scientific and philosophical inquiry into whether perception affords direct access to reality, into the use of the group-theoretic program in geometry to investigate both perceptual and physical space, into claims to know scientific facts and the justification for such claims, into the debate between empiricism and nativism, and more. Helmholtz's philosophical preoccupations thus make him important not only for historians of the neo-Kantian and early analytic traditions, but also for philosophers of science and philosophers of mathematics. By highlighting the connections between Helmholtz's work and these traditions, the essays on him in this issue illuminate his enduring significance for multiple areas of contemporary interest.

Gary Hatfield (2018) begins with the observation that Helmholtz was not a philosopher, but rather was a physiologist with a strong interest in physics, who sometimes wrote and spoke about philosophy. Hatfield examines his relation to philosophy in that light. Hatfield is concerned with two questions in particular. The first concerns the question of whether Helmholtz was influenced, in the theory of knowledge he developed alongside his sensory physiology, by J. G. Fichte. Drawing on a survey of the reception of Fichte among sensory physiologists in the first half of the nineteenth century, Hatfield argues that Helmholtz's appropriation of Fichte's distinction between the I and the not-I was opportunistic, and did not bring with it any of Fichte's other metaphysical commitments. Hatfield's second question is about Helmholtz's attitude towards metaphysics. Here, Hatfield argues that while Helmholtz disparages metaphysics in some early writings, his mature writings suggest a softening of his views. Hatfield thus concludes that Helmholtz's own mature metaphysics are best understood as a kind of modest structural realism.

In contrast with Hatfield, Liesbet De Kock (2018) argues that Helmholtz's use of the distinction between the I and the not-I must be understood as Fichtean in at least one significant respect. She is concerned with Helmholtz's account of how we come to represent the distinction between the subject and the external world—the problem, in her words, of "differential consciousness." Setting Helmholtz against the background of Hume, Kant, Fichte, and Mill, she argues that a representation within consciousness of a distinction between the self and the world depends on the subject being *active*. Indeed, De Kock argues that, for Helmholtz, the subject's will is free, that is, not subject to the causal law. Thus while De Kock, like Hatfield, resists attributing Fichte's Absolute idealism to Helmholtz, she argues that—at least on the role of an active and free will in grounding the distinction between subject and object—his views are indeed Fichtean.

Brian Tracz (2018) finds resources for understanding Helmholtz in contemporary philosophy of perception, and argues in turn that Helmholtz should be seen as part of the history of a particular view of colour perception, namely, relationalism. Tracz is concerned with Helmholtz's well-known "sign theory" of perception, and the consequence of that theory that there is a fundamental dissimilarity between our representations of colours, sounds, and shapes of things and the properties of those things in the mind-independent world. In the course of a detailed interpretation of Helmholtz's account of perceptual processes, Tracz argues that, for Helmholtz, the properties we perceive are relational properties that obtain when objects stand in the right relation to our sense organs. Helmholtz's theory of perception is thus relational.

Turning to Helmholtz's philosophy of natural science, Matthias Neuber (2018) intervenes in an interpretive debate that goes back at least to Schlick, if not before. The debate is about how to understand Helmholtz's theory of measurement, that is, his theory of how it is possible to assign numerical values to physical properties. Central to Helmholtz's theory is his "principle of congruence," the principle that, in a measurement, sections of a measuring device such as a measuring rod are brought into coincidence with features of the thing being measured. Drawing on Eino Kaila's 1941 interpretation of Helmholtz, Neuber argues that we must recognize the key status of the concept of congruence, and so the role of certain invariant relations, for the actual practice of measurement. Neuber argues further that this approach to measurement, with its emphasis on real invariant structures, provides an alternative to previous conventionalist and Kantian interpretations of Helmholtz's account of measurement.

From these essays, which focus on Helmholtz's theories of perception, space, and measurement, we move to a discussion of the philosophical consequences and reception of work in the broader Helmholtzian tradition. The essays by Paola Cantù (2018) and Francesca Biagioli (2018) draw our attention to links between Helmholtz's work and the work of the broader neo-Kantian and early analytic traditions, and so expand our understanding of the problems and questions we may see addressed in Helmholtz's writing.

Cantù's contribution mines the neo-Kantian and early analytic background to a question in philosophy of mathematics, in order to illuminate a controversy within contemporary neo-logicism and structuralism. She is concerned with the question of the applicability of mathematics to the world, and ultimately with Frege's (and Kant's) view that the applicability of real numbers to the world is an essential part of those numbers' definition. Cantù then argues that a debate in contemporary neo-logicism and structuralism over the definition of real numbers reveals some of the same fault lines that she finds in the neo-Kantian and early analytic discussion of mathematics' application to the world. The Kantian legacy in this debate is thus not merely that, like Kant, contemporary philosophers of mathematics aim to identify general conditions of mathematics' application to the world. Those contemporary philosophers also, perhaps in some cases unwittingly, echo views first articulated by neo-Kantians like Helmholtz and Cassirer.

Following Felix Klein, Francesca Biagioli suggests that Helmholtz anticipates a group-theoretical approach to the concept of space when he argues that the axioms of geometry have their origin in our observations of the free mobility of rigid bodies, rather than being, as Kant thought, *a priori*. But Helmholtz sought to preserve a measure of Kantianism in his account of space, arguing that while geometrical axioms are empirical, there is nevertheless a more general "form of intuition" that remains in some sense transcendental. Schlick objects that there is no criterion for distinguishing the level of invariance that counts as Helmholtz's general "form of intuition." Drawing on Cassirer's discussion of Helmholtz, Biagioli argues that a neo-Kantian does not need an absolute distinction between the one level of invariance that counts as "the form of intuition," and all the levels that do not.

From Helmholtz, we move to Cassirer, who belongs to a neo-Kantian school that often defined itself in opposition to important aspects of the Helmholtzian tradition: namely, the Marburg School. Founded by Hermann Cohen, the Marburg School rejected Helmholtz's and other earlier neo-Kantians' efforts to absorb the Kantian *a priori* into physiology and psychology. Before Cassirer, Cohen and Paul Natorp argued that the primary task of a philosophical theory of knowledge is to discover the logical foundations of the sciences—paradigmatically, mathematics and physics. Thus whereas Helmholtz had sought to avoid the speculative excesses of German idealism by bringing empirical and experimental methods to bear on epistemological questions, Cohen, Natorp, and Cassirer sought to avoid those same metaphysical excesses by conceiving of epistemology as the logic of mathematically-precise natural science. Their concern with the conceptual structure of mathematical and scientific theories is characteristic of the school. Indeed, as Biagioli's, Janet Folina's, Georg Schiemer's, and Thomas Ryckman's contributions all make clear (Biagioli 2018; Folina 2018; Ryckman 2018; Schiemer 2018) much of Cassirer's writing fits into the nineteenth- and twentieth-century debates about structuralism in mathematics and physical theory, debates which are very much still alive. Inquiry into structuralism in mathematics is related closely to the long tradition in philosophy of science of explication and of the rational reconstruction of scientific theories, found in Carnap and in the semantic view. Contemporary approaches emphasize the inference from persistence of structure to realist claims (see Neuber 2018).

The Marburg School, including both Cohen and Cassirer, aimed for their philosophical views to extend beyond the limits of philosophy of mathematics and philosophy of natural science. Thus Ryckman (2018) and, especially, Samantha Matherne (2018) remind us that in his mature period, Cassirer conceived of himself, not as a philosopher of science, but as a philosopher of culture. Cassirer's work thus raises questions about how philosophers should understand science as an activity that is situated in human culture.

Matherne is struck by the fact that while the Marburg School theory of knowledge Cassirer defends throughout *Substance and Function* is anti-psychologistic, he nevertheless concludes the book by calling for a "psychology of relations," which would account for the subjective dimensions of mathematical and scientific knowledge. Matherne makes the case that Cassirer's remarks on psychology in *Substance and Function* can be understood only in the context of the psychology of relations he develops in his mature *Philosophy of Symbolic Forms*, where he broadens his conception of the psychology of relations to make it the psychology of relations of culture as a whole. Matherne's account is fruitful, in part because it sheds light on a topic of central concern in the recent Cassirer literature, namely, his account of the role of *a priori* knowledge in mathematics and natural science, and because it emphasizes that interpretations of the "fact of science" are embedded in interpretations of the "fact of culture".

Folina's (2018) contribution serves as a reminder of two, closely related points: first, among late nineteenth-century mathematicians and philosophers of mathematics, a concern with retaining some measure of Kantianism extended well beyond the sphere of self-identified neo-Kantians; and second, in some cases, figures outside the sphere of self-identified neo-Kantians could maintain more orthodox Kantian doctrines than some neo-Kantians did. Folina is concerned with the fact that, by the end of the nineteenth century, the development of non-Euclidean geometries had made it entirely implausible that, as Kant maintained, mathematical knowledge is about or constrained by spatio-temporal intuition. Her question is, in what ways could mathematicians and philosophers of mathematics adjust or revise Kant's philosophy of mathematics, rather than rejecting it outright? Folina argues that Brouwer, Poincaré, and Weyl, each in his own way, all save the concept of intuition by adjusting it to make it consistent with non-Euclidean geometries. In striking contrast, Cassirer (like his mentors Cohen and Natorp) abandons intuition altogether, even while he maintains that there is something else about Kant's philosophy of mathematics that is right.

Schiemer (2018) aims both to expand our understanding of the mathematical influences that shaped Cassirer's structuralism, and to emphasize an aspect of that structuralism that differs in a philosophically significant way from its contemporary variants. Schiemer argues that in addition to the influence of Dedekind's *axiomatic* structuralism, Cassirer also defends a version of *geometrical* structuralism motivated by Klein's systematic use of transformations and invariants in his group-theoretical approach to geometry. In both kinds of structuralism, Cassirer sees a single, essential methodological development: all of these approaches shift the locus of mathematical theorizing away from mathematical objects and to the invariant structures that obtain between those objects. Schiemer aims further to show that, unlike structuralism in contemporary philosophy of mathematics, which is motivated by metaphysical concerns, Cassirer's structuralism is *methodological*. That is, it is concerned with the role of mathematical structure in mathematicians' formation of mathematical concepts.

Ryckman (2018) is concerned with Cassirer's mature philosophy of physics, as Cassirer articulates it in his *Determinism and Indeterminism in Modern Physics*. As we might expect, given what quantum mechanics means for Kantian epistemology on the old story, Cassirer argues against the view that quantum mechanics forces physicists to give up the causal principle, so long as that principle is understood "critically," that is, as a demand for order according to law. But Ryckman is struck by the fact that Cassirer thinks the real significance of quantum mechanics lies elsewhere—namely, in its new concept of physical state. Ryckman argues that the key to understanding Cassirer on this point is to recognize the importance of Paul Dirac for Cassirer's understanding of quantum mechanics. In particular, Ryckman shows, Cassirer recognizes the significance of Dirac's abstract algebraic formulation of quantum mechanics for the quantum mechanical concept of physical state. Dirac's abstract algebra severs quantum mechanics from any particular physical interpretation of unobserved states. In so doing, Ryckman argues, it cuts through the controversy among quantum mechanics' founders about the "visualizability" of quantum mechanical states, while at the same time revealing a deep, mathematical-structural continuity between classical mechanics and quantum mechanics.

Like Cassirer, Grete Hermann, who was a member of Werner Heisenberg's Leipzig group in the 1930s, rejects the view that quantum mechanics forces us to reject (the right) Kantian account of causality. As Erik Banks (2018) shows, for Hermann, the scientist can take a limited, partial *perspective on* a quantum mechanical system, and from that perspective construct a limited, partial, but semi-classical description of the system. The resulting causal description of the system can only ever be partial and, as Banks emphasizes, "retrocausal." That is, it is a causal description that can be constructed only after the fact, and can never be used to make predictions. However, for Banks what is most remarkable about Hermann's view is the explanation her account provides for our classical spatio-temporal and causal representations of the world: the more partial, classical spatio-temporal and causal perspectives on an entangled quantum mechanical system we obtain, the more a classical spatio-temporal and causal picture of the world emerges.

The essays collected here are, by and large, essays in the history and philosophy of mathematics, physics, and psychology. This might seem like a surprising focus for a collection of essays on early analytic philosophy and its connection to a contemporaneous tradition. After all, history and philosophy of science is not what many contemporary philosophers regard as the history of early analytic philosophy. I close by considering the reasons why the present collection of essays has the focus it does on the history and philosophy of science and mathematics.

Up to this point, I have used the terms "neo-Kantianism" and "analytic philosophy" as if they were unproblematic and uncontested, but they are not. Historiographical accounts of both traditions offer widely differing versions of what defines each tradition, who its major figures are, and what the philosophically significant connections are between the major figures. Depending on which accounts of "neo-Kantianism" and "analytic philosophy" we accept, we will end up with very different assessments of the connections between the two traditions, and very different assessments of the significance of neo-Kantianism for analytic philosophy. There are thus important historiographical assumptions that underpin the present collection of essays.

There is, and has been for some time, a growing gap between different historiographical narratives about the history of early analytic philosophy. Consider the oldest and, at least among contemporary analytic philosophers, best-known of those narratives. It is the historiographical narrative defended by contemporary analytic philosophers who believe that philosophy of language is or should be the core of philosophy. Thus, for example, Richard Rorty (1979), Michael Dummett (1993), and Scott Soames (2014) all offer leading histories of early analytic philosophy that aim to justify the privileged significance they believe language has for philosophy. These histories focus on early analytic figures such as Frege, Russell, G. E. Moore, Carnap, Ludwig Wittgenstein, and W. V. Quine, and they present those figures as concerned primarily with philosophical questions about meaning, reference, and other features of language.

In contrast, consider two distinct but overlapping traditions in history of early analytic philosophy and history of philosophy of science. Historians of early analytic philosophy in this alternative tradition are concerned with figures such as Frege, Russell, Wittgenstein, and Carnap. But in this tradition, those figures are not in the first instance portrayed as philosophers of language. Rather, they are portrayed as formal philosophers, concerned above all with the application of precise, formal methods to philosophical problems.[3] In a different but allied tradition, historians of philosophy of science expand their focus to include the philosophy of empirical science as it was practiced in the early analytic period. This is a narrative of the origins of analytic philosophy that emphasizes the contributions of the Vienna Circle and logical empiricism more generally, and that does not just include Carnap among its major figures, but the likes of Schlick and Reichenbach as well.

In fact, these two traditions—the history of early analytic philosophy as formal philosophy and the history of philosophy of science—are fruitfully seen as comprising a single, unified historiographical narrative. They are unified by the fact that, on both views, analytic philosophy is a tradition that focuses on philosophical reactions to the late nineteenth- and early twentieth-century revolutions in logic, mathematics, and physics. On both views, analytic philosophers are concerned most fundamentally with questions about those formal and empirical sciences, including psychology, as well as questions about how it might be possible to make philosophy scientific (see, e.g., Richardson 2008).

Unlike the view of analytic philosophy that privileges philosophy of language, the view that privileges philosophy of logic, mathematics, and science makes analytic philosophy's connection to neo-Kantianism perfectly clear. Frederick Beiser has recently argued that neo-Kantianism was an attempt to respond to two intellectual crises that consumed German academia in the 1850s and 1860s (Beiser 2014). The first was the materialism controversy, a controversy about whether research in natural science

[3] See Floyd (2009) for a much more careful contrast between the tradition I am discussing and the Soames tradition that privileges questions about language.

would inevitably lead to materialism and atheism. The second crisis was what Beiser calls the "identity crisis" in philosophy—the question of what philosophy's proper subject was. This question was made urgent to the point of crisis by the increasing sense that disciplines such as mathematics, physiology, and psychology were becoming successful at addressing topics that had, since Aristotle, belonged to philosophy: for example, the nature of space, or the natures of sensation, perception, and experience. On this view of what neo-Kantianism was, it was a movement in philosophy that aimed in the first instance to articulate the proper relation between philosophy and the sciences, including mathematics, physics, and psychology.

If we take this view of neo-Kantianism, and if we take the view of analytic philosophy that privileges philosophy of logic, mathematics, and science, the continuities between the two traditions become both clear and compelling. Both traditions are preoccupied by questions about the relation between philosophy and logic and mathematics, between philosophy and physics, and between philosophy and psychology. We find figures in both traditions who make logic and mathematics the topic of their theorizing, but who are also concerned to adapt the *methods* of logic for the purposes of doing philosophy—perhaps as a way of thereby making philosophy "scientific." (Although of course what "logic" means varies widely across these two traditions, and even within each.) In both traditions, we find figures who hold that modern mathematically-precise physics must be the guide to post-Kantian theorizing about the nature of space. More generally, in both traditions we find figures who take modern physics to be the paradigm of human knowledge, and thus the appropriate locus of epistemological theorizing. In both traditions, we find a central concern with the psychologism debates—that is, with questions about whether philosophy should be informed by, or perhaps be absorbed by, modern empirical psychology, perhaps (once again) as a way of making philosophy "scientific." Indeed, given certain logical empiricists' preoccupation with making philosophy "scientific," it is tempting to see large parts of early analytic philosophy as no less a response to philosophy's identity crisis than neo-Kantianism was.

My purpose here is not to argue that these historiographical narratives about neo-Kantianism and early analytic philosophy are the only correct ones. Indeed, they almost certainly omit important dimensions of their respective target traditions that other narratives make visible.[4]

However, the result of taking these narratives seriously, and of taking seriously the significant points of continuity between neo-Kantianism and early analytic philosophy, is a striking picture of analytic philosophy. On this picture, the core of analytic philosophy is not restricted to intellectually isolated questions about language. At its core, analytic philosophy concerns more urgent questions about philosophy's relation to the formal and empirical sciences, questions about philosophy's relation to psychology and the social sciences, and ultimately questions about philosophy's place in a broader cultural landscape.

This picture of analytic philosophy shapes this collection's focus on the history of the philosophy of mathematics, physics, and psychology. The following essays uncover, reflect on, and exemplify modes of philosophy that are engaged with these allied disciplines. They make the case that, to the extent that analytic philosophers are still concerned with philosophy's ties

[4]In particular, I note the importance of an account of analytic philosophy that focusses on *analysis* as a method, and seeks a historically accurate picture of how that method emerged from different traditions in philosophy, how it was used, and how it was consolidated in the middle of the twentieth century into a single methodological concept that gave unity to analytic philosophy as a whole. See for example, Beaney (2002), Lapointe (2002), and especially Beaney (2007). This historiographical account is unquestionably fruitful. I omit further discussion of it solely because it does not serve as the historiographic frame for the present essays.

to these disciplines, we would do well to pay attention to neo-Kantian views on those ties.

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References

Banks, Erik C., 2018. "Grete Hermann as Neo-Kantian Philosopher of Space and Time Representation." In *Method, Science, and Mathematics: Neo-Kantianism and Early Analytic Philosophy*, special volume, edited by S. Edgar and L. Patton. *Journal for the History of Analytical Philosophy* 6: 244–63.

Beaney, Michael, 2002. "Decompositions and Transformations: Conceptions of Analysis in the Early Analytic and Phenomenological Traditions." *Southern Journal of Philosophy* 40: 53–99.

———, ed., 2007. *The Analytic Turn: Analysis in Early Analytic Philosophy and Phenomenology*. New York: Routledge.

Beiser, Frederick C., 2014. *The Genesis of Neo-Kantianism: 1796–1880.* Oxford: Oxford University Press.

Biagioli, Francesca, 2016. *Space, Number, and Geometry from Helmholtz to Cassirer*. Cham: Springer.

———, 2018. "Articulating Space in Terms of Transformation Groups: Helmholtz and Cassirer." In *Method, Science, and Mathematics: Neo-Kantianism and Early Analytic Philosophy*, special volume, edited by S. Edgar and L. Patton. *Journal for the History of Analytical Philosophy* 6: 115–31.

Cantù, Paola, 2018. "The Epistemological Question of the Applicability of Mathematics." In *Method, Science, and Mathematics: Neo-Kantianism and Early Analytic Philosophy*, special volume, edited by S. Edgar and L. Patton. *Journal for the History of Analytical Philosophy* 6: 95–114.

De Kock, Liesbet, 2018. "Historicizing Hermann von Helmholtz's Psychology of Differentiation." In *Method, Science, and Mathematics: Neo-Kantianism and Early Analytic Philosophy*, special volume, edited by S. Edgar and L. Patton. *Journal for the History of Analytical Philosophy* 6: 42–62.

Dummett, Michael, 1993. *Origins of Analytical Philosophy*. Cambridge, MA: Harvard University Press.

Edgar, Scott, 2008. "Paul Natorp and the Emergence of Anti-Psychologism in the Nineteenth Century." *Studies in the History and Philosophy of Science* 39: 54–65.

———, 2015. "The Physiology of the Sense Organs and Early Neo-Kantian Conceptions of Objectivity: Helmholtz, Lange, Liebmann." In *Objectivity in Science: New Perspectives from Science and Technology Studies*, edited by Flavia Padovani, Alan Richardson, and Jonathan Y. Tsou, pp. 101–22. Cham: Springer.

Floyd, Juliet, 2009 "Recent Themes in the History of Early Analytic Philosophy." *Journal of the History of Philosophy* 47: 157–200.

Folina, Janet, 2018. "After Non-Euclidean Geometry: Intuition, Truth, and the Autonomy of Mathematics." In *Method, Science, and Mathematics: Neo-Kantianism and Early Analytic Philosophy*, special volume, edited by S. Edgar and L. Patton. *Journal for the History of Analytical Philosophy* 6: 163–81.

Friedman, Michael, 1999. *Reconsidering Logical Positivism*. Cambridge: Cambridge University Press.

———, 2000. *A Parting of the Ways: Carnap, Cassirer and Heidegger*. Peru, IL: Open Court.

———, 2001. *The Dynamics of Reason*. Stanford: CSLI Publications.

Hatfield, Gary, 2018. "Helmholtz and Philosophy: Science, Perception, and Metaphysics." In *Method, Science, and Mathematics: Neo-Kantianism and Early Analytic Philosophy*, special volume, edited by S. Edgar and L. Patton. *Journal for the History of Analytical Philosophy* 6: 11–41.

Heis, Jeremy, 2010. "'Critical Philosophy Begins at the Very Point Where Logistic Leaves Off': Cassirer's Response to Frege and Russell." *Perspectives on Science* 18: 383–408.

Kaila, Eino, 1941. "On the Concept of Reality in Physical Science: Second Contribution to Logical Empiricism." In *Reality and Experience: Four Philosophical Essays*, translated by A. Kirschenmann and P. Kirschenmann, edited by R. S. Cohen, pp. 126–258. Dordrecht: Riedel, 1979.

Lapointe, Sandra, 2002. "Substitution: An Additional Conception of Analysis in Early Analytic and Phenomenological Traditions?" *Southern Journal of Philosophy* 40: 101–13.

Matherne, Samantha, 2018. "Cassirer's Psychology of Relations: From the Psychology of Mathematics and Natural Science to the Psychology of Culture." In *Method, Science, and Mathematics: Neo-Kantianism and Early Analytic Philosophy*, special volume, edited by S. Edgar and L. Patton. *Journal for the History of Analytical Philosophy* 6: 132–62.

Neuber, Matthias, 2018. "Perception and Coincidence in Helmholtz's Theory of Measurement." In *Method, Science, and Mathematics: Neo-Kantianism and Early Analytic Philosophy*, special volume, edited by S. Edgar and L. Patton. *Journal for the History of Analytical Philosophy* 6: 79–94.

Patton, Lydia, 2014. "Hermann von Helmholtz." In *The Stanford Encyclopedia of Philosophy*, edited by Edward N. Zalta, https://plato.stanford.edu/archives/win2016/entries/hermann-helmholtz/, accessed 20 November 2017.

Reichenbach, Hans, 1951. *The Rise of Scientific Philosophy*. Berkeley: University of California Press.

Richardson, Alan, 1998. *Carnap's Construction of the World: The* Aufbau *and the Emergence of Logical Empiricism*. Cambridge: Cambridge University Press.

———, 2008. "Scientific Philosophy as a Topic for History of Science." *Isis: A Journal of the History of Science* 99: 88–96.

Rorty, Richard, 1979. *Philosophy and the Mirror of Nature*. Princeton: Princeton University Press.

Russell, Bertrand, 1897. *An Essay on the Foundations of Geometry*. Cambridge: Cambridge University Press.

Ryckman, Thomas, 2018. "Cassirer and Dirac on a Symbolic Method: A Confluence of Opposites." In *Method, Science, and Mathematics: Neo-Kantianism and Early Analytic Philosophy*, special volume, edited by S. Edgar and L. Patton. *Journal for the History of Analytical Philosophy* 6: 213–43.

Schiemer, Georg, 2018. "Cassirer and the Structural Turn in Modern Geometry." In *Method, Science, and Mathematics: Neo-Kantianism and Early Analytic Philosophy*, special volume, edited by S. Edgar and L. Patton. *Journal for the History of Analytical Philosophy* 6: 182–212.

Soames, Scott, 2014. *The Analytic Tradition in Philosophy*, vol. 1, *The Founding Giants*. Princeton: Princeton University Press.

Tracz, Brian, 2018. "Helmholtz on Perceptual Properties." In *Method, Science, and Mathematics: Neo-Kantianism and Early Analytic Philosophy*, special volume, edited by S. Edgar and L. Patton. *Journal for the History of Analytical Philosophy* 6: 63–78.

Yap, Audrey, 2017. "Dedekind and Cassirer on Mathematical Concept Formation." *Philosophia Mathematica* 25: 369–89.