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MICHAEL FRIEDMAN

Introduction: Carnap's revolution in philosophy

Rudolf Carnap (1891–1970) was a giant of twentieth-century philosophy. He was one of the leading figures of the logical empiricist movement associated with the Vienna Circle and one of the leaders of the analytic tradition more generally. In particular, the defining debates of this tradition involved, at its inception, Gottlob Frege, Bertrand Russell, Carnap, and Ludwig Wittgenstein, and, in a later phase, Carnap and Willard Van Orman Quine. Moreover, Carnap was engaged in significant philosophical interaction with some of the leaders of the continental tradition, including Edmund Husserl and Martin Heidegger. Finally, Carnap was a central participant in key episodes in the development of modern logic associated with Kurt Gödel and Alfred Tarski; and, after emigrating to the United States, he also interacted with important American pragmatist philosophers such as Charles Morris and John Dewey. He made major contributions to philosophy of science and philosophy of logic, and, perhaps most importantly, to our understanding of the nature of philosophy as a discipline. It is impossible adequately to understand twentieth-century philosophy without appreciating Carnap's central position within it.

Yet the general understanding of Carnap's place within twentieth-century philosophy among philosophers on both sides of the Atlantic is at present severely limited, and for two interrelated reasons. On the one hand, Carnap tends to be exclusively identified with logical empiricism, and this movement, in turn, tends to be exclusively identified with a rather naïve version of empiricist foundationalism or phenomenalist reductionism, according to which all (synthetic) knowledge of the world is to rest on a certain basis of immediately given sensory experience. Logical empiricism, understood in this

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way, is then widely viewed as a failed philosophical project – whose failure, moreover, is conclusively documented in Carnap's own failure to execute it in precise logical terms in *Der logische Aufbau der Welt* (the logical structure of the world) (1928). On the other hand, Quine's celebrated paper "Two Dogmas of Empiricism" (1951) is widely thought to have definitively demolished the "first dogma" of logical empiricism – that there is a clear and sharp distinction between formal or analytic truth (in logic and mathematics), on the one side, and factual or synthetic truth (in empirical natural science), on the other. (The "second dogma" is phenomenalist reductionism, and Quine famously claims that it and the first dogma are "at root identical.") Since the analytic/synthetic distinction becomes absolutely central to Carnap's philosophy from the period of *Logical Syntax of Language* (1934c/1937) onwards, there is a widespread tendency to conclude that there is now nothing left in Carnap's philosophy worth considering.

Beginning in the 1970s and early 1980s, as Richard Creath explains in his Preface, increasing numbers of scholars on both sides of the Atlantic have made groundbreaking contributions towards reevaluating Carnap's central philosophical significance. It has emerged that the widespread conception of Carnap's philosophy just presented involves very serious misunderstandings and, in the end, amounts to little more than a caricature. Indeed, this is not especially surprising when we appreciate that the (mis-)conception in question derives from polemical discussions of logical empiricism – both for and against – rather than serious scholarly investigations of Carnap's own work in its historical and philosophical context. In particular, the standard picture of the logical empiricist movement and Carnap's place within it derives, in large part, from A. J. Ayer's militantly pro-logical-empiricist polemic in *Language, Truth and Logic* (1936), written after visiting the leading members of the Circle in Vienna; and the standard picture of the significance and fate of Carnap's analytic/synthetic distinction derives, as just noted, from Quine's polemical attack in 1951 – where Quine, after having studied with Carnap in Europe in the 1930s, now stakes out a new philosophical direction for himself. Of course it does not follow that there is no truth at all in either polemically motivated picture, nor that we have nothing important to learn from Ayer's militant advocacy or Quine's critical attack. But it now appears, in light of the new

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research in question, that we have ample reason to pursue a more balanced and dispassionate understanding of Carnap's place within twentieth-century philosophy and its history.

The present volume aims to make the fruits of the recent renaissance in Carnap scholarship as widely available as possible. Some of the contributors discuss previously unknown or underappreciated aspects of Carnap's work, such as his connections with the phenomenological tradition originating with Husserl (Thomas Ryckman), his interactions with Gödel and Tarski during the late 1920s and early 1930s, when our modern understanding of mathematical logic first crystallized (Erich Reck), or his relationship with the American pragmatist tradition of Morris and Dewey (Alan Richardson). But we are primarily concerned, in general, to expose the originality and depth of Carnap's overall position, which amounts to an entirely novel philosophical perspective on empiricism and the critique of metaphysics, on logicism and the analytic/synthetic distinction, on the role of logic within philosophy as a discipline, and on the relationship between philosophy and the empirical sciences. The revolutionary character of Carnap's reconfiguration of these themes is completely obscured in the picture promulgated by Ayer, Quine, and many others, where Carnap, and the Vienna Circle more generally, are characteristically assimilated to well-worn versions of epistemological foundationalism associated with British empiricism. Carnap's position, it turns out, has virtually nothing to do with such views, and everything to do, instead, with a radically voluntaristic philosophy of what we might call logical pragmatism (see A. W. Carus's and Alan Richardson's contributions). Hence, even when more familiar topics are discussed here, such as Carnap's relationships with Frege (Gottfried Gabriel) and Russell (Christopher Pincock), his work in semantics and intensional logic (Steve Awodey), his contributions to philosophy of science (William Demopoulos) and probability and induction (S. L. Zabell), or his place within the Vienna Circle (Thomas Uebel), it is always with an eye to the deeply revolutionary character of his overall philosophical position.

CARNAP AND MODERN LOGIC

The leading theme of Carnap's philosophy, throughout his career, is the overriding philosophical importance of the modern

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mathematical logic created by Frege, with whom Carnap had studied at the University of Jena, and by Russell, from whom he had learned both the theory of logical types developed in *Principia Mathematica* and the great value to be gained by the application of modern logic to the problems of philosophy. Moreover, Carnap imbibed from them a logicist philosophy of mathematics – the view that, as Carnap (1963a, 12) puts it, “knowledge in mathematics is analytic in the general sense that it has essentially the same nature as knowledge in logic.” For Carnap, however, the significance of this view is not that we can thereby justify or explain mathematical knowledge on the basis of another type of knowledge – logical knowledge – presumed to be antecedently (or better) understood, but rather that logic and mathematics together play a distinctively formal or inferential role in framing our empirical knowledge:

It is the task of logic and mathematics within the total system of knowledge to supply the forms of concepts, statements, and inferences, forms which are then applicable everywhere, hence also to non-logical knowledge. It follows from these considerations that the nature of logic and mathematics can be clearly understood only if close attention is given to their applications in non-logical fields, especially in empirical science . . . This point of view is an important factor in the motivation for some of my philosophical positions, for example, for the choice of forms of languages, for my emphasis on the fundamental distinction between logical and non-logical knowledge. (1963a, 12–13)

In particular, Carnap’s emphasis on the importance of the analytic/synthetic distinction is in no way derived from a foundationalist epistemological program for pure logic and mathematics aiming to explain how logical and mathematical certainty is possible by appealing to truth-by-convention or truth-in-virtue-of-meaning. The point is rather that logic and mathematics, in their extraordinarily fruitful and indeed indispensable applications to empirical science, are thereby seen as purely formal, empty, and devoid of factual content.

Carnap’s first book-length discussion of the application of mathematical logic to the problems of philosophy, explicitly following Russell’s example in *Our Knowledge of the External World* (1914a), was, of course, *Der logische Aufbau der Welt* (1928). Carnap here develops a “constitutional system” in which all concepts of empirical science

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are defined or “constituted” in a step-wise progression of logical constructions extending up through the hierarchy of logical types, whose basis (individuals or objects of lowest type) is given by the subjective “elementary experiences” of a single cognitive subject. This project, however, is no more of a contribution to traditional foundationalist epistemology (here an empiricist foundationalism directed at our empirical knowledge) than is Carnap’s logicist philosophy of logic and mathematics. The point is rather to depict, in the most general possible terms, the way in which the “forms of concepts” supplied by modern mathematical logic can in fact succeed in structuring our empirical knowledge. Carnap, in his student days at Jena, had also imbibed a healthy dose of Kantian and neo-Kantian philosophy, according to which empirical knowledge is itself only possible in virtue of a priori forms and principles antecedently supplied by thought. Here, in the *Aufbau*, Carnap defends an empiricist version of this conception, in so far as such (still indispensable) formal structuring is now seen – in virtue of modern mathematical logic (understood in a logicist context) – as *analytic* rather than *synthetic* a priori.

Carnap takes the subjective basis in “elementary experiences” he starts with to be entirely uncontroversial, in the sense that all current “epistemological tendencies” will agree with the order of “epistemic primacy” he depicts. In particular, Carnap does not assume that our knowledge of “elementary experiences” is any more certain than anything else, but merely that our actual empirical knowledge is in fact based, in the end, on precisely such subjective experiences. The point of depicting this order of logical construction rather than some other, therefore, is not so much to give a traditional empiricist justification for our knowledge of the external world as to exhibit what Carnap calls the “neutral basis” common to *all* epistemological views – whether empiricist, transcendental idealist, realist, or subjective idealist. Modern logic, now applied to the form of our empirical knowledge in general, allows us precisely and rigorously to dissolve the idle metaphysical disputes between such views (especially the dispute between realism and idealism) and, therefore, to import “the rigorous and responsible basic attitude of scientific researchers” into philosophy (see my own contribution).

Although the *Aufbau* was written largely in the years 1922–25, before Carnap moved to Vienna, it appeared in 1928 during the

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heyday of the Vienna Circle. In the meantime, however, modern mathematical logic had become embroiled in considerable turmoil due to a “foundations crisis” precipitated by the failure to achieve general agreement on a solution to the serious logical contradictions or paradoxes afflicting both Frege’s original system presented in his *Basic Laws of Arithmetic* (1893/1903) and Cantorian set theory. (Paradigmatic, of course, was Russell’s famous paradox of the “class of all classes that are not members of themselves,” which cannot, on pain of contradiction, be either a member or a non-member of itself.) The theory of types of *Principia Mathematica* (on which Carnap had depended in the *Aufbau*) was supposed to provide a solution, but this turned out to require controversial axioms (such the axioms of infinity, reducibility, and choice) in order to recapture the mathematical laws of arithmetic (and analysis) Frege had derived. As a result, three opposing schools in the foundations of mathematics were articulated in the 1920s: logicism attempted to preserve the original Frege–Russell view; intuitionism, represented especially by L. E. J. Brouwer, developed a radical challenge to classical mathematics and logic based on a denial of the law of excluded middle applied to elements of infinite collections (like the natural numbers); formalism, represented by David Hilbert, then attempted to save classical mathematics and logic from Brouwer’s challenge by developing a formal proof-theoretic consistency proof (in which the terms and sentences of classical logic and mathematics are now viewed as purely formal sequences of uninterpreted symbols) using only the more limited (“finitist”) logico-mathematical methods sanctioned by Brouwer.

In the late 1920s and early 1930s, immediately after the publication of the *Aufbau*, Carnap, the Vienna Circle, and the whole brave new world of “scientific philosophy” became embroiled in this controversy as well. From the point of view of modern mathematical logic itself, the upshot was our now dominant view of the subject, which is due, in large part, to the fundamental results attained by Gödel and Tarski in the 1930s: Gödel’s completeness theorem for first-order logic in 1930, his famous incompleteness theorems for arithmetic (and thus for higher-order logical systems, like *Principia Mathematica*, which contain arithmetic) in 1931, and Tarski’s celebrated work on the semantical conception of truth in 1931–36 (which, in turn, led to the later development of contemporary model

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theory). It follows from Gödel's results, in particular, that Hilbert's proof-theoretic program for defending the consistency of classical logic and mathematics (sufficient to include arithmetic) cannot in fact be achieved (at least in Hilbert's original form), and, more generally, that no axiomatic (deductive) system for logic and mathematics (again sufficient to include arithmetic) can contain all the logico-mathematical truths – a result which severely challenges classical logicism as well, in so far as it had envisioned a single logical (deductive) system containing *all* of mathematics.

It has long been clear that Carnap was one of the very first philosophers to understand and appreciate these groundbreaking results. In particular, he interacted extensively with both Gödel and Tarski during the period in question, and he immediately put their results to use in the further development of his own philosophical position. It is well known, for example, that Gödel's results figure centrally in *Logical Syntax of Language* (1934c/1937), and that Tarski's work on the concept of truth provides the basis for Carnap's succeeding semantical period, beginning in the mid to late 1930s and extending throughout the 1940s and beyond. One of the most striking discoveries of recent scholarship, however, is that Carnap was not only a competent (and very early) apologist for and expositor of these results, but his own logical research in the late 1920s provided an important part of their background and immediate motivation (see Erich Reck's contribution). Carnap was then engaged in a systematic "investigation into general axiomatics," whose aim was to disentangle various concepts of consistency, completeness, and what we now call categoricity for axiomatic systems in general – and, on this basis, to prove general theorems about the relationships among these concepts. Although this work was never published (since it contained technical flaws and inadequacies which were later clarified in the work of Gödel and Tarski), it was then at the cutting edge of research into what we now call metamathematics, and it provided a crucial part of the background, in particular, for Gödel's own work in the early 1930s.

Logical Syntax was Carnap's philosophical response to this very complex situation in the evolving foundations of logic and mathematics, and, at the same time, the very first formulation of his mature philosophical position. The key innovation is a radically new approach to the philosophy of logic and mathematics based on what

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Carnap calls the Principle of Tolerance (see Thomas Ricketts's contribution). There is no such thing as the unique, "correct" formulation of logic and mathematics, and there is no uniquely correct answer, in particular, to the dispute among the three foundational schools. Intuitionism is right to claim that we can coherently develop a formal system or calculus for logic and mathematics in which the law of excluded middle is no longer universally valid, and such a system, moreover, is less likely to be inconsistent (paradoxical) than the (logically stronger) classical system. Formalism is right to claim that we can fruitfully view logic and mathematics as purely syntactic formal systems and, more generally, that the metamathematical method, in which we sharply distinguish between the object-language or system under investigation and the meta-language in which our investigation is carried out, is indispensable for a rigorous formulation of logic. And logicism is right to claim, finally, that the best way to appreciate the distinctive character of logic and mathematics is within a formal system or calculus for the total language of empirical science which makes it clear, in particular, that, as Carnap (1963a, 12) puts it (see above), "knowledge in mathematics is analytic in the general sense that it has essentially the same nature as knowledge in logic." Now, in *Logical Syntax*, Carnap articulates this idea in terms of a clear and sharp distinction, within any such formal language, between the contentful terms of the empirical sciences ("descriptive terms") and the contentless terms of logic and mathematics ("logical terms").

The Principle of Tolerance, formulated against the background of the recent metamathematical results of Gödel and Tarski (which, as we now know, were themselves inspired, in part, by Carnap's own earlier proto-metamathematical research), thus gives new meaning and significance to Carnap's non-traditional understanding of logicism. For the point of viewing the terms of logic and mathematics as factually empty – and the propositions of logic and mathematics as therefore analytic – is now seen to lie precisely in our *freedom to choose* which system of logic and mathematics among the infinite number of possible such systems best serves the formal deductive needs of empirical science. The choice between classical logic and mathematics and intuitionism, for example, turns on the circumstance that classical mathematics is much easier to apply (in developing derivations) than intuitionist or constructive mathematics, while the latter, being logically weaker, is much less

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likely to result in contradiction. The choice between the two systems, from Carnap's new point of view, is therefore purely practical or pragmatic, and it should thus be sharply separated, in particular, from traditional metaphysical disputes about what mathematical entities "really are" (independent "Platonic" objects or mental constructions, for example) or which such entities "really exist" (for example, only natural numbers or also real numbers, that is, arbitrary sets of natural numbers). Carnap's aim, once again, is to use the new tools of modern mathematical logic (here the new tools of metamathematics) definitively to dissolve all such metaphysical disputes and to replace them, instead, with the much more rigorous, fruitful, and constructive project of language planning, language engineering. In this project, which Carnap now calls *Wissenschaftslogik* (the logic of science), our task is to develop and investigate a variety of formal deductive structures for application in the empirical sciences, where the only criteria for choosing one such structure over another are then purely practical or pragmatic; and it is *Wissenschaftslogik*, Carnap (1934c/1937, §72) explains, which now "takes the place of the inextricable tangle of problems known as philosophy."

CARNAP AND QUINE

The final paragraph of the last section of Quine's "Two Dogmas of Empiricism" (1951, §6, "Empiricism without the Dogmas") explicitly acknowledges that Carnap views the choice between different "language forms" or "scientific frameworks" as entirely pragmatic. The problem, in Quine's words, is that such "pragmatism leaves off at the imagined boundary between the analytic and the synthetic," so that, Quine continues, "[i]n repudiating such a boundary I espouse a more thorough pragmatism." In particular, according to the holistic empiricist epistemology Quine has just presented, all statements of science – statements of logic, mathematics, physics, or biology – equally face the "tribunal of experience" together. When faced with a "recalcitrant experience" in conflict with our total system, we then have a choice of where to make revisions: we normally try to make them as close as possible to the periphery of our overall "web of belief," but, when the conflict is particularly acute and persistent, for example, we can also revise the most abstract and general parts of science, including even the statements of logic and mathematics, lying at the center of this web. In all such cases our criteria of choice

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are, in the end, purely pragmatic, a matter of continually adjusting our overall web of belief to the flux of sensory experience so as to achieve the simplest total system best adapted to that experience. Therefore, Quine concludes, "[e]ach man is given a scientific heritage plus a continuing barrage of sensory stimulation; and the considerations which guide him in warping his scientific heritage to fit his continuing sensory promptings are, where rational, pragmatic."

The difference between Carnap's position and Quine's at this point is rather subtle. For, in a crucial section of *Logical Syntax* (1934c/1937, §82, "The Language of Physics"), Carnap makes two claims which sound rather similar to Quine's. First, Carnap adopts an holistic view of theory testing he associates with the names of Duhem and Poincaré: "*the test applies at bottom not to a single hypothesis but to the whole system of physics as a system of hypotheses.*" Second, Carnap also claims that, although when faced with an unsuccessful prediction of an observation sentence or "protocol sentence" (what Quine would call a "recalcitrant experience"), "some change must be made in the system," we always have, nonetheless, a choice of precisely where to make the needed revisions. In particular, both the fundamental principles of physics (which Carnap calls "P-rules") and the fundamental principles of logic and mathematics (which Carnap calls "L-rules") are subject to revision: "For instance, the P-rules can be altered in such a way that those particular primitive sentences are no longer valid; or the protocol-sentence can be taken as being non-valid; or again the L-rules which have been used in the deduction can also be changed." And, Carnap adds, "[t]here are no established rules for the kind of change which must be made." Indeed, in this regard there is only a difference of degree between the logico-mathematical sentences and the sentences of empirical physics:

No rule of the language of physics is definitive; all rules are laid down with the reservation that they may be altered as soon as it seems expedient to do so. This applies not only to the P-rules but also to the L-rules, including those of mathematics. In this respect, there are only differences in degree; certain rules are more difficult to renounce than others.

(This was written, I emphasize, some fifteen years before the publication of Quine's "Two Dogmas.") Where, then, does Carnap's pragmatism, in Quine's words, "leave off"?