

Frank's Austrian Reading of the *Aufbau*

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1. Introduction . In the last two decades quite a few philosophers and historians of philosophy of science have been engaged in dissecting the various currents of epistemology and philosophy of science that informed the Logical Empiricism of the Vienna Circle. In this endeavour, Neo-Kantian influences use to be distinguished from philosophical doctrines attributed to a specific "Austrian philosophy" whose origins are traced back to 19th century philosopher-scientists such as Bolzano, Brentano and Mach. The first who put forward 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 Circle* (Neurath 1929) he characterized Austrian philosophy as Anti-Kantian, science-oriented, clinging to the spirit of enlightenment empiricism and particularly interested in questions of logic and language. Later, Neurath's thesis was elaborated by Haller and others and is now known as the Neurath-Haller thesis (cf. Neurath 1929, Haller 1991, Uebel 2003). Although many members of the Vienna Circle may be characterized as Austrian philosophers in the sense of the Neurath-Haller thesis there were also some whose philosophical origins spoke against a smooth subsumption under the Austrian label, at least *prima facie*. Schlick and Carnap were the most important cases in point.

The aim of this paper is to discuss how Austrian and Non-Austrian philosophical currents met in a very special constellation, namely, how the Austrian philosopher Frank read Carnap's *Aufbau*.

It is known for some time now that the *Aufbau* is deeply marked by neo-Kantian, Kantian and other Non-Austrian influences. This is, after all, 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. And, more important, the first version of the *Aufbau* was written in the years 1922 to 1925 when he lived as an "independent scholar" in Buchenbach near Freiburg in Germany. Thus, the first version of the *Aufbau* was written, *before* he came to Vienna. Hence, what *is* surprising, at least in the light of the Neurath-Haller thesis, is that the *Aufbau* was welcomed by the Austrians as congenial with the Circle's Austrian philosophy such that at least for a certain time the *Aufbau* became the

philosophical reference point of the Austrian *Scientific World Conception* as was emphatically formulated by Frank¹:

"Carnap gave the new philosophy [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." (Frank 1955, p.33)

Carnap himself did not pay much attention to the originality of Austrian philosophy.² In *Logical Syntax* (Carnap 1934) as well as in his later works that were written after he had left Europe, Austrian philosophers were not mentioned at all (with the exception of Wittgenstein).³ Even for the *Aufbau* he didn't get it exactly right when he retrospectively described Mach's role for this work as follows:

"The choice of a phenomenalist basis [for the construction system mainly dealt with in the *Aufbau*⁴] 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 construction 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, p. 18)

Apparently he was not aware of the importance to distinguish between Austrian and German philosophy and drew his inspiration from wherever he could get it, be it from Austrian, German, or British sources. A striking evidence for this eclectic attitude was his confession that the *Aufbau's* construction theory had two very different sources:

"[T]wo entirely different and frequently hostile philosophical positions have the merit of both having discovered the necessary basis of the construction 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 construction system. Transcend-

¹ Frank did not take Carnap's non-Austrian philosophical heritage seriously debunking it as "some sentimental ties to traditional German philosophy" (Frank 1955, p. 34).

² He never dealt with Bolzano, and Brentano is mentioned in the *Aufbau* only once as the founder of "the traditional theory of intentionality" (§ 164).

³ 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 towards logic and language from the thirties onwards Machian ingredients in Carnap's empiricism faded away.

⁴ In the *Aufbau* he was more critical with Mach's phenomenism pointing out that a Machian construction system did not satisfy the requirement of "epistemic primacy" in contrast to the gestaltist one based on *Elementarerlebnisse* (cf. § 54).

dental 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." (*Aufbau*, §75)

Although Carnap acknowledged to have been influenced by Poincaré, he considered Russell's influence as far more important as will be discussed in some detail in section 3. These evidences do not yet 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. Be this as it may, at least *prima facie* the *Aufbau* poses a problem for the Neurath-Haller thesis since it challenges the contraposition of German Neo-Kantian and Austrian anti-Kantian philosophy. The *Aufbau* may be taken as witness 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* (Frank 1955) he whole-heartedly subscribed to Neurath's peculiar thesis that "things happen in Austria parallel to what happens in Warsaw, Cambridge, or Paris, rather than to what takes place in Berlin." (Frank 1955, p. 47).⁵ According to the Neurath-Haller thesis a characteristic trait of Austrian philosophy was its openness to non-German philosophical and scientific traditions, in particular, to French conventionalism and American pragmatism (cf. Frank 1955, Neurath 1929). This claim is certainly true for Frank. Since his philosophical youth in the "first Vienna Circle" ("Protocircle") in the early years of the last century Frank was eagerly engaged in absorbing the philosophical doctrines of Poincaré, Duhem, and other French conventionalists as well as James's American pragmatism (cf. Frank 1955, Uebel 2003). All these components were to play an important role for his reading of the *Aufbau* and rendered it a typical Austrian reading, or so I want to argue.

The outline of this paper is as follows. To set the stage section 2 outlines Frank's philosophical background⁶ with special attention to its phenomenalist, conventionalist, and pragmatist ingredients. As will be shown in some detail in section 3 these philosophical currents played a role also in his interpretation of the *Aufbau*. In section 4 Frank's Austrian interpretation is compared with some contemporary readings of Carnap's *opus magnum*. In section 5 we conclude with some general remarks on the chances of a "scientist

⁵ As it seems, Neurath and Frank never came to realise that what happened in Göttingen, Marburg, Jena or Freiburg might have been philosophically more important than what happened in Berlin.

⁶ Most of Frank's philosophical papers are collected in *Modern Science and its Philosophy* (Frank 1949). If not indicated otherwise, all quotations are from the 1955 edition of that book.

pragmatism" (as Frank's philosophical project may be called) in the context of contemporary philosophy of science.

2. Frank's Philosophical Background . Before we engage in a discussion of the details of Frank's philosophy some general remarks on his philosophical style may be in order. Frank was not a professional philosopher interested in discussing hair-splitting philosophical, logical and philological nuances. Rather, he considered himself as a philosophising scientist in the line of philosopher-scientists such as Poincaré, Duhem, and Mach. Engaged in a permanent struggle against "school philosophy" he did not care much for subtle distinctions and interpreted those philosophical accounts he considered useful for his purposes in a rather liberal manner, to put it mildly. Hence, Frank's adaptations of phenomenalism, conventionalism and pragmatism do not always closely resemble the accounts of these philosophical currents that result from modern, more careful interpretations. These differences need concern us only in so far as they affected his reading of the *Aufbau*.

Throughout his life Frank considered himself as a faithful follower of Mach (cf. Frank 1955).⁷ For him Mach was the "real master of the Vienna Circle" (Frank 1955, p. 79). Hence, it is appropriate to begin the presentation of Frank's philosophical background with Mach.⁸ As a philosopher Mach is best characterized as a phenomenalist. At least, Frank took him as such. Roughly, phenomenalism may be taken as the claim that the world consists of sensations or phenomena. Mach often called them "elements" in order to avoid too narrow psychological connotations.⁹ Frank took the Machian "elements" or "phenomena" as empirical experiences. Phenomena were the source of evidence in whatever field we may inquire, not speculation nor apriori insight. Science was understood as an attempt to provide useful descriptions of relevant "complexes of the elements and their changes" that 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", "atom" etc. Auxiliary concepts were to be understood not as a priori categories but as instruments

⁷ 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.

⁸ For a thorough discussion of Mach's philosophy and its impact on Logical Empiricism, see (Banks 2004).

⁹ It is argued by Banks that Mach indeed believed in "observer-independent elements in matter *all the way* from 1863 to 1916" (Banks 2004, p. 7).

useful in some limited contexts. Ignoring their provisional character could harm the progress of science smuggling in metaphysical pseudo-questions.

For Frank, the main value of Mach's phenomenalist doctrines was "not that they help the physicist to go forward in his physical work, but rather that they provide the means for defending the edifice of physics against (metaphysical) attacks from outside" (Frank 1955, p. 67). Mach's *elements* had for empirical science a function analogous to that of natural numbers in Kronecker's reductionism in mathematics according to which all statements of mathematics could be reduced to statements about natural numbers, at least in principle (Ibid. p. 66). Machian phenomenism as antimetaphysics admonished us to be aware of the limitations of the auxiliary concepts. Knowledge that could not be cashed out in terms of phenomenal knowledge at least in principle, was metaphysical blunder. In the end, then, all empirical knowledge was knowledge about phenomena, just as for Kronecker all mathematical knowledge was knowledge about natural numbers.

On the basis of this antimetaphysical stance of Mach's theory of elements Frank considered Mach as the most important philosopher of enlightenment in the 19th century. Mach's primordial merit was to have pointed out that enlightenment was an unendable process: each historical epoche had to overcome the auxiliary concepts of its predecessor and formulating its own new conceptualizations of the world that inexorably would fall prey to the new conceptual systems of the 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 our theories led Frank easily to conventionalism. He mainly relied on Poincaré and Duhem, and to a lesser extent on Rey. Since the days of the "Protocircle" Frank considered the French conventionalists as allies in the struggle against "school philosophy". Poincaré was the first who had pointed out 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 since 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 own work on causality (Frank 1932) as a contribution to a conventionalist philosophy of science in Poincaré's sense, since it showed that also the law of causality was not much more than a convention.¹⁰ Duhem was appreciated by Frank for his "sharpness of logic" by

¹⁰ Admittedly, "not much more than a convention" is pretty vague. But I feel unable to ascribe a more precise position to Frank with respect to this issue: in 1907 he subscribed to a radical conventionalist conception of causality, in 1932 he recanted this thesis, while in 1955 he claimed that "the presentation of the law of causality as an arbitrary convention (as exhibited in his [1907], T. M.) can be freed of its paradoxical appearance[.] The law of causality, as a part

which he allegedly surpassed Mach's more informal presentation of conventionalism (Frank 1955(1930), p. 100)

Frank conceived 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's 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 gave an explanation 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 as 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." (Frank 1955, pp.11-12)

Pragmatism was the third ingredient of Frank's philosophical *Weltauffassung*. In some sense pragmatism may be said to be the first modern philosophical current that did not arise in Europe and was then extended to the rest of the world; rather it first arose in North America and spread then to Europe. It was, of course, not a monolithic doctrine. One may distinguish two pragmatisms, the "hard" semiotic pragmatism of Peirce, and the "soft" one made famous by James and later developed by Dewey (cf. Mounce 1997). Frank subscribed to James's version. 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 1955, p.33).¹¹ If a statement did not provide such a direction, it was meaningless. Conceiving meaningfulness in this way Frank was led to the following interpretation of James's pragmatic theory of truth:

of an axiomatic system, is an arbitrary convention ... but if interpreted physically it becomes a statement about observable facts." (ibidem, p. 14)

¹¹ It may be noted that the idea that the meaning of a concept is ultimately determined by its experiential "cash value" was adopted also by Carnap in his *Von Gott und Seele. Scheinfragen in Metaphysik und Theologie* (Carnap 2004 (1929), p. 59, 62).

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 1955 (1930), p. 101)

This is a rather peculiar interpretation of James's pragmatism. Hence, the following comments may be in order:

(i) The insight attributed to James that a physical theory does not yield a faithful copy of reality is not exactly new. It can be traced back to Kant (cf. KdrV A318/B375), and the neo-Kantians made a lot out of it (cf. Cassirer (1910)). In other words, by contrasting a pragmatist and a correspondence theory of truth in a very simplified manner, Frank construed an opposition of the *Scientific World Conception* and "school philosophy" that did not exist in this clear-cut manner.

(ii) In a similar vein, Frank's claim that James rejected the truth concept of "school philosophy" *tout court* needs qualification. In reality, James *accepted* the traditional definition of truth of "veritas est adaequatio rei et intellectus". This is evidenced by the following quote of 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." (James 1997, ix).

In contrast to "school philosophy", however, James and other pragmatists asked what is the meaning of "reality" and "agreement" (cf. Putnam 1997). James's account of truth was by no means as simplistic as Frank contended (cf. James 1997). Moreover, in some sense Carnap became an adherent of a correspondentist account of truth when he subscribed to Tarskian semantics in the early 1930s. On the other hand, the Neo-Kantian Cassirer strongly dismissed any correspondence theory of truth (Cassirer 1910).

Summarizing one may say that Frank harboured a rather idiosyncratic idea of James's pragmatism marked by his intention to use it as a weapon against "school philosophy". His adaptation 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. While pragmatism might have been a new game for philosophers at the turn of the beginning of the last century, according to Frank

"[T]he 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 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." (Frank 1955, p. 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 the scientists's own philosophical convictions. Although Frank considered the pragmatic account of meaningfulness and truth as basically 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 as 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:

"[T]he 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 logics as well" (ibidem, p. 104).

In making this sweeping claim Frank is conflating two different things: on the one hand, one may plausibly conceive the relational logic of Whitehead and Russell as a means to render precise the broadly relational stance of Mach and other neutral monists. On the other hand, there was no particular affinity between the new relational logic and James's account of truth. On the contrary, Russell harshly criticised James's pragmatic account of truth as "silly", and James responded to Russell's criticism in a similar way (cf. James 1911, Russell 1910). Thus, by no means pragmatism and the new relational logic lived together thus peacefully as Frank wanted to make his readers believe. Analogous claims held for the relationships between phenomenalism and conventionalism, and pragmatism and phenomenalism, respectively. In sum, Frank's idyllic sketch of the peaceful co-existence of phenomenalism, conventionalism, and pragmatism as ingredients of a "new positivism" does not withstand closer scrutiny.

3. Reading the *Aufbau* in Vienna and Prague. For Frank as a member of the "left wing" of the Vienna Circle philosophy of science was not a merely academic affair: philosophy of science should contribute to the battle against metaphysics and its pernicious consequences for science and society. In Vienna as well as in Prague the philosophers subscribing to a *Scientific Conception of the World* were not only an academic minority engaged in the usual quarrels of academia, but they rightly could consider themselves as an endangered species for very solid political and societal reasons. This situation also affected Frank's philosophical style leading to an activist orientation that also characterized his interpretation of the *Aufbau*. He did not write a scholarly commentary of this work. Rather, his reading of the *Aufbau* has to be reconstructed from his remarks and observations made in various philosophical articles engaged in a struggle against metaphysical "school philosophy".

In the lengthy introductory chapter *Historical Background*² of *Modern Science and its Philosophy* Frank was at pains to stylize the "real" Vienna Circle of the 20s and 30s ("Schlick Circle") as the natural continuation of the Austrian "Protocircle" formed by him, Hahn, and Neurath (cf. Frank 1955, Uebel 2003). According to Frank's narrative the program of both circles was to bring about a "new philosophy of science" envisaged as an integration of "Mach and Poincaré" improved by some ingredients of James's pragmatism (cf. Frank 1955, p.33). This blend marked his reading of the *Aufbau*. Frank's most detailed presentation of the *Aufbau's* aim and structure can be found in the paper *Physical Theories of the Twentieth Century*.

"The most determined attempt [of constructing on the basis of Mach's views a scientific edifice that is superior to the school philosophy in its logical precision] was undertaken by Rudolf Carnap. In his book "The Logical Structure of the World" which appeared in 1928, he seeks to build up the whole system of science, starting from concrete experiences. He tries to show that all principles in which physical or psychological objects are involved can be replaced by statements concerning concrete experiences. The rules according to which statements about concepts must be replaced by statements about concrete experiences are called by Carnap the constitution of these concepts. In a scientific statement there should occur only concepts the constitution of which is known. The basis of every science is the system of concept constitutions. The building of this system step by step with the help of modern logic of Russell is what Carnap calls the logical structure of the world. (Frank 1955(1930), pp. 110 - 111)

This was a rather optimistic assessment of what Carnap had achieved in the *Aufbau*. While Carnap himself described the *Aufbau* only as a sketch, Frank attributed to it the achievement of having given a full reconstruction of scientific knowledge in terms of con-

¹² Aptly called by Uebel a "programmatic history of the Vienna Circle".

crete experiences. Thereby he implicitly assumed that the primary goal of this work was a full-blown reconstruction of scientific knowledge as such. Exactly this claim has come under fire from some of the modern readings of the *Aufbau* that contend that it actually intended to offer an outline of a general theory of construction systems, while the reconstructions really carried out in this work are to be considered only as sketchy examples (cf. Friedman 1999, Richardson 1998).

Assuming that the reconstruction of the logical structure of the world in Carnap's sense was feasible, Frank concluded that every scientific problem could be reduced to a problem concerning the similarity or non-similarity between concrete experiences. Thus, every scientific problem could be solved at least in principle (cf. Frank 1955, p. 111). He went even further and contended:

"[T]here are no boundaries between science and philosophy, if one formulates the task of physics in accordance with the doctrines of Ernst Mach, using the words of Carnap: namely, the task of science is to order the perceptions systematically and to draw from present perceptions conclusions about perceptions to be expected." (Frank 1955 (1930), p. 121).

This "naturalized" conception of philosophy of science, which denied any strict difference between science and philosophy may perhaps be read as a precursor of Quine's radical holism but it was hardly compatible with Carnap's account that insisted on a strict division of labour between the two disciplines as is stated, for instance, in *On the Character of Philosophical Problems*:

"In order to discover the correct standpoint of the philosopher, which differs from that of the empirical investigator, we must not penetrate *behind* the objects of empirical science into presumably some kind of transcendent level; on the contrary we must take a *step back and take science itself as the object*." (Carnap 1934, p. 6).

Frank's phenomenalist convictions led him to ascribe to the *Aufbau* a "sense-data" meaning theory that was even more radical than the one Carnap endorsed in *Überwindung* (Carnap 1932):

"The "meaning" of a statement in science would be the sum of all statements about similarity and diversity between sense impressions that can be derived logically from the statement in question." (Frank 1955, p. 33)

For Frank, this "meaning theory" with its emphasis on the role of experiences suggested an affinity of the construction theory of the *Aufbau* with James's pragmatism in that both currents were based on similar meaning theories. In *Pragmatism* James had brought

forward a meaning criterion according to which for the determination of the meaning of a concept

"... we are to take account of what conceivable effects of a practical kind the object may involve, what sensations we are to expect from it, and what reactions we must prepare." (James 1907, p. 29).

This analogy seems to have led Frank to see an affinity between the structural meaning account of the *Aufbau* according to which the meaning of a concept is determined by its place in the construction system and James's pragmatic account, which determined a concept's meaning by its possible sensational effects:

"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." (Frank 1955, p. 33)

Regrettably, Carnap never took to heart Frank's hint. His relation to pragmatism always remained luke-warm: although he paid some lip-service to a close alliance of pragmatism and Logical Empiricism in *Testability and Meaning* (Carnap 1936/37) he did not heed Frank's adhortations to take into account more eagerly the pragmatic aspects of science (cf. Frank 1963, Carnap 1963). Rather, "going pragmatic" remained an unrealized option of construction theory and Logical Empiricism. Morris's vision of a "Scientific Empiricism" as a synthesis of Logical Empiricism and pragmatism was never realized (cf. Dahms 1992, p. 253f).

Frank's observation that the *Aufbau* program had some affinity to pragmatism was not his only contribution to read this work in an original and non-orthodox way. Another example is provided by his thesis that the construction theory of the *Aufbau* was relevant for the project of *Unified Science*. Usually, this project is identified with Neurath's *Encyclopedia of Unified Science*. This, however, does not tell the whole story. In the late 20s and early 30s, Carnap's construction theory was to serve as the formal framework for unified science (cf. *Manifesto* p. 331).

When Carnap had been persuaded by Neurath that the program of unified science would best be pursued in a physicalist framework, Frank's interpretation of the *Aufbau* as a successor of Mach's monism run into difficulties: Frank had to explain how the switch from phenomenalism to physicalism was compatible with Mach's *Elementenlehre*. He argued that Mach's "principle of conceptual economy" according to which the task of

science was to organize our experiential knowledge in the most economic way possible would justify this move. Assuming that a unified science was a science satisfying the requirement of conceptual economy Frank argued that

"... it is of secondary importance whether this unification be achieved in terms of perceptions, as Mach believed and Carnap proved to be right in his first paper (sic) "The Logical Construction of the World" (sic) or whether the physical language is to be introduced, as Carnap proclaims in his recent papers in accordance with Neurath's suggestions." (Frank 1955(1938), p. 86)

It seems doubtful if Mach would have accepted this move. For him, the *complexes of elements* and their functional relations were a general ontological schema designed for comprehending physics, psychophysics, and psychology. Hence, from a Machian point of view the move from a phenomenalist to a physicalist system was a large jump. This did not hold for Carnap: he had asserted time and again in the *Aufbau* that the choice of a construction system was a matter of convenience (see section 4).

After having treated the roles of Mach and James for Frank's reading of the *Aufbau* in some detail, let us finally come to Poincaré. Bibliographical evidence for an important role of Poincaré for the *Aufbau* is thin. He is mentioned only four times (§§3, 16, 124, 130) of which the last two lack importance. In §3 Carnap ascribed to him (and to Avenarius, Mach, and Driesch) the achievement to have at least partially reduced "reality" to the "given". This was for Carnap a first step towards 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 having pointed out that

"[not the given itself, but only the relations between the sensations have an objective value]. This obviously is a move in the right direction, but does not go far enough. From the relations, we must go on to the structures of relations if we want to reach totally formalized entities. Relations themselves, in their qualitative peculiarity, are not intersubjectively communicable. It was not until Russell (Math. Phil. 62f) that the importance of structure for the achievement of objectivity was pointed out." (*Aufbau* § 16)

This is virtually the only important reference to Poincaré in the *Aufbau*. It clearly shows that for Carnap, Russell was much more important than Poincaré. It would have been more appropriate to characterise the *Aufbau* as an integration of Mach and Russell, instead of Mach and Poincaré as Frank did.

For Frank as belonging to the left wing of the Circle, "phenomenalism", "conventionalism", and "pragmatism" were not neutral philosophical tools or perspectives, but "banners, self-consciously flown to mark the Circle's *Frontstellung* in the battle against metaphy-

sics..." (Uebel 2004, p. 261). From hindsight, Frank's *Frontstellungen* often appear ill-positioned based on philosophical oversimplifications and verbal radicalism.¹³ Frank ignored the close relationship of Logical Empiricism with at least some Neo-Kantian projects and other science-oriented philosophical currents. This bereft the *scientific world conception* of important allies in its fight against irrationalist metaphysics.¹⁴ With respect to the *Aufbau* Frank was led to ignore its affinities with Neo-Kantianism and Kantianism which have been brought to light by the recent "German" interpretations of this work as will be discussed in more detail in the next section.

4. The Austrian Interpretation in Perspective . In the last twenty years the *Aufbau* has been the target of much interpretative work. Painting with a broad brush, we may distinguish between two different groups of interpretations:

- (i) The traditional interpretations read the *Aufbau* as the culmination of British empiricism of Locke and Hume updated with the then new logic of Whitehead and Russell.
- (ii) The 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.

It should be noted from the outset that (i) and (ii) are to be considered as two opposite positions in a continuous spectrum. Recently, some intermediate interpretations have been

¹³ For instance, according to him the members of the Vienna Circle belonged to the "shock troops" of the "anti-metaphysical and consequently scientific" movement (cf. Frank 1935, p. 4).

¹⁴ Elisabeth Nemeth recently claimed to have spotted "some remarkable intersections between Frank's views and Ernst Cassirer's" on philosophy of science in general and the topic of scientific objectivity in particular (Nemeth 2003, p. 124). She may well be right, but it should be noted that these "intersections" have never been acknowledged by Frank. On the contrary, Frank was always busy to emphasise existing and non-existing differences between "scientific philosophy" and "school philosophy". To be fair, it must be admitted that there is one belated exception to his generally negative attitude towards neo-Kantianism, to wit, his review of Cassirer's *Determinismus und Indeterminismus in der modernen Physik* (Cassirer 1936). Nevertheless, even there he could not abstain from closing with some pointing remarks against "school philosophy": "Cassirer's book is to be welcomed from the standpoint of logical empiricism as a highly successful attempt to continue the adjustment of the traditional idealist philosophy to the progress of science... For the adherent of the school philosophy the book signifies, like many previous writings of Cassirer, a way out of an impasse." Frank (1955 (1938), p. 184/185). Thus, in the end Frank generously admitted that Cassirer had been successful for almost 30 years

put forward that intend to do justice to both the empiricist and the neo-Kantian aspects of the *Aufbau* (cf. Pincock 2002, Tsou 2003). Both recognize the importance of neo-Kantianism for the *Aufbau* but they consider the revisionist German readings of the *Aufbau* as incomplete, as they unduly neglect the empiricist aspects of Carnap's project. Pincock argues that both the German and the British readings misunderstood Russell's influence on the *Aufbau* project. If Pincock is right, this provides an argument against Frank's interpretation since Frank never cared much about Russell's role for the *Aufbau*. Frank would have fared better with Tsou, who considers the construction theory of the *Aufbau* as an empiricist method of justification that "aims to rationally justify concepts by showing how questions posed about them can be empirically answerable" (Tsou 2003, p. 680). This is more in line with the sense-data meaning theory Frank ascribed to the *Aufbau* (cf. Frank 1955, p.33). For reasons of space, however, these new proposals cannot be discussed in detail here.¹⁵ For the sake of brevity, let us dub (i) and (ii) the British reading and the German reading of the *Aufbau*, respectively.¹⁶ Then, the natural task arises to compare Frank's Austrian reading with the British and German readings. In 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 Russell's influence was played down in favor of French conventionalism. The latter move implied that the role of logical and mathematical constructions in the *Aufbau* was systematically underestimated in Frank's reading. Nevertheless, I think that with some good will on both sides, the Austrian and the British reading of the *Aufbau* could be rendered compatible with each other.

Things are different with respect to the Austrian and the German reading. A reconciliation between seems to be more difficult. As has been pointed out by the adherents of the German reading of the *Aufbau*, the British and hence *a fortiori* the Austrian reading, is fundamentally misguided (cf. Friedman 1999). According to the German reading the

to find "ways for school philosophy out of its metaphysical impasses". A neutral observer might ask why then Frank had made such a fuss about school philosophy all the time.

¹⁵ Both Pincock and Tsou recognize the importance of neo-Kantianism for the *Aufbau* but they consider the revisionist German readings of the *Aufbau* as seriously incomplete, as they unduly neglect the empiricist aspects of Carnap's project. Pincock argues that both the German and the British readings misunderstood Russell's influence on the *Aufbau* project. If Pincock is right, this provides an argument against Frank's interpretation since Frank was inclined to play down Russell's role. Frank would have fared better with Tsou, who considers the construction theory of the *Aufbau* as an empiricist method of justification that "aims to rationally justify concepts by showing how questions posed about them can be empirically answerable" (Tsou 2003, p. 680). This is more in line with the sense-data meaning theory Frank ascribed to the *Aufbau* (cf. Frank 1955, p.33).

¹⁶ The best-known partisans of the British reading were Quine and Goodman, the protagonists of the German reading are Friedman (Friedman 1999) and Richardson (Richardson 1998).

Aufbau is to be considered as the first instance of a new philosophical discipline called construction theory ("Konstitutionstheorie") envisaged by Carnap as a scientific successor discipline of traditional epistemology and philosophy of science. Carnap designed *construction theory* as a discipline that was to be neutral with respect to the familiar quarrels between realism, idealism, and empiricism that marked for Frank an unsurmountable barrier between "school philosophy" and "scientific world conception". Thus, for Carnap, construction theory had a much more general aim than to reconstruct the system of scientific knowledge on the basis of Mach's elements, as Frank contended. This clearly transpires from Carnap's 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... The ontological theses of the traditional doctrines of either phenomenism or materialism remained for me entirely out of consideration." Carnap (1963, p. 18)

Summarizing one may contend that in the light of the German readings of the *Aufbau* Frank's full-bodied characterization of the *Aufbau* as an integration of Mach and Poincaré is untenable.

This leaves us with that feature of Frank's Austrian interpretation which is the most interesting one, to wit, his claim that the *Aufbau* points towards a pragmatist philosophy of science. This feature is missing in the British as well as in the German reading of the *Aufbau* and deserves special attention.

According to Frank, the relations between Logical Empiricism and pragmatism were easily to be characterized: the former might be understood as a logically refined version of the latter:

"In contrast to the method of pragmatism, however, [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 1955 (1929), p. 105)

This account is too simple. Already in the times of Mach and James the relations between the phenomenalism and pragmatism were not without problems: James was at pains to dissociate pragmatism from Machian phenomenalism, considering the claim that "pragmatism was only a re-editing of positivism" as "the first misunderstanding" the pragmatists had to suffer from (James 1912, p. 182). On the other hand, Mach regarded much of James's pragmatism dealing with ethics and religion as romantic metaphysics. Frank never dealt with these disputes. He simply took pragmatism as a version of logical positivism that lacked logical sophistication.¹⁷ In contrast to Carnap he did not engage in serious work on the formal structure of empirical theories, and he never elaborated what was to be understood precisely by the "logical improvement of the ideas of Mach and James" allegedly achieved by Logical Empiricism. His Logical Empiricism is characterized by the feature of taking logic lightly. Consequently, logical, mathematical, and structural considerations, appreciated thus highly by the author of the *Aufbau*, played only a minor role for Frank. In sum, one has to acknowledge that Frank's Austrian interpretation did not do full justice to the *Aufbau*. *Pace* Frank, Mach was not the master of the Vienna Circle, and the Vienna Circle philosophers were not his heirs (cf. Banks 2004, p. 15). Despite its logical and philosophical shortcomings, Frank's interpretation offers important insights into the pragmatic aspects of Carnap's construction theory that has been largely overlooked by other readings.

5. Concluding Remarks . Although Frank's Austrian interpretation of the *Aufbau* cannot compete with the more elaborated British and German interpretations with respect to logical and philosophical sophistication it is not without interest even for today's agenda of philosophy of science. It captured a feature of the *Aufbau* that has escaped the attention of the German as well as the British reading so far, to wit, the pragmatic dimension of construction theory.

¹⁷ Peirce's logically sophisticated semiotic pragmatism was never considered by Frank although at the First International Congress for the Unity of Science 1935 in Paris (which Frank attended) Morris had pointed out 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. ... [I]t 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." (Morris 1936, p. 48-49)

Frank was on the right track when he stressed the importance of pragmatic-historical considerations for the development of a socially and politically engaged philosophy of science, which many contemporary philosophers of science are missing thus badly (cf. Howard 2003). But his approach needs a thorough modernisation. Why this is so may be read off from the succinct description of Frank's program recently proposed by Uebel:

"The original Viennese program for a program might be put thus: with Hilbert and the French conventionalists for Mach against Kant!" (Uebel 2003, p. 87).

I think Uebel's formulation captures well the spirit of the Austrian Circle's early philosophical *Weltauffassung*. At the same time, it brings to light the inherent philosophical difficulties of the Austrian program: These may be bluntly expressed as follows: Hilbert, the French conventionalists, and Mach were contemporaries of the Viennese thinkers while Kant was dead for more than 100 years. For the partisans of the program, he played the part of a philosophical *Wiedergänger* that could not be laid to rest due to the vicious machinations of "school philosophy". This picture could be maintained only if one ascribed to the various versions of Neo-Kantian philosophy a thoroughgoing Kantian orthodoxy. But this is untenable. Neo-Kantianism had gone a long way from Kant. In particular, it shared many of its scientific heroes with Logical Empiricism. For instance, it went well with French conventionalism and modern logic. Cassirer and other Neo-Kantians had the highest esteem for Poincaré, Duhem, Helmholtz, Hilbert and Russell who populated the gallery of scientific heroes of the *scientific world conception*.¹⁸ Thus, orientation towards science was not a monopoly of Austrian philosophers. Moreover, the Anti-Kantian reliability of the Circle's alleged allies was doubtful. The anti-Kantianism of Hilbert's philosophy can hardly be taken for granted.¹⁹ Also pragmatism can be shown to have connections with the Kantian tradition as well (see e.g. Carlson 1997), as was already noticed by Morris (1936), and even Mach may be interpreted as a philosopher who "succeeded in combining a Kantian appreciation of the active, even constitutive role of the mind in generating scientific knowledge with scientific ...theory of the origins and functions of the role of knowledge and ideas " as Cohen aptly remarked (Cohen 1970, p.

¹⁸ As is well known, Cassirer vigorously argued for a relational account of scientific knowledge, (cf. Cassirer 1910). Thus, as Uebel rightly remarks, the relational stance does not distinguish between Neo-Kantianism and Logical Empiricism.

¹⁹ Indeed, as has been carefully argued by Stöltzner (2002), there was much in Hilbert's philosophical outlook that was repulsive from a logical empiricist point of view. As a clear sign of the fact that Hilbert had some Kantian inclinations it may be sufficient to note that he took as the maxim of his *Foundations of Geometry* (Hilbert 1899) a quote from *The Critique of Pure Reason*.

156/7).²⁰ Thus, a philosophical program whose battle cry was "With Hilbert and the French Conventionalists for Mach against Kant" may have some problems with its internal coherence, to say the least. There was more of Kantian heritage in the equipment of the allegedly Anti-Kantian allied warriors than the Viennese strategists might have imagined. Judged from hindsight, the attempt of constructing an opposition between "German" (neo-)Kantian and Austrian Anti-Kantian approaches of scientific philosophy was not helpful for building up a comprehensive modern philosophy of science in the long run. Rather, this distinction was bound to lead to parochial quarrels that are overcome by such works as the *Aufbau*. Interpreting this work from such a perspective is bound to miss its essential points.

Summarizing I'd like to put forward the following thesis: What is still promising in Frank's reading of the *Aufbau* is that it provided the first version of a *pragmatist* reading of this work. In line with the terminology introduced in the last section, this pragmatist reading may be characterized as an *American* reading. Although Frank's version of the *American* reading is plagued with serious shortcomings, this does not exclude that better versions can be obtained in the future. For this task, one needs a more comprehensive and better argued pragmatism than Frank's mutilated Jamesian version.²¹ Only then the left Vienna circle's program of a "scientist pragmatism" (Uebel) may have a chance to find a continuation in contemporary philosophy of science.

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²⁰ In a comprehensive manner, the influence of Herbart, Fechner, and other German philosophers and scientists (more or less influenced by some current of Kantianism) on Mach is discussed in Banks (2004).

²¹ Putnam made some tentative proposals in this direction pointing out that a truly pragmatist approach of scientific knowledge has to take into account the complex relations between facts, theories, values, and interpretations (cf. Putnam 1995, p. 14f). This program is probably incompatible with Frank's "positivist" pragmatism. For some evidence that hint at a more optimistic assessment of Frank's account in this respect, see Nemeth 2003.

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