

PHILIPP FRANK'S AUSTRO-AMERICAN LOGICAL EMPIRICISM

Thomas Mormann

The aim of this article is to discuss the “Austro-American” logical empiricism proposed by physicist and philosopher Philipp Frank, particularly his interpretation of Carnap’s *Aufbau*, which he considered the charter of logical empiricism as a scientific world conception. According to Frank, the *Aufbau* was to be read as an integration of the ideas of Mach and Poincaré, leading eventually to a pragmatism quite similar to that of the American pragmatist William James. Relying on this peculiar interpretation, Frank intended to bring about a rapprochement between the logical empiricism of the Vienna Circle in exile and American pragmatism. In the course of this project, in the last years of his career, Frank outlined a comprehensive, socially engaged philosophy of science that could serve as a “link between science and philosophy.”

1. Introduction

In the past 3 or 4 decades, quite a few philosophers and historians of philosophy of science have engaged in dissecting the various currents of epistemology and philosophy of science that informed the logical empiricism of the Vienna Circle. In this endeavor, neo-Kantian influences were initially distinguished from philosophical doctrines attributed to a specific “Austrian philosophy” whose origins are traced to nineteenth-century philosopher-scientists such as Bolzano, Brentano, and Mach. The first to propose the thesis that there was a genuine Austrian philosophical tradition in the larger context of German-speaking philosophy was Otto Neurath. In *The Scientific Conception of the World: The Vienna*

Contact Thomas Mormann at Department of Logic and Philosophy of Science, University of the Basque Country UPV/EHU, Avenida de Tolosa 70, 20080 Donostia-San Sebastián, Spain (ylxmomot@ehu.es).

I am grateful to two anonymous *HOPOS* referees for their extremely helpful comments, suggestions, and criticisms on two earlier versions of this article. They helped improve considerably the final version of this article. Of course, I am responsible for any remaining errors and other shortcomings.

HOPOS: The Journal of the International Society for the History of Philosophy of Science, vol. 7 (Spring 2017). 2152-5188/2017/0701-0003\$10.00. © 2017 by the International Society for the History of Philosophy of Science. All rights reserved. Electronically published January 18, 2017.

Circle he characterized Austrian philosophy as anti-Kantian, science oriented, clinging to the spirit of enlightenment, empiricist, and particularly interested in questions of logic and language (Neurath 1929). Later, Neurath's thesis was elaborated by Rudolf Haller and others and is now known as the Neurath-Haller thesis (see Neurath 1929; Haller 1991; Uebel 2003).

Although many members of the Vienna Circle, particularly Neurath and Philipp Frank, can be characterized as Austrian philosophers in the sense of the Neurath-Haller thesis, there were others who could not so easily be subsumed under the Austrian label. Among them, Schlick and Carnap were the most important examples. The aim of this article is to discuss the bold attempt of the Austrian philosopher Frank to read Carnap's *Der logische Aufbau der Welt* as a work in the tradition of Austrian philosophy in the sense of the Neurath-Haller thesis (Carnap 1928/1967, henceforth *Aufbau*).

For some time, it has been nearly unanimously agreed that the *Aufbau* is deeply marked by neo-Kantian, Kantian, and other non-Austrian influences. This is not surprising; Carnap began his philosophical career in Jena as a neo-Kantian, writing his dissertation under the direction of the neo-Kantian Bruno Bauch. More importantly, the first version of the *Aufbau* was written in the years 1922–25, when he lived as an “independent scholar” in Buchenbach near Freiburg in Germany.¹ Thus, the first version of the *Aufbau* was written before Carnap came to Vienna. Hence, what is surprising, at least in light of the Neurath-Haller thesis, is that the Austrians welcomed the *Aufbau* as congenial with the Circle's allegedly Austrian philosophy.

Indeed, at least for a certain time, the *Aufbau* became the philosophical reference point of the Austrian “scientific world conception.” This point was emphatically formulated by Frank:² “Carnap gave the new philosophy [i.e., logical empiricism of the Vienna Circle] its ‘classical shape.’ He coined many of its terms and phrases and endowed it with subtlety and simplicity. . . . In . . . *The Logical Structure of the World* [*sic*] the integration of Mach and Poincaré was actually performed in a coherent system of conspicuous logical simplicity. Our Viennese group saw in Carnap's work the synthesis that we had advocated for many years” (1949, 33). Carnap himself did not pay much attention to the originality of Austrian philosophy.³ In *Logical Syntax of Language* (Carnap 1937a), as well as in later texts after he had left Europe, Austrian philosophers

1. When Carnap lived in Buchenbach, he came into contact with Husserl's phenomenology. The influence of Husserl's phenomenology on the *Aufbau* is well confirmed (see Mayer 1991).

2. Frank did not take Carnap's non-Austrian philosophical heritage seriously, debunking it as “some sentimental ties to traditional German philosophy” (1949, 34).

3. He never dealt with Bolzano, and Brentano is mentioned in the *Aufbau* only once as the founder of “the traditional theory of intentionality” (Carnap 1928/1967, sec. 164).

were not mentioned at all (with the exception of Wittgenstein and Popper).⁴ Even for the *Aufbau*, he did not get it exactly right when he retrospectively described Mach's role for this work as follows:

The choice of a phenomenalist basis [for the constitution system mainly dealt with in the *Aufbau*⁵] was influenced by some radical empiricist or positivist German [*sic*] philosophers of the end of the last century whom I had studied with interest, in the first place Ernst Mach, and further Richard Avenarius, Richard von Schubert-Soldern, and Wilhelm Schuppe. For the constitution of scientific concepts on the phenomenal basis I found fruitful suggestions in the works of Mach and Avenarius, and, above all, in the logical constructions made by Russell. (Carnap 1963, 18)

He was apparently unaware of the importance of distinguishing between Austrian and German philosophy, drawing his inspiration from wherever he could find it, whether Austrian, German, or British sources.⁶ Striking evidence for this eclectic attitude was his confession that the *Aufbau*'s constitution theory had two very different sources: "Two entirely different and frequently hostile philosophical positions have the merit of both having discovered the necessary basis of the constitution system. Positivism has emphasized that the only material of cognition consists in the undigested experientially given. It is here that we have to look for the basic elements of the constitution system. Transcendental idealism, especially the neo-Kantian school (Rickert, Cassirer, Bauch) has justly emphasized that these elements do not suffice. Order concepts, our basic relations, must be added" (Carnap 1928/1967, sec. 75).

Although Carnap acknowledged having been influenced by Poincaré, he considered Russell's influence far more important, as will be discussed in some detail in section 3. This evidence does not imply that Frank's Austrian reading of the *Aufbau* as an "integration of Mach and Poincaré" was mistaken. Carnap might have arrived at some sort of "Austrian philosophy" independently, starting from a "German" philosophical base. Nevertheless, the *Aufbau*, at least *prima facie*,

4. Further evidence that Mach only played a minor role for Carnap is that he was never mentioned in Carnap's pre-*Aufbau* articles, with one or two exceptions that lack importance. With the shifting of emphasis toward logic and language from the thirties onward, Machian ingredients in Carnap's empiricism faded away.

5. In the *Aufbau*, he was more critical of Mach's phenomenism, noting that a Machian constitution system did not satisfy the requirement of "epistemic primacy" in contrast to the gestaltist system based on *Elementarerlebnisse* (see Carnap 1928/1967, sec. 54).

6. In fact, Schubert-Soldern may be characterized as an Austrian philosopher (born in Prague). Avenarius is sometimes considered a "German-Swiss" thinker.

poses a problem for the Neurath-Haller thesis because it challenges the contraposition of German neo-Kantian and Austrian anti-Kantian philosophy. The *Aufbau* demonstrates that Kant's shadow loomed larger than many Austrian philosophers might have thought.

Frank, as an Austrian philosopher par excellence, never acknowledged that Kant and other German philosophical traditions had any importance for the *Aufbau*. As he showed in his *Historical Background*, he wholeheartedly subscribed to Neurath's bold thesis that "things happen in Austria parallel to what happens in Warsaw, Cambridge, or Paris, rather than to what takes place in Berlin" (Frank 1949, 47).⁷

According to the Neurath-Haller thesis, a characteristic trait of Austrian philosophy was its openness to non-German philosophical and scientific traditions, particularly French conventionalism and American pragmatism (see Neurath 1929; Frank 1949). This claim is certainly true for Frank. Since his philosophical youth in the "first Vienna Circle" ("Proto-Circle") in the early years of the twentieth century, Frank was eagerly engaged in absorbing the philosophical doctrines of Poincaré, Duhem, and other French conventionalists, as well as the American pragmatism of William James (see Frank 1949; Uebel 2003). These components played an important role in Frank's reading of the *Aufbau* and rendered it a typical Austrian reading, or so he argued.

The outline of this article is as follows. To set the stage, section 2 outlines Frank's philosophical background,⁸ with special attention to its phenomenalist, conventionalist, and pragmatist ingredients. These philosophical currents strongly influenced Frank's interpretation of the *Aufbau* and provided it with a specific Austro-American flavor. In section 3, Frank's interpretation is briefly compared with some contemporary readings of this work. In section 4, we consider in detail what may have been the most peculiar feature of Frank's general philosophical outlook, namely, his pronounced aversion to "school philosophy." Notwithstanding that Frank had already been engaged in a fight against "school philosophy" in the early 1930s, long before he emigrated to the United States, this aspect of his philosophical work became particularly visible in the last period

7. It seems that Neurath and Frank never came to realize that what happened in Göttingen, Marburg, Jena, or Freiburg might have been philosophically more important than what happened in Berlin.

8. Most of Frank's early philosophical papers are collected in *Modern Science and Its Philosophy* (1949), and some can be found in *Between Physics and Philosophy* (1941). Often, these papers were published for the first time in the early decades of the twentieth century, and the original sources are sometimes difficult to find. Thus, the page numbers of the papers quoted are not from the original publications but from Frank (1949). For instance, "(Frank 1930/1949, 102)" refers to page 102 of Frank (1949) of a paper originally published in 1930. The introduction *Historical Background of Modern Science and Its Philosophy*, originally published in 1949, is referred to as "(Frank 1949)."

of his career when he struggled against American neo-Thomists. In section 5, we discuss the vicissitudes of Frank's "pragmatism of an enlightened and socially engaged physicist" (as his wider philosophical project may be characterized) within the context of midcentury American pragmatism. Section 6 addresses Frank's attempts to conceive of science as a subsystem of society and to determine its relation to ethics, politics, and religion. This approach led him to conceptualize philosophy of science as "a link between science and philosophy" (see Frank 1957/1962).

2. Frank's Philosophical Background

Frank was not a professional philosopher interested in discussing hairsplitting philosophical, logical, and philological nuances. Rather, he considered himself a philosophizing scientist in the tradition of philosopher-scientists such as Poincaré, Duhem, Mach, Boltzmann, and Einstein, all of whom he addressed over the decades in various contributions (see Frank 1949). Frank was a committed philosopher and scientist who did not care much for subtle distinctions. Consequently, he interpreted those philosophical accounts he considered useful for his purposes in a rather liberal manner, to put it mildly. Hence, his adaptations of phenomenalism, conventionalism, and pragmatism do not always closely resemble the accounts of the philosophical currents that result from more careful modern interpretations. As Uebel put it, "For Frank, 'phenomenalism,' 'conventionalism,' and 'pragmatism' were not neutral philosophical terms," but "banners, self-consciously flown to mark the Circle's *Frontstellung* in the battle against metaphysics" (Uebel 2004, 261). Throughout his life, Frank considered himself a faithful follower of Mach (see Frank 1949).⁹ For him, Mach was the "real master of the Vienna Circle" (Frank 1938b/1949, 79). Hence, it is appropriate to begin the presentation of Frank's philosophical background with Mach.¹⁰ For Frank, Mach, as a philosopher, was best characterized as a phenomenalist. Roughly, phenomenalism may be understood as the claim that the world consists of sensations or phenomena. Mach often called them "elements" to avoid too narrow psychological connotations.¹¹ Frank took the Machian "elements" or "phenomena" as empirical experiences. Phenomena were the source of evidence in whatever field we may inquire, not speculation or a priori insight.

9. Bolzano and Brentano played no role for him, and Boltzmann as a philosopher is mentioned only in passing as Mach's adversary in matters of atomism.

10. For a thorough discussion of Mach's philosophy and its impact on logical empiricism, see Banks (2003).

11. Banks argued that Mach believed in "observer-independent elements in matter *all the way* from 1863 to 1916" (2003, 7).

Science was understood as an attempt to provide useful descriptions of relevant “complexes of the elements and their changes.” These were expressed in terms of functional dependencies in the most economical, comprehensive, and simple manner possible. For this task, one had to introduce appropriate “auxiliary concepts,” such as “body,” “substance,” “individual,” and “atom,” which were not to be understood as a priori categories but as instruments useful in some limited contexts. Ignoring their provisional character could harm the progress of science by smuggling in metaphysical pseudo-questions.

For Frank, the main value of Mach’s phenomenalist doctrines was that they provide the means “for defending the edifice of physics against (metaphysical) attacks from outside” (1917/1949, 67). For empirical science, Machian *elements* had a function analogous to that of natural numbers in Leopold Kronecker’s reductionist account of mathematics, according to which all statements of mathematics could be reduced to statements about natural numbers, at least in principle (66). Machian phenomenism admonished us to be aware of the limitations and the provisional character of all auxiliary concepts. Knowledge that could not be cashed out in terms of phenomenal knowledge, at least in principle, was considered a metaphysical blunder. Thus, for a Machian, all empirical knowledge was knowledge about phenomena, just as for Kronecker all mathematical knowledge was knowledge about natural numbers.

Based on this antimetaphysical stance of Mach’s theory of elements, Frank considered Mach the most important philosopher of enlightenment in the nineteenth century. Mach’s primary merit was to note that enlightenment was a never-ending process; each historical époque had to overcome the auxiliary concepts of its predecessor and formulate its own new conceptualizations of the world that would inexorably fall prey to new conceptual systems of subsequent generations. This restless spirit of permanent enlightenment kept science and scientific philosophy alive, saving it from degenerating into a new scholasticism.

The emphasis on the purely instrumental character of all theories led Frank to conventionalism, wherein he mainly relied on Poincaré, Duhem, and, to a lesser extent, Abel Rey. Since the days of the “Proto-Circle,” Frank considered the French conventionalists allies in the struggle against “school philosophy.” Poincaré was the first to note that the principles of physics often contained concepts defined by these very same principles. In such cases, the principles could never be tested against experience because they were definitions in disguise, or, as Poincaré used to say, “conventions.” Examples of such principles were the law of conservation of energy and the law of inertia. Frank considered his book *Das Kausalgesetz und seine Grenzen* a contribution to a conventionalist philosophy of science in Poincaré’s sense because it showed that the law of causality was also a convention (Frank 1932/1998).

Frank conceived of the philosophy of the Vienna Circle as a new philosophical frame in which Mach's phenomenalism was embedded in such a way that its empiricist virtues were maintained and its logicity was improved, mainly by the conventionalists' detailed investigations of how mathematics played a role in economically organizing the phenomena. In line with Mach and the French conventionalists, Frank insisted that an empirical theory did not describe (a part of) the world as it really was, nor did it offer explanations in the sense of giving the "real causes" of events. Rather, an empirical theory was to provide mathematical models useful for the comprehensive and economical description of phenomena. Frank considered Poincaré's conventionalist contribution to a modern empiricism to be so important that he envisaged logical empiricism as an integration of Mach and Poincaré:

I soon realized that any advance in the philosophy of science would consist in setting up a theory in which the views of Mach and Poincaré would be two special aspects of one more general view. To summarize these two theories in a single sentence, one might say: According to Mach the general principles of science are abbreviated economical descriptions of observed facts; according to Poincaré they are free creations of the human mind which do not tell anything about the observed facts. The attempt to integrate the two concepts into one coherent system was the origin of what was later called Logical Empiricism. (1949, 11–12)

The third ingredient of Frank's philosophical *Weltauffassung* was pragmatism. In some sense, pragmatism may be said to be the first modern philosophical current that did not arise in Europe and then spread to the rest of the world; rather, pragmatism first arose in North America and spread to Europe. It was, of course, not a monolithic doctrine. One may distinguish at least two pragmatisms: the "hard" semiotic pragmatism of Peirce and the "soft" pragmatism made famous by James and further developed by Dewey (see Mounce 1997). Frank subscribed to a version of James's soft pragmatism. For him, the core of the pragmatist account was a behaviorist theory of meaning according to which "the meaning of any statement was given by its 'cash value,' that is, by what it meant as a direction for human behavior" (Frank 1949, 33).¹² If a statement did not provide such a direction, it was meaningless. Understanding meaningfulness in this way, Frank was led to the following interpretation of

12. It may be noted that the idea that the meaning of a concept is ultimately determined by its experiential "cash value" was also adopted by Carnap in his *Von Gott und Seele. Scheinfragen in Metaphysik und Theologie* (1928/2004, 59, 62).

James's pragmatic theory of truth: "According to James, the truth of a system of principles—a physical theory, for instance—does not consist in its being a faithful copy of reality, but rather in its allowing us with the help of these principles to change our experiences according to our wishes. According to this view, which essentially agrees with that of Mach, but rejects even more bluntly the truth concept of the school philosophy, every solution of a problem is the construction of a procedure that can be of use to us in the ordering and mastering of our experiences" (Frank 1930/1949, 101). The insight attributed to James that a physical theory does not yield a faithful copy of reality is not new at all. It can be traced back to Kant (see *Kritik der reinen Vernunft* A318/B375), and the neo-Kantians made much of it (see Cassirer 1910/1985). In other words, by contrasting a pragmatist and a correspondence theory of truth in a rather simplified manner, Frank construed an opposition of the "scientific world conception" and "school philosophy" that hardly existed in such a clear-cut manner. In a similar vein, Frank's claim that James rejected the truth concept of "school philosophy" *tout court* needs qualification.¹³ James's account of truth was by no means as simplistic as Frank contended (see James 1911/1997). Moreover, in some sense, Carnap had become an adherent of a correspondentist account of truth when he subscribed to Tarskian semantics in the mid-1930s. In contrast, neo-Kantians such as Cassirer dismissed any correspondence theory of truth (Cassirer 1910/1985). In short, the issue of truth was more complex than Frank wanted his readers to believe.

Summarizing, one may say that Frank harbored a rather idiosyncratic idea of James's pragmatism, marked by his intention to use it as a device against "school philosophy." His adaption of James's pragmatism exemplifies his strong inclination to draw sharp boundaries between "school philosophy" and "scientific philosophy," even where such neat boundary lines did not exist.

Whereas pragmatism and its theory of truth might have been a new game for philosophers at the beginning of the twentieth century, for scientists, according to Frank, the pragmatist theory of truth was nothing new: "The physicist in his own scientific activity has never employed any other concept of truth than that of pragmatism. . . . In practice we encounter only experiences, never an object; hence nothing can be compared with an object. Actually, the physicist compares only experiences with experiences. . . . This procedure, which

13. In some sense, James accepted the traditional definition of truth as "adaequatio rei et intellectus," as evidenced by the following quote from his *Theory of Truth*: "Truth is a property of certain of our ideas. It means their agreement, as falsity means their disagreement, with reality. Pragmatists and intellectualists [James's expression for the partisans of "traditional philosophy"] both accept this definition as a matter of course" (1911/1997, ix). In contrast to "school philosophy," however, James and other pragmatists asked what the meanings of "reality" and "agreement" were (see Putnam 1997).

the physicist is accustomed to use in his work, has been made by Mach and James into a general conception of the criteria of truth" (1930/1949, 102). Hence, according to Frank, pragmatism could also be regarded as a promising candidate for a truly scientific philosophy in the sense of being in line with scientists' own philosophical convictions. Although Frank considered the pragmatic account of meaningfulness and truth correct, he admitted that it might look a bit murky from a logical point of view. He readily granted that "the old logic" was not suitable to save James's pragmatic account of truth. On the contrary, traditional logic might be considered one of the hirelings (as Frank insinuated) of school philosophy; it was all too eager to refute the new account as logically untenable. Fortunately, the new logic of Russell and Whitehead came to the rescue: "the new logic of Russell and his school was suitable to help build up the purely empirical, and hence still somewhat vague, conceptions of Mach and James into a real system of the scientific world conception that was superior to the school philosophy from the standpoint of formal logic as well" (104).

Although the relational logic of Whitehead and Russell may be a useful tool to render more precise the broadly relational stance of neutral monists such as Mach, James, and Russell, this understanding did not exclude the fact that these authors were strongly opposed with respect to other philosophical problems. For instance, Russell harshly criticized James's pragmatic account of truth as "silly," and James responded to Russell's criticism in a similar way (see Russell 1910; James 1911/1997). Frank tended to ignore such troubles, claiming that there was "a close relationship between the truth concept of the modern logical movement and that of pragmatism" (1930/1949, 112). Frank's argumentation for this claim was rather peculiar and relied on some far-fetched assumptions. It brought into play the then-famous (or infamous) *Ignorabimus* thesis of the German physiologist and philosopher Emil du Bois-Reymond, according to which there existed some (meaningful) problems that science would never be able to solve for principal reasons ("we shall never know") (see du Bois-Reymond 1882).

To argue for the affinity between pragmatism and the *Aufbau*, Frank first assumed that in the *Aufbau* Carnap had shown that all relations between objects could be reduced to similarity relations between concrete experiences (see Frank 1930/1949, 111).¹⁴ This entailed that every problem that could be formulated in scientifically acceptable terms at all could be solved in principle because, in principle, it could be decided whether two experiences were similar.

14. Actually, Carnap had never shown anything like this. He simply assumed that a constitutional system with a single binary relation (*Ähnlichkeitserinnerung*) sufficed for the constitution of the world.

Thus, for a logically reconstructed world, du Bois-Reymond's notorious *Ignorabimus* did not hold. All scientifically meaningful problems could be solved scientifically—at least in principle. However, from a pragmatist point of view, any *Ignorabimus* thesis was clearly meaningless. Hence, both the constitution theory of the *Aufbau* and James's pragmatism rejected du Bois-Reymond's skepticism. For Frank, this agreement sufficed to assert the following: "We see that the consistent carrying through of a purely scientific world conception, as attempted by Carnap, leads us just as far away from the *ignorabimus* as does the pragmatism of James, which is thought out somewhat less logically but in its tendencies has the same goal" (111).

Indeed, Frank explicitly asserted that the basic tendencies of James's pragmatism and Carnap's constitutional theory coincided: "When I read [the *Aufbau*] it reminded me strongly of William James's pragmatic requirement, that the meaning of any statement is given by its 'cash value,' that is, by what it means as a direction for human behavior. I wrote immediately to Carnap, 'What you advocate is pragmatism.' This was astonishing to him as it had been to me. We noticed that our group, which lived in an environment of idealistic philosophy, had eventually reached conclusions by which we could find kindred spirits beyond the Atlantic in the United States" (1949, 33). Carnap never took Frank's hint seriously. His relation to American pragmatism remained lukewarm. Although he paid some lip service to a close alliance between pragmatism and logical empiricism in *Testability and Meaning* (Carnap 1936, 1937b), he did not heed Frank's exhortations to more eagerly take into account the pragmatic aspects of science (see Carnap 1963; Frank 1963). Rather, "going pragmatic" remained a largely unrealized option of constitution theory and logical empiricism.

For Frank and other members of the Vienna Circle, the refutation of du Bois-Reymond's *Ignorabimus* was characteristic of the "scientific world-conception." The authors of the *Manifesto* unequivocally decreed, "Neatness and clarity are striven for, and dark distances and unfathomable depths are rejected. In science there are no 'depths'; there is surface everywhere: . . . The scientific world-conception knows *no unsolvable riddle*" (Neurath 1929, 328; emphasis in the original). In the last paragraph of the *Aufbau*, Carnap proposed a more cautious formulation borrowed from the *Tractatus* (see *Tractatus* 6.52): "[For] us there is no '*Ignorabimus*'; nevertheless, there are perhaps unsolvable riddles of life. This is not a contradiction. *Ignorabimus* would mean: there are questions to which it is in principle impossible to find answers. However, the '*riddles of life*' are not questions, but are practical situations" (Carnap 1928/1967, sec. 183). Similarly, mathematician, physicist, and philosopher Richard von Mises criticized du Bois-Reymond's *Ignorabimus* thesis as an artifact of bad metaphysics.

According to him, “du Bois-Reymond’s ‘ignorabimus’ has no other significance for us than the sober knowledge that the mathematician has of the impossibility of squaring the circle and of other similar problems, which in being brought to their proper form are at once settled and annulled” (von Mises 1930, 892). The rejection of the *Ignorabimus* was not, however, reliable evidence for an anti-school-philosophical stance. For instance, the neo-Kantian Cassirer also rejected du Bois-Reymond’s thesis (see Cassirer 1937).¹⁵ In any case, the logical empiricists regarded the *Ignorabimus* as the gateway for all types of antiscientific and metaphysical assertions of school philosophy. The alleged refutation of du Bois-Reymond’s *Ignorabimus* in the *Aufbau* could also be used to put Mach’s “instinctive aversion . . . to the use of vague terms such as ‘idealism’ or ‘materialism’ in science” on more solid ground (Frank 1938b/1949). Under the strict scrutiny of modern logic, these terms turned out to be metaphysically contaminated—thus Mach’s “instinctively felt aversion”: “We can today formulate in words, if we take the standpoint of logical empiricism, as it was formulated very precisely in Carnap’s *Logical Syntax of Language* and his paper ‘Testability and Meaning’” (Frank 1938b/1949, 86). Frank never substantiated these claims. Apparently, he alluded to the fact that both Mach and Carnap considered the question of whether an idealist or a realist epistemology is correct as a pointless metaphysical pseudo-problem (see Carnap 1928/1967, sec. 175).

For Frank, philosophy of science was not a merely academic affair; philosophy of science should contribute to the battle against metaphysical school philosophy and its pernicious consequences for science and society. In the 1930s, in Vienna as well as in Prague, philosophers who subscribed to a “scientific conception of the world” were not only an academic minority; with some justification, they could also consider themselves an endangered species for rather solid political and societal reasons. This situation also affected the philosophical style of Frank’s interpretation of the *Aufbau*. He did not write a scholarly commentary on this work. Rather, his reading of the *Aufbau* must be reconstructed from his remarks and observations in various philosophical articles engaged in a struggle against metaphysical “school philosophy.” Or, expressed positively, he wanted to contribute to a “new philosophy of science” envisaged as an integration of “Mach and Poincaré” and improved by ingredients taken from James’s pragmatism (see Frank 1949, 33). This understanding marked his

15. Perhaps the most vigorous rejection of the *Ignorabimus* was that of David Hilbert, who in 1930, at the meeting of the German Mathematical Society in Königsberg, felt called to contradict du Bois-Reymond: “We must not believe those, who today, with philosophical bearing and deliberative tone, prophesy the fall of culture and accept the *ignorabimus*. For us there is no *ignorabimus*, and in my opinion none whatever in natural science. In opposition to the foolish *ignorabimus* our slogan shall be: *Wir müssen wissen—wir werden wissen!*” (Hilbert 1930, 963).

reading of the *Aufbau* and his version of logical empiricism in general.¹⁶ As he explicitly recognized, the most determined attempt in this direction had been undertaken by Carnap in the *Aufbau* (see Frank 1930/1949, 110–11).

3. Frank's Reading of the *Aufbau* in Perspective

In the past 20 or 30 years, the *Aufbau* has been the target of much interpretative work. The natural task then arises to compare Frank's Austro-American reading with at least some of the many interpretations of this work on the market. Painting with a broad brush, we may roughly distinguish between two distinct groups of interpretations:

- i. Traditional interpretations read the *Aufbau* as the culmination of the British empiricism of Locke and Hume, updated with the logic of Whitehead and Russell.¹⁷
- ii. Revisionist interpretations read the *Aufbau* as a work of German neo-Kantianism that aimed to establish *Konstitutionstheorie* as a scientific successor discipline to epistemology in the sense of traditional philosophy.¹⁸

This dichotomic classification is, to be sure, quite rough. Recently, some intermediate interpretations have sought to do justice to both the empiricist and neo-Kantian aspects of the *Aufbau* (see Pincock 2002; Tsou 2003).¹⁹ In con-

16. Actually, evidence for an important influence of Poincaré on the *Aufbau* is scarce. He is mentioned only four times (Carnap 1928/1967, sec. 3, 16, 124, 130), of which the last two lack importance. In section 3, Carnap ascribed to him (and to Avenarius, Mach, and Driesch) the achievement of having at least partially reduced "reality" to the "given." According to Carnap, this was the first step toward the task he was really interested in, namely, "to apply the theory of relations to the task of analyzing reality." More precisely, Poincaré had contributed to this task by noting that it is not the given itself but only the relations between the sensations that have an objective value (see Carnap 1928/1967, sec. 16). In other words, in the *Aufbau*, Poincaré is mentioned as a representative of a structuralist realism.

17. Quine's classical interpretation succinctly asserts, "To account for the external world as a logical construct of sense data, such, in Russell's terms, was the program. It was Carnap, in his *Der logische Aufbau der Welt* of 1928, who came nearest to executing it" (1969, 74).

18. See Richardson (1998) and Friedman (1999).

19. These authors recognize the importance of neo-Kantianism for the *Aufbau* but consider the revisionist readings of the *Aufbau* incomplete because they unduly neglect the empiricist aspects of Carnap's project. Pincock argues that both the German and British readings misunderstood Russell's influence on the *Aufbau* project. If Pincock is right, this provides an argument against Frank's interpretation because Frank did not care much about Russell's role in the *Aufbau*. Frank would have fared better with Tsou, who considered the constitution theory of the *Aufbau* an empiricist method of justification that "aims to rationally justify concepts by showing how questions posed about them can be empirically answerable" (2003, 680). This is more in line with the sense-data meaning theory Frank ascribed to the *Aufbau* (see Frank 1949, 33).

sideration of space, however, these new proposals cannot be discussed in detail here.

For the sake of brevity, let us dub interpretations (i) and (ii) the British and German readings of the *Aufbau*, respectively.²⁰ At first approximation, the Austrian reading may be characterized as a modified British reading in which the empiricist ingredient of Hume was replaced by Mach and in which Russell's influence was downplayed in favor of French conventionalism. Nevertheless, I think that with some good will, the Austrian and British readings of the *Aufbau* could be rendered compatible with each other.

A reconciliation between the Austrian and German readings is more difficult. According to the German reading, the *Aufbau* is the first instance of a new philosophical discipline called constitution theory (*Konstitutionstheorie*), envisaged by Carnap as a scientific successor discipline of traditional epistemology and philosophy of science. Carnap designed *constitution theory* as a discipline that was to be neutral with respect to the familiar quarrels among realism, idealism, and empiricism that marked, for Frank, an insurmountable barrier between "school philosophy" and the "scientific world conception." Thus, for Carnap, constitution theory had a much more general aim than to reconstruct a system of scientific knowledge based on Mach's elements, as Frank contended. This clearly transpires from his retrospective assessment of the *Aufbau* in his *Intellectual Autobiography*:

When I developed the system of the *Aufbau*, it actually did not matter to me which of the various forms of philosophical languages I used, because to me they were merely modes of speech, and not formulations of positions. Indeed, in the book itself, in the description of the system . . . I used in addition to the neutral language of symbolic logic three other languages. . . . The system of concepts was constructed on a phenomenalist basis. . . . However, I indicated also the possibility of constructing a total system of concepts on a physicalist basis. . . . My attitude was . . . ontologically neutral. For me it was simply a methodological question of choosing the most suitable basis for the system to be constructed. . . . The ontological theses of the traditional doctrines of either phenomenism or materialism remained for me entirely out of consideration. (Carnap 1963, 18)

If one so wishes, one may see in Carnap's maxim of always "choosing the most suitable basis for the system to be constructed" a kind of minimal pragmatism.

20. The best-known partisan of a British empiricist reading of the *Aufbau* is Quine. The protagonists of a German neo-Kantian reading are Richardson (1998) and Friedman (1999).

However, even under this assumption, Frank's bold characterization of the *Aufbau* as a (pragmatist) integration of Mach and Poincaré is incomplete, to put it mildly. This is not to say, however, that Frank's reading should be readily dismissed as obsolete. Rather, one should take into consideration that Frank's primary interest was not that of performing the job of a meticulous historian of philosophy faithful to the historical facts; rather, his "Austro-American" interpretation of the *Aufbau* is to be considered an integral part of Frank's larger project of developing a scientific philosophy (or a philosophical science) that overcame the separation between philosophy and science and avoided the deficiencies of conventional philosophy: "How can we avoid the traditional ambiguity and obscurity of philosophy? How can we bring about the closest possible *rapprochement* between philosophy and science? By 'science' we did not mean 'natural science' only, but we included always social studies and the humanities" (Frank 1949, 1). These general questions suggest a broader perspective for assessing Frank's interpretation of the *Aufbau*. Frank's was a "programmatic" interpretation, so to speak, and should be assessed accordingly in light of the purposes and goals of this larger project in which Frank was working. The main aim of Frank's interpretation of the *Aufbau* was to show that Carnap's philosophical approach and Frank's own philosophical project of a comprehensive, enlightenment-oriented, and committed scientific philosophy fit well together.

Thus, to assess Frank's "Austro-American reading," it is expedient to not only consider the ingredients of his philosophical *Weltanschauung* in a narrower sense, such as Mach's monistic phenomenalism, James's pragmatism, and French conventionalism, but also pay attention to a factor of a different type that was particularly relevant for the committed character of Frank's account, namely, his "aversion against school philosophy." This is the task of the next section.

4. "School Philosophy"

The sketch Frank provided in the introduction of his book *Modern Science and Its Philosophy* (Frank 1949) regarding a fruitful collaboration among phenomenalism, conventionalism, and pragmatism as ingredients of a "new positivism" contained much wishful thinking. It was less an objective description of facts than a programmatically motivated intervention that intended to further a future scientific philosophy that combined logical empiricism, pragmatism, and possibly other progressive philosophical currents (see Uebel 2004). To better understand this project, it is expedient to bring to the fore another factor of Frank's philosophical background that gave his approach its specific critical flavor. This extra factor may be described as a general attitude that profoundly

influenced Frank's way of doing philosophy. Succinctly, it may be characterized as a strong aversion against "school philosophy." This attitude was one of the invariants that marked Frank's philosophy from its beginnings in Vienna and Prague until its final period in Boston and Cambridge. The rejection of school philosophy was the critical driving force behind Frank's project of a committed philosophy of science that aimed to contribute to the scientific, cultural, and political progress of society as a whole. Thus, Frank's philosophy of science fit into the frame of the "scientific world conception" as outlined in the *Manifesto* (Neurath 1929).²¹ The core of Frank's anti-school-philosophical attitude was a radical Machian phenomenalism, according to which "the aim of natural science is to obtain connections among phenomena. Theories, however, are like withered leaves, which drop off after having enabled the organism of science to breathe for a time" (Frank 1917/1949, 62). For Frank, the particular value of Mach's phenomenalist doctrines was that they helped foster a critical attitude among scientists against science itself. This was essential to avoid succumbing to a "new scientific scholasticism" that took science as a stock of definite and final truths, thereby endangering the enlightenment-oriented project of science (78).

Frank (1917/1949) addressed the threat of new "scientific" scholasticism only in passing. At the end of the 1920s, when the Vienna Circle had established itself as an important force in the struggle for philosophical and societal progress in the German-speaking cultural sphere, this issue moved to the forefront. From then onward, Frank replaced the term "scholasticism" (originally used in Frank 1917/1949) with "school philosophy" ("Schulphilosophie"), apparently to emphasize the pejorative connotations associated with this expression. According to Frank, "school philosophy" was a widespread attitude among scientists, philosophers, and others who were convinced of an erroneous and reactionary idea of the role of science in modern society. One of the characteristic features of such a world vision was the conviction that the capacities of science were principally limited: "there are questions so profound that they cannot be solved by the exact sciences. . . . Some believe that there is a special method, the 'philosophical,' with the help of which such questions . . . can be answered, while others regard these problems as forever insoluble, as 'eternal riddles'" (Frank 1930/1949, 91–92). Frank's "school philosophy" was not necessarily a sophisticated academic doctrine (as medieval scholasticism certainly was). Quite often, "school philosophy" was a sort of common sense that pretended to be philosophy:

21. Frank called the Vienna Circle the "shock troop [*Stoßtrupp*] of the anti-metaphysical science-oriented movement" (1935, 4).

It need not be supposed that one has to make any philosophical studies in order to become acquainted with the world conception of school philosophy. In all our knowledge that has come to us from the elementary school, in all metaphors of our language, it is implicitly contained. Its presence is not noticed because traditions, centuries old, make us take it for granted. The pure “empiricist” uses it under the name “common sense.” Hence it is no wonder that it is just the physicist opposed to speculation who is easily inclined to the “ignorabimus” of du Bois-Reymond, with his surrender of the scientific conception of nature. (Frank 1917/1949, 97)

In his contribution to the first volume of *Erkenntnis*, Frank characterized “school philosophy” through its “truth theory” (1930/1949, 101). He frankly admitted that he felt unable to present the basic ideas of “school philosophy” better than Henri Bergson had in his introduction to the French translation of James’s *Pragmatism* (1911/1997):

For the ancient philosophers there existed a world, raised above space and time, in which all possible truths had dwelt since eternity. According to these philosophers, the truth of human judgments was measured by the degree to which they were faithful copies of those eternal truths. The modern philosophers, to be sure, have brought down truth from heaven to earth, but they still regard it as something that exists prior to our judgments. A proposition such as “Heat expands a body,” according to them would be a law of governing the facts: if not ruling over them, at least ruling in their midst; a law actually contained in our experience; it remains for us only to extract it from the latter. Even a philosophy like that of Kant, which assumes that every scientific truth is such only in relation to the human mind, considers the true propositions as given a priori by human experience. Once this experience, in general, is organized by human thought, the whole work of science consists in breaking through the obstructing husk of facts, in the interior of which the truth is housed like a nut in its shell. (Bergson 1911/1968, 14; cited in Frank 1930/1949, 95)

In modern terms, the approach Bergson and Frank describe here may be characterized as a sort of “metaphysical realism.”²² According to this doctrine, there is

22. For both Carnap and Neurath, Bergson was a notorious metaphysician. In contrast, Frank considered Bergson an authority for a correct characterization of school philosophy. This situation points to a certain tension between the concepts of school philosophy in Frank’s sense and metaphysical philosophy in Carnap’s or Neurath’s sense.

a mind-independent world with a well-determined unique structure. The task of science is to describe this structure as faithfully and precisely as possible, thereby providing us with a true description of the world as it really is. Some school philosophers despaired of this task and fell back on a resigned *Ignorabimus* à la du Bois-Reymond. Others reached for an even worse escape route, contending that there were other nonscientific methods that allowed us to go beyond the limits of scientific knowledge by tapping the sources of metaphysics and religious revelation. Thus, school philosophy, in Frank's sense, could cover a wide variety of more or less metaphysically infected philosophical positions, to describe it in logico-empiricist terms. All variants of school philosophy agreed that truth was always to be conceived of as a discovery of something "out there," not as an invention of the cognizing subject engaged in the process of knowledge production. As Bergson put it, school philosophers contended that science (and perhaps also metaphysics) discovered truths as Columbus had discovered America (Bergson 1911/1968, 15; see Frank 1930/1949, 101).²³

As Bergson had already observed, this "discovery theory" of scientific truth was proposed by the more common sense-oriented version of school philosophy, as well as by the more speculative variant of this philosophical current: "This conception of truth appears natural to common sense as well as to philosophy because it is natural to conceive of reality as a perfectly coherent and systematized whole that has a logical structure. This structure would be the truth itself; our science only rediscovers it" (Bergson 1911/1968, 14, my translation).²⁴ Frank fully agreed with Bergson and approvingly quoted his recapitulation of this idea on the following page: "It seems to me that one might summarize the essence of the pragmatic conception of truth in a formula of the following kind: *Whereas for the other conceptions a new truth is a discovery, for pragmatism it is an invention*" (Bergson 1911/1968, 15; Frank 1949, 102). In his anti-school philosophy manifesto of 1930, Frank mentioned three examples of the pernicious consequences of the school-philosophical "truth theory":

23. Isaiah Berlin cast the essential difference between classical and romanticist (i.e., modern) thought in the dichotomy *discovered versus invented*: "The common assumption of the romantics . . . is that the answers to the great questions are not to be discovered so much as to be invented. They are not something found, they are something literally made" (2001, 203). Indeed, ascribing to Frank a "romanticist" understanding of science is not as far-fetched as one may think at first sight. For instance, in *Contemporary Science and the Contemporary World View*, Frank asserted that "the main activity of science . . . consists in the inventions of symbols and in the building of symbolic systems from which our experience can be logically derived. This system is the work of our creative imagination. . . . The work of the scientist is probably not fundamentally different from the work of the poet. . . . Science and all other types of knowledge, including art, consist in building up systems of symbols" (1958, 62).

24. Frank resumed this idea much later in Frank (1950a) and Frank (1950b).

1. The resigned attitude of those scientists and philosophers who accepted the *Ignorabimus*, according to which some important and meaningful problems were principally unsolvable by scientific means and therefore might have to be handed over to other, more powerful non-scientific agencies. As we shall see, in its most virulent version, this attitude might lead to the conviction that science had nothing to contribute to the solution of the really important problems. For their solution, one had to rely instead on other, nonscientific, genuinely “philosophical” methods. Thus, highly metaphysical idealistic systems, such as those of, say, Hegel and Schelling, could be subsumed under the label of school-philosophical currents because they were based on the assumption that “truth” could be found by nonscientific means. Another type of metaphysical school philosophy, not addressed by Frank himself (but by his fellow logical empiricist Neurath (see Neurath 1921/1973), is represented by Oswald Spengler’s *The Decline of the West* (Spengler 1918/1991), which claimed to provide answers to a variety of profound “morphological” questions concerning universal history that ordinary sober historical research could not give.
2. The disdain for modern science and its fallible and limited methods may lead partisans of school philosophy to a kind of intellectual laziness that allows them to maintain an outdated Aristotelian logic, although this has turned out to be rather useless for most scientific and other purposes.
3. The unconscious adherence to outdated school-philosophical doctrines may lead to a misinterpretation of the new scientific world conception in opposite realistic or idealist ways so that “it appeared not as the beginning of a new scientific world conception but as a new fashionable form of the school philosophy” (Frank 1930/1949, 100). Thus, unnecessary quarrels and misunderstandings between philosophical currents might arise that actually share a common interest in scientific and societal progress. For Frank, a case in point was Lenin’s savage attack against “Machism” in *Materialism and Empirio-Criticism: Critical Remarks on a Reactionary Philosophy* (Lenin 1909/1958), which he saw as a misunderstanding caused by Lenin’s reading of Mach in a school-philosophical way (see Frank 1930/1949; Frank 1949, 190).

Bergson’s just-quoted contention that “Kant’s philosophy . . . considers the true propositions as given a priori by human experience” (Bergson 1911/1968, 14) may suggest that for him and Frank, neo-Kantian philosophers might have been the best contemporary candidates for “school philosophers.” This choice,

however, was problematic in that, at the turn of the twentieth century, those philosophers had long since abandoned the fixed and apodictic Kantian a priori that Bergson considered a characteristic mark of Kantian “school philosophy.” Indeed, the Southwest neo-Kantian school of Rickert, as well as the Marburg neo-Kantianism of Cohen, Natorp, and Cassirer, explicitly criticized the traditional Kantian a priori, to say nothing of any naive “copy theory” of scientific knowledge, according to which science aimed at an accurate copy of the world as it really is.

Frank never clearly distinguished between Kant’s philosophy and the various currents of neo-Kantian philosophy. He recognized that Cassirer’s neo-Kantianism had the merit of contributing to the “disintegration” (*Zersetzung*) of school philosophy. Nevertheless, he accused Cassirer of never having abandoned school philosophy completely (see Frank 1938a/1949).

The influence of school philosophy was in no way restricted to the Old World, however. As Frank, Carnap, and other logical empiricists of the Vienna Circle had to experience firsthand, there was also no scarcity of “school philosophers” in America.²⁵ Representatives of a radical Thomist school philosophy, such as Mortimer Adler, Robert Hutchins, and Jacques Maritain, challenged the autonomy of science, contending that scientific knowledge was a lower kind of knowledge, subordinated to theological and philosophical knowledge.

Perhaps the harshest attack of this kind was launched by Mortimer Adler at the first Conference on Science, Philosophy, and Religion in Their Relation to the Democratic Way of Life, which took place in New York in 1940. In his notorious speech “God and the Professors,” Adler put forward the following theses:

The essential point of [positivism] is simply the affirmation of science, and the denial of philosophy and religion. . . . The professors, by and large, are positivists. . . . The most serious threat to Democracy is the positivism of the professors, which dominates every aspect of modern education and is the central corruption of modern culture. Democracy has much more to fear from the mentality of its teachers than from the nihilism of Hitler. It is the same nihilism in both cases, but Hitler’s is more honest and consistent, less blurred by subtleties and queasy qualifications, and hence less dangerous. (1950, 72)

25. Carnap reported some of the more amusing experiences of this kind in his *Intellectual Autobiography*, particularly a lecture by Mortimer Adler at the philosophical department of the University of Chicago in 1936 (see Carnap 1963, 39–42).

The conference in New York was the first of a series of annual meetings of teachers, sociologists, historians, philosophers, and scientists that continued well into the 1950s. The aim of the conferences was to find answers to the threats of totalitarianism and the apparent weaknesses of democracy that allegedly resulted from the “relativism” and “nihilism” of modern society. Many of the participants, particularly neo-Thomists such as Adler, Hutchins, and others, contended that excessive esteem for science was responsible for these deficiencies. Frank, as one of the protagonists of these meetings, vigorously argued against these contentions. He wanted to show that, on the contrary, the relativism of science had nothing to do with skepticism and agnosticism and that it posed no threat to democratic and religious beliefs.²⁶

Hence, one may say that in the United States, Frank's *bête noire* “school philosophy” acquired a clearer and sharper contour than it had in Europe. The addressees of Frank's attacks against school philosophy in America can be clearly identified as neo-Thomist philosophers such as Adler, Hutchins, and Maritain. These partisans of a “new medievalism,” as Sidney Hook characterized Adler's doctrine, wished to relegate the sciences to a subordinate place in their schema of knowledge (see Hook 1950). According to this schema, the studies were hierarchically ordered according to their intrinsic educational merits. The highest rank was attributed to the knowledge of God (i.e., to theology), followed by the knowledge of reason (i.e., the metaphysics of [school] philosophy) in the second rank, with scientific knowledge relegated to the third and final rank.

One may say that in the United States, Frank made the discussion with school philosophy a main point of his philosophical work. Whereas in the 1950s he seems to have given up the project of bringing back the (early) Carnap to the fold of (Jamesian) pragmatism, the issue of school philosophy occupied a high rank on Frank's agenda until the end of his career (see Frank 1950a, 1950b, 1954/1961, 1957/1962).²⁷

As a result of his many discussions with philosophers, sociologists, and other nonscientists and as one of the protagonists of the Conferences on Science, Philosophy, and Religion, Frank seems to have concluded that the traditional, brusque, logical-empiricist rejection of metaphysics as a heap of meaningless “pseudo-sentences” did not suffice to fully understand this societal and cultural phenomenon. As we shall see in section 6, this insight profoundly influenced the last phase of Frank's philosophy of science, when he was engaged in the

26. In the first part of his booklet *Relativity—a Richer Truth* (Frank 1950b), the reader may find a summary of his interventions from 1940 to 1949.

27. Frank's intense occupation with school philosophy even had the absurd consequence that one of his less benevolent critics accused him of having converted to Thomism (see Kegley 1959; Rutherford 1960).

elaboration of the conception of philosophy of science as “a link between science and philosophy.” Before this issue is treated in detail, however, it seems appropriate to take a closer look at Frank’s relation to American pragmatists.

5. Frank’s Project in the Context of American Pragmatism

It is well known that pragmatism is not a monolithic doctrine. Already at the beginning of the twentieth century, A. O. Lovejoy had argued that there were at least 13 different pragmatisms (see Lovejoy 1908a, 1908b). This classification may be too fine-grained to be useful, but it may be taken as evidence that different philosophical currents were sailing under the flag of pragmatism (see Mounce 1997; Misak 2013). Frank was never interested in these subtleties. For him, pragmatism meant a (watered-down) version of James’s pragmatism. He never mentioned C. I. Lewis, and he mentioned Peirce and Dewey only in passing (see Frank 1950a, 1950b, 1957/1962). In particular, he never discussed the discrepancies between, for instance, James’s and Peirce’s pragmatisms. He painted the relation between logical empiricism and pragmatism with a similarly broad brush, where the former might be understood as a logically refined version of the latter: “In contrast to the method of pragmatism, however, they [the logical empiricists] not only tried to characterize the system of science in a general and somewhat indefinite way by saying that the system is an instrument to be invented and constructed in order to find one’s way among experiences, but also—and instead—they investigated the structure and the construction of this instrument. The investigation took place through an analysis of the method by which physics orders experiences through a mathematical system of formulas” (Frank 1930/1949, 105). This account of the relation between logical empiricism and pragmatism ignored fundamental discrepancies between the two currents. Moreover, it did not consider the possibility that logical empiricism might suffer from certain deficiencies that did not plague pragmatism.²⁸ Already in the times of Mach and James, the relations between positivism and pragmatism were not without problems: James was at pains to dissociate his pragmatism from Mach’s positivism, whereas Mach regarded much of James’s pragmatism dealing with ethics and religion as romantic metaphysics. Frank never addressed these disputes; he never elaborated what was to be understood precisely by the “logical improvement of the ideas of Mach and James” that logical empiricism had allegedly brought about.

28. From the side of American pragmatism, a more elaborate assessment of the strong and weak points of the two currents may be found in Morris (1937; see also Mormann 2016).

Already in 1911, James had vigorously protested against the thesis that “pragmatism was only a re-editing of positivism.” For him, this was just “the first misunderstanding” (of no less than eight) from which pragmatists suffered (see James 1911/1997, 182).

With respect to his own philosophical position, Frank pursued a double-pronged strategy. On one hand, he presented himself as a member of the logical empiricist camp and availed himself of the higher reputation logical empiricists enjoyed in matters of logical sophistication and precision. On the other hand, in his own philosophical work, he did not always feel obliged to comply with the logical-empiricist standards of precision and logicity.²⁹ Formal precision and philosophical sophistication did not play a preeminent role for him, as various critics observed (see Toulmin 1951; Putnam 1958).³⁰

Thus, the relevance of Frank’s “Austro-American” reading of the *Aufbau* does not primarily reside in its philosophical precision and subtlety. Rather, its main merit is that it pointed toward a broader issue, namely, the problem of the relation between the logical empiricists and their “kindred spirits” the American pragmatists (see Frank 1949, 33).

Frank’s “programmatic retrospectives” were attempts to strengthen the ties between Austrian logical empiricism and American pragmatism to further the project of a modern, enlightenment-oriented, comprehensive scientific philosophy (Frank 1941, 1949). By presenting the *Aufbau* as an essentially pragmatist work, he might have hoped to win new American readers by showing that one of the key texts of logical empiricism had a genuine affinity to pragmatism. Moreover, the author of the *Aufbau* might have been persuaded to invest more work in the project of fostering the collaboration between logical empiricists

29. For instance, he accepted without qualms Bergson’s account of school philosophy’s theory of truth. Peirce’s logically sophisticated semiotic pragmatism was never considered by Frank, although at the First International Congress for the Unity of Science in Paris in 1935 (which Frank attended), Morris had noted the relevance of Peirce for a “scientific” empiricism as follows: “A distinguishing tendency of contemporary empiricism is the great interest in the formal sciences of logic and mathematics. One immediately thinks, among others, of the names Peirce, Russell, Hilbert, Lukasiewicz, Lewis, Carnap, Tarski. . . . It is significant that many empiricists have adopted mathematical logic as a tool for logical analysis. [The scientific empiricists] wish to integrate the formal sciences within an empiricism wide enough to include observation of the manipulation of symbols . . . grounding [thereby] formal logic and mathematics upon a general theory of signs. . . . The most important steps [in this direction] have been made by Charles Peirce” (1936, 48–49). Frank could hardly be considered a representative of this “distinguishing tendency of contemporary empiricism.”

30. For instance, for a hard-boiled logical empiricist such as Carnap, Frank’s ample references to Bergson may have appeared somewhat strange.

and their pragmatist fellow philosophers. Both enterprises failed. The American public was not much impressed by Carnap's allegedly pragmatist pedigree, and Carnap did not feel inclined to invest greater efforts to render the pragmatist features of his approach more visible.³¹

After World War II, the project of developing a working alliance between pragmatism and logical empiricism began to flounder, at least in the opinion of many pragmatists and logical empiricists (see Uebel 2003). For instance, C. I. Lewis contended that there had been a greater affinity of American pragmatism to the earlier logical empiricism than to the latter:

In . . . the early documents of the neopositivists—particularly in Carnap's *Der logische Aufbau der Welt* . . . I found an empiricism and an analytic method which were congenial to my own persuasions. I still find them so. But if the younger and present protagonists of neopositivism should re-read these, I think that they might be a little startled, not only by the overlapping of them with pragmatic empiricism but also by the extent of their own removal from this first phase of the movement. . . . But when the phenomenal analysis of the *Aufbau*, squarely based on direct experience . . . became replaced by physicalism . . . and any retained empiricism became reduced to a semantic ghost of direct experience—protocol or observations statements—my sense of the congenial suffered a like attenuation. (1968, 664)

Although both Frank and Lewis saw affinities between the *Aufbau* and pragmatism, they did not refer to the same features of Carnap's work. Lewis (since 1936) had contended that Carnap's sketched constitution of values by "value experiences" gave them an empirical content that was as definite as that of other (physical) qualities (see Lewis 1936/1970, 153). For Lewis, this analogy between the verifiability of judgments of facts and that of judgments of value provided a common ground among pragmatists and the members of the Vienna Circle on which a common edifice could be built. Regrettably, as with Lewis, the logical empiricists, particularly Carnap, later abandoned this common ground.

For Frank, the affinity of the *Aufbau* with pragmatism did not reside in the common conviction that value judgments were empirically meaningful, of course, but rather in their closely related truth theories, both of which considered nonverifiable assertions meaningless (see sec. 2). Nevertheless, Lewis

31. After all, the *Aufbau* was published in English only in 1963.

and Frank agreed that the Carnap of the 1940s had moved away from his earlier, “more pragmatist” logical empiricism.³²

In a different way than Lewis, Dewey also diagnosed Carnap's persistent inclination of strictly separating the domains of the “emotive” and the “scientific” as evidence for a basically nonpragmatic attitude that evaded the real practical problems: “The hard-and-fast impassible line which is supposed by some to exist between the ‘emotive’ and ‘scientific’ language is a reflex of the gap that exists between the intellectual and the emotional in human relations and activities. . . . The practical problem that has to be faced is the establishment of cultural conditions that will support the kinds of behavior in which emotion and ideas, desires and appraisals are integrated” (1944, 444–45). In light of Frank's later work (see Frank 1950a, 1950b, 1954/1961, 1957/1962), it seems plausible to assume that he might have agreed with Dewey's diagnosis. For the later Frank, it was clear that a comprehensive theory of science, to overcome a too narrowly conceived purely epistemological perspective, had to consider science a subsystem of society. This entailed that scientific theories should and could be validated not only by internal criteria of correctness or simplicity, for example, but also by their general usefulness to human society: “Only in this way can science as a human activity be ‘scientifically’ understood and the gap between the scientific and the humanistic aspect can be abridged [*sic*]” (Frank 1954/1961, 26). In his contribution to the Schilpp volume dedicated to Carnap, Frank explicitly diagnosed a lack of pragmatism in Carnap's approach (see Frank 1963). In extensively quoting the Marxist philosopher Brushlinsky, he criticized Carnap for having made use of “three metaphysical creeds: idealism, formalism and mechanism” (Frank 1963, 164). Carnap, in his reply to “Philipp Frank and V. Brushlinsky,” testily admitted that “the pragmatic component has so far not been sufficiently investigated by our movement, although its importance has been acknowledged theoretically by me and by empiricists in general” (1963, 868).³³ However, beyond the theoretical recognition of a pragmatic deficit of the movement, Carnap did not make any real effort to improve this situation. Thus, in the last years of his career, Frank was increasingly on his own in this respect. Nevertheless, in his last book, *Philosophy of Science as a Link between Science and Philosophy* (Frank 1957/1962), and related work, one finds new and original

32. Richard Creath even went so far as to assert that Lewis “hated the logical empiricists” (1995, 288). This might be a slight exaggeration. Nevertheless, Lewis certainly disliked the later Carnap's “empiricism” as it had evolved in America.

33. To be sure, the issue of the pragmatist character of Carnap's later philosophy is by no means settled. Recently, Richardson (2007) and Uebel (2013) argued that Carnap's later account may be characterized as essentially pragmatist. Others argue that key ingredients for a genuine pragmatism in Carnap are missing (see Mormann 2007).

ideas concerning the place of science in modern democratic societies. This will be the topic of the following section.

6. Philosophy of Science as a Link between Science and Philosophy

In Frank's last book, the logical empiricism of the Vienna Circle, particularly Carnap's *Aufbau*, is not mentioned at all, and Bergson and James are only mentioned in passing (Frank 1957/1962).³⁴ Frank no longer seemed to be interested in building bridges between European logical empiricism and American pragmatism, at least not primarily. Instead, we see him engaged in the ambitious task of sketching a novel account of philosophy of science that conceived it as the "missing link" between science and philosophy (see Frank 1957/1962, xv). This novel philosophy of science went beyond science proper as it was understood by the traditional logicist empiricism:

We need a full understanding of the principles of physics or biology, an understanding not only of logical argument but also of psychological and sociological laws; briefly, we need to complement the science of physical nature by the science of man. . . . In order to understand not only science itself but also the place of science in our civilization, its relation to ethics, politics, and religion, we need a coherent system of concepts and laws, within which the natural sciences, as well as philosophy and the humanities, have their place. Such a system may be called "philosophy of science," it would be the "missing link" between the sciences and the humanities. (3)

Frank was well aware that the new philosophy of science envisaged by him was not the only candidate for connecting science with the broader concerns of a democratic society. In the introduction to Frank (1957/1962), he mentioned as other competitors for this job a (Thomistic) *philosophia perennis* and dialectical materialism. For him, the decisive disadvantage of those options was that they could be upheld only by authorities (i.e., by the church or the party), which would have jeopardized democracy proper (see Frank 1957/1962, xv).

As a concrete example of the need to take into account more than purely scientific aspects in the discussion on scientific matters, Frank mentioned the problem of finding criteria to decide in a rational and responsible way which

34. This is not to say that Carnap had fallen completely out of Frank's philosophical horizon. Rather, instead of praising the pragmatist virtues of the *Aufbau* in this book, Frank argued that Carnap's inductive logic may be considered the core of a pragmatic decision theory (see Frank 1957/1962, 327–40).

theory one should choose among different candidates: “The problem of deciding between different theories of the physical sciences cannot be solved within these sciences if we have to do with theories of high generality. New lines of research arise for the scientist who wants to achieve a real understanding of his science. We are guided into the wide field which embraces science as a part of human behavior in general. We may speak of a ‘sociology of science’ or of the ‘humanistic background of science’ if we want to give these new fields a frame of reference in our traditional parlance” (1957/1962, 359). These were new tones to the ears of the more traditional (empiricist) philosophers of science, perhaps too new; there were not many who wanted to listen to them. Indeed, Frank’s later work was generally received rather negatively by the community of philosophers of science (see Howard 2003; Reisch 2005). For instance, Stephen Toulmin, in his review of *Relativity—a Richer Truth* (Frank 1950b), sarcastically proposed as an appropriate subtitle for this book “*Logical Empiricism Told to Children*” (Toulmin 1951, 181). Toulmin’s criticism was unfair insofar as *Relativity* was directed at the general public and not professional analytic philosophers.³⁵ Frank’s last book, *Philosophy of Science: The Link between Science and Philosophy* (1957/1962), was dismissed even more harshly by Putnam, who bluntly disqualified it as obsolete: “Professor Frank’s knowledge of the issues that concern philosophers of science . . . is thirty years out of date. Anyone who still thinks that the issue in philosophy of science is between ‘operational definition’ and ‘metaphysical interpretation’ might enjoy reading the book. Afterwards he should learn some *real* philosophy of science” (1958, 750).

Putnam completely ignored Frank’s attempts to overcome the narrow confines of traditional philosophy of science and to formulate a sociologically and politically more comprehensive perspective that explicitly considered science a subsystem of society and aimed to elucidate the “humanistic background of science.”

The ultimate motivation of his new approach may, perhaps, be found in the intense discussions he had with the varied audiences at the already-mentioned Conferences on Science, Philosophy, and Religion in Their Relation to the Democratic Way of Life (see sec. 4). Due to this experience, it seems, Frank came to the conclusion that the most convincing way of arguing for a comprehensive “scientific world conception” was not to dismiss “metaphysics” simply as meaningless nonsense. Rather, science, metaphysics (aka philosophy), and

35. Indeed, *Relativity* was an enriched and elaborated reedition of contributions and comments Frank had made to the series of Conferences on Science, Philosophy, and Religion that took place in the 1940s and 1950s. For a more recent sympathetic and uncritical interpretation of Frank’s book, see Nemeth (2003).

common sense all had to be recognized as important ingredients that had an influence on the factual worldviews pursued in modern societies. According to the later Frank, it was not to be expected that, in favor of a fully scientific world conception, the philosophical (metaphysical) and commonsensical elements could be eliminated in one fell swoop. Rather, following the French mathematician and philosopher Édouard Le Roy (1899–1900), Frank insisted that one had to acknowledge a kind of “dialectic” between science, common sense, and philosophy: “Science departs from common sense and does not join it in its development as science proper. Thus science by itself does not close the cycle of knowledge and does not realize the unity of knowledge. Science needs therefore a prolongation and this will be philosophy. . . in one way science itself is a prolongation of common sense. Common sense, science, philosophy, common sense form a cycle” (Frank 1947/1949, 299; Frank 1957/1962, 47). To historically explain this “cycle,” in the opening chapter of *Philosophy of Science* Frank told a story of the expulsion from a paradise when science, philosophy, and common sense still lived in harmony. In broad terms, it went like this: “In ancient and medieval science, science and philosophy were part of one chain of thought and not distinguished from one another. One end of this chain touched the ground—directly knowable observations. The chain connected them with the other, more lofty end—the intelligible principles” (Frank 1957/1962, 10). In those times, the requirements for checking general principles against observed facts were not very strict. This situation gradually changed in modern times. Instead of relying on vague but intelligible and plausible principles, modern science became based on intermediate, precise principles that were usually intelligible neither by common sense nor by philosophy. It was considered the task of philosophy to connect scientific principles with common sense (see Frank 1957/1962, 46). This connection was to be achieved by a kind of metaphysical translation of the scientific principles that rendered them plausible for common sense. Thus, the principles became analogous to the laws of everyday experience (see Frank 1947/1949, 298). A dangerous consequence of the translation of scientific principles into common sense principles is that they lose their hypothetical and, thus, their scientific character. They take on the same allegedly apodictic character as commonsense principles: “To interpret the principles of science as results of our common sense leads to the opinion that they are self-evident and cannot be refuted by further empirical checking. This belief is the very core of the metaphysical interpretation of science” (286). This situation may lead to a petrification of scientific knowledge. “Petrified” scientific knowledge may become the basis for new irrefutable pseudo-religious convictions because the metaphysical translation of scientific principles into commonsense principles does not do justice to the dynamic and fallible character of sci-

entific knowledge: “What we call in a vague sense ‘common sense’ is actually an older system of science which was dropped because new discoveries demanded a new conceptual scheme, a new language of science. Therefore the attempt to interpret scientific principles by ‘common sense’ means actually an attempt to formulate our actual science by the conceptual scheme that was adequate to an older stage of science, now abandoned” (301). Here is not the place to discuss the shortcomings and obscurities of Frank’s account of the complex “cyclic” relation among science, philosophy, and common sense. I think it is more important to recognize that Frank was right in emphasizing that science was not a problem of science alone but that it involved other factors and required consideration of perspectives other than those that were on the agenda of the traditional logico-empiricist philosophy of science. In hindsight, the easy dismissal that Putnam, Toulmin, and other critics applied to Frank’s embryonic “socially engaged philosophy of science” was too hasty. Today, we understand that philosophy of science did not benefit from the exodus to the “icy slopes of logic.” Only much later did the issue of a “socially engaged philosophy of science (SEPOS),” which Frank had already pursued in the 1950s, reappear on the agenda of the discipline (see, e.g., Cartieri and Potochnik 2014). The prospects of this new perspective on philosophy of science are described optimistically by Cartieri and Potochnik as follows: “We are optimistic that SEPOS is emerging from shifting attitudes in philosophy of science. After a long period of social and political disengagement, the field and its participants are taking steps to assert the availability of philosophy of science as a public resource” (2014, 914). As classical forerunners of such a socially engaged philosophy of science (“SEPOS”), these authors mention Reichenbach, Carnap, and Neurath—Frank is not mentioned at all.

7. Concluding Remarks

With respect to logical acuity and historico-philosophical scholarship, Frank’s Austro-American empiricism, particularly his interpretation of the *Aufbau*, cannot compete with other philosophically more sophisticated interpretations of logical empiricist thought. The philosophical content of the *Aufbau* is richer than Frank realized, and there are many other philosophical, cultural, and scientific factors that influenced Carnap’s logical empiricism beyond Mach’s monism, Poincaré’s conventionalism, and James’s pragmatism. Moreover, Frank’s interpretation of these philosophical currents was certainly not free from misunderstandings and simplifications. This does not imply, however, that Frank’s “programmatic” interpretation should be dismissed without further considerations. Rather, his Austro-American account of logical empiricism remains im-

portant because it put an important issue on the agenda of (the history of) philosophy of science, namely, the task of understanding the complex relations between the European logical empiricism of the Vienna Circle and American pragmatism in the first half of the twentieth century. This will certainly remain a central theme of (the history of) philosophy of science for some time to come.

REFERENCES

- Adler, Mortimer J. 1950. "God and the Professors." In *Pragmatism and American Culture*, Boston, ed. Gail Kennedy, 67–76. Lexington, MA: Heath.
- Banks, Erik C. 2003. *Ernst Mach's World Elements: A Study in Natural Philosophy*. Dordrecht: Springer.
- Bergson, Henri. 1911/1968. Introduction to *Le Pragmatisme*, by William James. Repr. Paris: Flammarion.
- Berlin, Isaiah. 2001. *The Power of Ideas*. Ed. H. Hardy. London: Pimlico.
- Carnap, Rudolf. 1928/1967. *The Logical Structure of the World; and Pseudoproblems in Philosophy (Aufbau)*. Repr. La Salle, IL: Open Court.
- . 1928/2004. *Scheinprobleme in der Philosophie und andere metaphysikkritische Schriften*. Ed. T. Mormann. Repr. Hamburg: Meiner.
- . 1936. "Testability and Meaning." *Philosophy of Science* 3 (4): 419–71.
- . 1937a. *The Logical Syntax of Language*. London: Routledge & Kegan Paul.
- . 1937b. "Testability and Meaning—Continued." *Philosophy of Science* 4 (1): 1–40.
- . 1963. "Intellectual Autobiography." In *The Philosophy of Rudolf Carnap*, ed. Paul A. Schilpp. La Salle, IL: Open Court.
- Cartieri, Francis, and Angela Potochnik. 2014. "Toward Philosophy of Science's Social Engagement." *Erkenntnis* 79 (S5): 901–16.
- Cassirer, Ernst. 1910/1985. *Substanzbegriff und Funktionsbegriff*. Darmstadt: Wissenschaftliche Buchgesellschaft.
- . 1937. *Determinismus und Indeterminismus in der modernen Physik; Historische und systematische Studien zum Kausalproblem*. Göteborg: Elanders Boktryckeri Aktiebolag. Translated into English as *Determinism and Indeterminism in Modern Physics: Historical and Systematic Studies* (New Haven, CT: Yale University Press, 1956).
- Creath, Richard. 1995. "Are Dinosaurs Extinct?" *Foundations of Science* 1 (2): 285–97.
- Dewey, John. 1944. "A Theory of Valuation." In *Foundations of the Unity of Science* 2:379–447.
- du Bois-Reymond, Emil. 1882. *Über die Grenzen des Naturerkennens*. Berlin: Teubner.
- Frank, Philipp. 1917/1949. "The Importance for Our Times of Ernst Mach's Philosophy of Science." Repr. in *Modern Science and Its Philosophy*, 61–78. Cambridge, MA: Harvard University Press.
- . 1930/1949. "Physical Theories of the Twentieth Century and School Philosophy." Repr. in *Modern Science and Its Philosophy*, 90–120. Cambridge, MA: Harvard University Press.

- . 1932/1998. *Das Kausalgesetz und seine Grenzen*. Repr. Frankfurt/Main: Suhrkamp.
- . 1935. "Die Prager Vorkonferenz 1934." *Erkenntnis* 5:3–5.
- . 1938a/1949. "Determinism and Indeterminism in Modern Physics." Repr. in *Modern Science and Its Philosophy*, 172–85. Cambridge, MA: Harvard University Press.
- . 1938b/1949. "Ernst Mach and the Unity of Science." Repr. in *Modern Science and Its Philosophy*, 79–89. Cambridge, MA: Harvard University Press.
- . 1941. *Between Physics and Philosophy*. Cambridge, MA: Harvard University Press.
- . 1947/1949. "The Place of Logic and Metaphysics in the Advancement of Modern Science." Repr. in *Modern Science and Its Philosophy*, 286–303. Cambridge, MA: Harvard University Press.
- . 1949. *Modern Science and Its Philosophy*. Cambridge, MA: Harvard University Press.
- . 1950a. "Metaphysical Interpretations of Science I, II." *British Journal for the Philosophy of Science* 1:60–74, 77–91.
- . 1950b. *Relativity—a Richer Truth*. Boston: Beacon.
- . 1954/1961. "The Variety of Reasons for the Acceptance of Scientific Theories." In *The Validation of Scientific Theories*, ed. P. Frank, 13–25. New York: Collier.
- . 1957/1962. *Philosophy of Science: The Link between Science and Philosophy*. Englewood Cliffs, NJ: Prentice Hall.
- . 1958. "Contemporary Science and the Contemporary World View." In *Science and the Modern Mind*, ed. G. Holton, 53–62. Boston: Beacon.
- . 1963. "The Pragmatic Components in Carnap's 'Elimination of Metaphysics.'" In *The Philosophy of Rudolf Carnap*, ed. Paul A. Schilpp, 159–64. La Salle, IL: Open Court.
- Friedman, Michael. 1999. *Logical Positivism Reconsidered*. Cambridge: Cambridge University Press.
- Haller, Rudolf. 1991. "On the Historiography of Austrian Philosophy." In *Rediscovering the Forgotten Vienna Circle*, ed. T. E. Uebel, 41–50. Dordrecht: Kluwer.
- Hilbert, David. 1930. "Naturerkennen und Logik." *Naturwissenschaften* 47:959–63.
- Hook, Sidney. 1950. "The New Medievalism." In *Pragmatism and American Culture*, Boston, ed. Gail Kennedy, 76–80. Lexington, MA: Heath.
- Howard, Don. 2003. "Two Left Turns Make a Right." In *Logical Empiricism in North America*, ed. G. L. Hardcastle and A. W. Richardson, 25–93. Minneapolis: University of Minnesota Press.
- James, William. 1911/1997. *The Meaning of Truth*. Amherst, NY: Prometheus.
- Kegley, Charles W. 1959. "Reflections on Philipp Frank's Philosophy of Science." *Philosophy of Science* 26:35–40.
- Lenin, Vladimir I. 1909/1958. *Materialism and Empirio-Criticism*. Repr. in *Critical Remarks on a Reactionary Philosophy*. London: Lawrence & Wishart.
- Le Roy, Édouard. 1899–1900. "Science et Philosophie." *Revue de métaphysique et de morale* 7:375–425, 501–62, 708–31; 8:37–72.
- Lewis, Clarence I. 1936/1970. "Value Theory and Ethics." In *Collected Papers of Clarence Irving Lewis*, ed. John D. Goheen and John L. Mothershead, 151–61. Stanford, CA: Stanford University Press.

- . 1968. "Replies to My Critics." In *The Philosophy of C. I. Lewis*, ed. Paul A. Schilpp. La Salle, IL: Open Court.
- Lovejoy, Arthur O. 1908a. "The Thirteen Pragmatists I." *Journal of Philosophy, Psychology and Scientific Methods* 5 (1): 5–12.
- . 1908b. "The Thirteen Pragmatists II." *Journal of Philosophy, Psychology and Scientific Methods* 5 (2): 29–39.
- Mayer, Verena. 1991. "Die Konstruktion der Erfahrungswelt: Carnap und Husserl." *Erkenntnis* 35:287–303.
- Misak, Cheryl. 2013. *The American Pragmatists*. Oxford: Oxford University Press.
- Mormann, Thomas. 2007. "Carnap's Logical Empiricism, Values, and American Pragmatism." *Journal of General Philosophy of Science* 38:127–46.
- . 2016. "Morris' Pariser Programm einer wissenschaftlichen Philosophie." In *Wissenschaftsphilosophie in Frankreich und Österreich in der ersten Hälfte des 20 Jahrhunderts*, ed. Christian Bonnet and Elisabeth Nemeth, 73–88. Wien: Veröffentlichungen des Instituts Wiener Kreis.
- Morris, Charles W. 1936. "Semiotic and Scientific Empiricism." In *Actes du Congrès International de Philosophie Scientifique I, Sorbonne, Paris, Philosophie Scientifique et Empirisme Logique*, 42–56. Paris: Hermann.
- . 1937. *Logical Positivism, Pragmatism and Scientific Empiricism*. Paris: Hermann.
- Mounce, Howard O. 1997. *The Two Pragmatists: From Peirce to Rorty*. London: Routledge.
- Nemeth, Elisabeth. 2003. "Philosophy of Science and Democracy: Some Reflections on Philipp Frank's *Relativity—a Richer Truth*." In *Wissenschaftsphilosophie und Politik, Veröffentlichungen des Instituts Wiener Kreis*, ed. M. Heidelberger and Friedrich Stadler, 119–38. Vienna: Springer.
- Neurath, Otto. 1921/1973. "Anti-Spengler." In *Empiricism and Sociology*, ed. Marie Neurath and R. S. Cohen, Vienna Circle Collection, vol. 1, chap. 6, 158–213. Dordrecht: Reidel.
- . 1929. "The Scientific Conception of the World: the Vienna Circle." In *The Emergence of Logical Empiricism: From 1900 to the Vienna Circle*, ed. S. Sarkar, 321–40. New York: Garland.
- Pincock, Christopher. 2002. "Russell's Influence on Carnap's *Aufbau*." *Synthese* 131 (1): 1–37.
- Putnam, Hilary. 1958. "Review of *Philosophy of Science: The Link between Science and Philosophy* (Philipp Frank)." *Science* 127:750–51.
- . 1997. "James's Theory of Truth." In *The Cambridge Companion to William James*, ed. Ruth A. Putnam, 166–85. Cambridge: Cambridge University Press.
- Quine, Willard V. O. 1969. *Ontological Relativity and Other Essays*. New York: Columbia University Press.
- Reisch, George. 2005. *How the Cold War Changed Philosophy of Science*. Cambridge: Cambridge University Press.
- Richardson, Alan W. 1998. *Carnap's Construction of the World*. Cambridge: Cambridge University Press.
- . 2007. "Carnapian Pragmatism." In *The Cambridge Companion to Carnap*, ed. M. Friedman and R. Creath, 295–315. Cambridge: Cambridge University Press.
- Russell, Bertrand. 1910. *Philosophical Essays*. London: Longmans, Green.

- Rutherford, F. James. 1960. "Discussion: Frank's Philosophy of Science Revisited." *Philosophy of Science* 27 (2): 183–86.
- Spengler, Oswald. 1918/1991. *The Decline of the West*. Repr. New York: Oxford University Press.
- Toulmin, Stephen. 1951. "Review of *Relativity—a Richer Truth* (Philipp Frank)." *Philosophical Quarterly* 1:180–81.
- Tsou, Jonathan Y. 2003. "The Justification of Concepts in Carnap's *Aufbau*." *Philosophy of Science* 70 (4): 671–89.
- Uebel, Thomas. 2003. "Philipp Frank's History of the Vienna Circle: A Programmatic Retrospective." In *Logical Empiricism in North America*, ed. G. L. Hardcastle and A. W. Richardson, 149–69. Minneapolis: University of Minnesota Press.
- . 2004. "Carnap, the Left Wing Circle, and Neopositivist Antimetaphysics." In *Carnap Brought Home: The View from Jena*, ed. C. Klein and S. Awodey, 247–77. La Salle, IL: Open Court.
- . 2013. "Pragmatics in Carnap and Morris and the Bipartite Metatheory Conception." *Erkenntnis* 78 (3): 523–46.
- von Mises, Richard. 1930. "Über das naturwissenschaftliche Weltbild der Gegenwart." *Die Naturwissenschaften* 18:885–93.