ering itself around it? True to the logic of the Third Critique, I think that Kant would argue that it is neither or both. My analysis, I hope, brought out why Kant speaks of form just as much in relation to the movement of the mind as in relation to the object, equally of the form of finality of an object and the formal finality in the play of the cognitive faculties. Just as the movement of the mind reveals the faculty of representation as a whole, so the corresponding revelation 'in the thing' can be called the intuiting of its possibilities as they are embodied in it, the manifestation of its form. Form is opened up and presented by the movement of the mind. But what is such a space of meaning which is neither subjective nor objective? And how does it relate to the possibilities of significance of a human world? In other words, what is the peculiar lack of reality of beauty, and how does its semblance nevertheless leave room to relate it to truth? (I use the word 'semblance' to distinguish what I speak of here from 'illusion', as well as from falsifications of aesthetic experience such as fanaticism and kitsch).[11]

Beauty's lack of ultimate reality can be understood of course in terms of its being a matter of how things appear, rather than what they truly are. But, in Kant's account this ontological deficiency of beauty is translated into the understanding that the aesthetic, though treated in the critical philosophy, does not constitute a further realm beyond those of nature and freedom. From each of these points of view, the judgment upon the beautiful will appear to lack something essential to our assessments of reality. To put it in terms of an expression that often recurs in Kant's account of judgment: Our judgments would have an "as if" quality to them. From the point of view of cognition, the judgment of taste will be found lacking in conceptual determination. From the point of view of morality, it will also be found to lack the seriousness and commitment required to motivate action. What is extolled as the spirit of free play that governs the judgment of taste is liable to appear from these perspectives, in less favorable light, seen as the postponement, ambiguity, and evasiveness typical of the aesthetic. But would there be an option, assuming that beauty does not exclude meaning, to lead from beauty and through it, to significance that one would take seriously as being truthful?

What would, at least, be required, would be to give an account of the evasiveness of meaning in beauty that makes it more than a mere defect, mere vagueness. This is why I wish to formulate it in terms of the pull of the idea on the phenomenal. My account of the universal voice has already suggested, I think, how the idea orients the judgment of taste. Not symbolically, as when Kant speaks of beauty being the symbol of morality, but, as indicated by the very movement of meaning characteristic of the aesthetic judgment. Similarly, though I have not discussed it here, Kant's account of the ideal of beauty would precisely address how the beauty of the human figure is a presentation of that which is not visible in experience—namely, morally good character. But think further of Kant's characterization of the beauty of art as an "aesthetic idea for which a rational concept can never be found" (Ak. 5: 210) which he further elucidates as follows: "Just as the *imagination*, in the case of a rational idea, fails with its intuitions to attain to the given concepts, so *understanding*, in the case of an aesthetic idea, fails with its concepts to attain to the completeness of the internal intuition which imagination conjoins with a given representation" (Ak. 5: 212).

How are we to understand this feature of beauty? I take it that beauty does not just, in itself, show us that no concept would be adequate to it. Rather, it is through the attempt to give it expression in the aesthetic judgment that the evasiveness of its meaning is realized. Put differently, a beautiful thing is not merely a particular, determined by its specific properties or by its particular spatiotemporal location. It does not have the same principle of identity as an object of experience. Its assumed identity is not a result of conceptual synthesis, but rather its singularity is understood in relation to the completeness or self-enclosed totality of the idea. Treating it as such would demand constantly leaving our judgments open to further significance, thus, at the same time, inherently ambiguous.

Assuming that the idea plays a role in our relation to the beautiful, that the revelation of form is oriented by the idea would at the same time account for the possibility of the movement of meaning that enlivens beauty, as well as for the problematic nature of its existence, for the ambiguity that traverses it. The semblance of beauty would have to do with its incorporating within itself the very dialectical tension of the phenomenal and the ideal. That tension becomes the condition of possibility of beauty, of its truthfulness as well as of its problematic nature.[12]

NOTES

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1. From *Walter Benjamin Selected Writings,* vol. II (Cambridge: Harvard University Press, 1999), 547.
2. My aim here is not to argue against specific interpretations of Kant, but rather to provide an alternative that gives a central place to expression in the structure of the judgment of taste. I do think, though, that many views of Kant's account share the assumption that language does not play a part in the grammar of the aesthetic judgment. This is evident for instance in Paul Guyer's *Kant and the Claims of Taste* (Cambridge: Cambridge University Press, 1997), and specifically in his interpretation of the universal communicability intrinsic to the aesthetic judgment. It is also evident, to give another example, in Henry Allison's understanding of the division between free and dependent beauty, leading to his neglect of Kant's discussion of the ideal of beauty (see chapter 6 of Henry E. Allison, *Kant's Theory of Taste: A Reading of the Critique of Aesthetic Judgment* [Cambridge: Cambridge University Press, 2001]).
3. The poverty imposed on the aesthetic by the aforementioned account cannot even be alleviated, as is sometimes attempted, by supplementing it with a reference to a generalized sense of the significance of beauty supposedly expressed in Kant's famous claim that "beauty is the symbol of morality." For such a symbolic analogy would leave meaning just as extrinsic to the judgment on beauty itself.

4. See my "On Examples, Representatives, Measures, Standards and the Ideal," in *Reading Cavell*, ed. A. Crary and S. Shieh (London and New York: Routledge, 2006).
5. All references to Kant's *Critique of Judgment* are to the translation of James Creed Meredith (Oxford: Oxford University Press, 1952). The page references will be given following the quote, according to the pagination of the *Akademie* edition.
6. One might therefore surmise that if there is such a thing as a pure reflective judgment, it *must* be a disinterested judgment. Kant's emphasis on disinterestedness is not only the result of the reflection on the phenomenon of the aesthetic, but also results from the reflection on the nature of judgment and the condition for the possibility of a critique of that faculty.
7. I am here indebted to Hannah Ginsborg's insights on the relation of pleasure and the judgment of taste. See in particular her "Reflective Judgment and Taste," in *Noûs* 24 (1990): 63–78.
8. As an initial motivation for this identification of the notion of form with a space of possibilities, I would point to Kant's understanding of the forms of intuition in the *Critique of Pure Reason*. More specifically, thinking of the activity of the imagination, so central to the aesthetic, consider that what Kant calls 'schematization' does not provide the image of a specific state of affairs, but rather the *possibilities* of the appearance of a concept in experience. I also wish to motivate my use of the notion of form somewhat anachronistically by mentioning Clement Greenberg's Kantian understanding of modernism, according to which aesthetic judgment, identified now as criticism, is to show how each art is primarily concerned with presenting the conditions of its possibility, or the medium.
9. This makes clear that what Kant thinks of as the adaptation of our faculties in the aesthetic judgment "to cognition generally" does not mean finding a shadowy state common or at the background of all acts of cognition. Rather, by referring the judgment to "cognition generally" Kant points to the possibility of having a representation generate a movement of meaning which makes present to us precisely the power of our faculties, that which makes possible every act of cognition. To speak of 'cognition generally' is not to speak of an average, nor of what is common equally in all states of cognition. "Cognition generally" must not be assumed to be a sort of "buzz" that accompanies or is in the background of each and every act of cognition. The indeterminacy of that state does not mean its vagueness, nor its being of a particularly high level of generality. We might be tempted to take Kant's claim that in the judgment upon beauty our faculties are brought together to an *indefinite* activity to mean that such a state of mind is a vague conglomerate of perception and pleasure, something not definite enough to involve words. And further assume that because it is a state that occurs wherever we are confronted by beauty it must be something very minimal indeed, which is common to our experience of a flower and the Mona Lisa. Yet, the mistake might be in having too narrow or reified a notion of what a state of mind is. For Kant does not characterize a common *static* state but a common form of activity: the putting into words. Such state of mind is not confused, but rather its characterization as indefinite precisely points to the fact that no single conceptual determination can do the work. It is a state of mind identified by the inner logic of its changes, a continuous activity, whose whole scope defines what it is to judge something to be beautiful. That activity can be exact and exacting, while not eventuating in a conceptual determination.
10. Granted it cannot be the object of a pure judgment of taste: "An estimate formed according to such a standard," Kant writes, "can never be purely aesthetic, and . . . one formed according to an ideal of beauty cannot be a simple judgment of taste" (Ak. 5: 236). But this polarization of free and ideal beauty precisely reflects the polarization that traverses the Third Critique. It is the upshot of the understanding of judgment to be a mediating function, thus to always touch upon irreconcilable extremes.
11. On the structure of illusion in fanaticism and kitsch, see my "Kant and the Critique of False Sublimity," *Iyun* (January 1999), as well as "Some Thoughts on Kitsch," *History and Memory* (Fall 1997): vol. 1/2.
12. This way of formulating the matter is not, at this point, so far from Walter Benjamin's understanding of the relation of the art-work, its form (or medium) and the idea of art. Benjamin's "The Concept of Criticism in German Romanticism," in which he engages the Romantic's inheritance of Kant, rethinks the principle of identity of, at least, artistic beauty, in terms of a history or tradition through which it gathers and transforms its meaning. He further considers the modes in which the semblance of beauty can be dispelled without thereby dismissing the meaning revealed

in critical reflection as illusory. This would require arresting the restlessness of meaning, without ending it with a conceptual determination. This arrest, call it the sublime moment in beauty, is central to the structure of the ideal of beauty as well as to Benjamin's understanding of the dialectical image. See on this matter my "Measure of the Contingent: Walter Benjamin's Dialectical Image," forthcoming in *Boundary 2.*

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Carnap and Quine: Twentieth-Century Echoes of Kant and Hume

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As a student at the University of Jena—where, in particular, he learned modern mathematical logic from Gottlob Frege—Rudolf Carnap was exposed early on to the Kantian view that the geometry of space is grounded in the pure form of our spatial intuition; and, as Carnap explains in his autobiography, he was initially strongly attracted by this view:

> I studied Kant's philosophy with Bruno Bauch in Jena. In his seminar, the *Critique of Pure Reason* was discussed in detail for an entire year. I was strongly impressed by Kant's conception that the geometrical structure of space is determined by the form of our intuition. The after-effects of this influence were still noticeable in the chapter on the space of intuition in my dissertation, *Der Raum.* (1963a, 4)

In particular, Carnap's dissertation, completed—under Bauch—in 1921 and published in *Kant-Studien* in 1922, defends the view that the form of our pure intuition has only the infinitesimally Euclidean structure presupposed in Riemann's theory of n-dimensional manifolds (rather than a global three-dimensional Euclidean structure), and, in this way, Carnap accommodates the Kantian doctrine of pure spatial intuition to Einstein's recent formulation of the general theory of relativity.[1]

But even this attenuated version of pure intuition and the synthetic a priori was abandoned when Carnap became a leading member of the Vienna Circle in the mid- to late 1920s—and it was probably already abandoned while Carnap, in

1924–25, was working on *Der logische Aufbau der Welt* before he joined the Circle. Indeed, Carnap also tells us in his autobiography (1963a, 11–13) that he intensively studied Whitehead and Russell's *Principia Mathematica* and Frege's *Grundgesetze der Arithmetik* in 1919–20; and from Frege, in particular, he "gained the conviction that knowledge in mathematics is analytic in the general sense that it has essentially the same nature as knowledge in logic" (12). For Carnap, however, the significance of this view was 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. Although the greater part of my work belongs to the fields of pure logic and the foundations of mathematics, nevertheless great weight is given in my thinking to the application of logic to non-logical knowledge. 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)

The point of the *Aufbau*, accordingly, is then 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 retains the Kantian idea that empirical knowledge is itself only possible in virtue of a priori forms and principles antecedently supplied by thought. But now, in the *Aufbau*, he defends an empiricist version of this conception, in the sense that such (still indispensable) formal structuring is now seen (in virtue of modern mathematical logic) as *analytic* rather than *synthetic* a priori.[2]

Another well-known passage in Carnap's autobiography describes how a combination of Frege-Russell logicism with Wittgenstein's conception of tautology allowed the Vienna Circle to arrive "at the conception that all valid statements of mathematics are analytic in the specific sense that they hold in all possible cases and therefore do not have any factual content" (1963a, 47)—a conception which resulted in a major advance over all earlier forms of empiricism:

> What was important in this conception from our point of view was the fact that it became possible for the first time to combine the basic tenet of empiricism with a satisfactory explanation of the nature of logic and mathematics. Previously, philosophers had only seen two alternative positions: either a non-empiricist conception, according to which knowledge in mathematics is based on pure intuition or pure reason, or the view held, e.g., by John Stuart Mill, that the theorems of logic and of mathematics are just as much of an empirical nature as knowledge

> about observed events, a view which, although it preserved empiricism, was certainly unsatisfactory. (ibid.)

Indeed, this rejection of pure intuition and the synthetic a priori in favor of the view that all logico-mathematical truth is analytic and has no factual content quickly became definitive of what Carnap and the Vienna Circle meant by their empiricism.[3]

In the late 1920s and early 1930s, however, the Circle became involved with the "crisis" in the foundations of mathematics precipitated by L. E. J. Brouwer's development of a Kantian-inspired version of "intuitionism" concerning the objects of arithmetic and analysis and David Hilbert's development of proof-theory in response to Brouwer. In particular, Brouwer gave a famous lecture in Vienna in 1928, and the Circle was appropriately impressed:

> In the Circle we also made a thorough study of intuitionism. Brouwer came to Vienna and gave a lecture on his conception, and we had private talks with him. We tried hard to understand his published or spoken explanations, which was sometimes not easy. The empiricist view of the Circle was of course incompatible with Brouwer's view, influenced by Kant, that pure intuition is the basis of all mathematics. On this view there was, strangely enough, agreement between intuitionism and the otherwise strongly opposed camp of formalism, especially as represented by Hilbert and Bernays. But the constructivist and finitist tendencies of Brouwer's thinking appealed to us greatly. (1963a, 49)

One way to understand the problem with which the Circle was now faced, therefore, is how to acknowledge the evident strengths of Brouwer's viewpoint without becoming entangled with a "non-empiricist" commitment to pure intuition.

Carnap's solution is the *Logical Syntax of Language*, published in 1934. In conformity with the basic metamathematical method of Hilbertian proof-theory, we view any formulation of logic and mathematics as a syntactically described formal system, where the notions of well-formed formula, axiom, derivation, theorem, and so on can all be syntactically expressed. In light of Gödel's recently published incompleteness theorems, however, we do not pursue the Hilbertian project of constructing a proof of the consistency of classical mathematics using finitary means acceptable to the intuitionist. Instead, we formulate both a formal system or calculus conforming to the strictures of intuitionism (Carnap's Language I, a version of primitive recursive arithmetic) and a much stronger system adequate for full classical mathematics (Carnap's Language II, a version of higher-order type theory over the natural numbers as individuals). For both systems, moreover, we define a notion of logical truth (analyticity) intended formally or syntactically to express their essential independence from all factual content. Finally, and most important, Carnap formulates the principle of tolerance: *both* types of system should be syntactically described and investigated, and the choice between them, if there is one, should then be made on practical or pragmatic grounds rather than on the basis of prior, purely philosophical commitments.[4]

Once again, Carnap presents a very clear and succinct description of this new view in his autobiography:

> According to my principle of tolerance, I emphasized that, whereas it is important to make distinctions between constructivist and non-constructivist definitions and proofs, it seems advisable not to prohibit certain forms of procedure but to investigate all practically useful forms. It is true that certain procedures, e.g., those admitted by constructivism or intuitionism, are safer than others. Therefore it is advisable to apply these procedures as far as possible. However, there are other forms and methods which, though less safe because we do not have a proof of their consistency, appear to be practically indispensable for physics. In such a case there seems to be no good reason for prohibiting these procedures so long as no contradictions have been found. (1963a, 49)

And, as we know, the principle of tolerance then became absolutely central to Carnap's philosophy from this point on.

It might appear, however, that Carnap's attempt thereby to dissolve the dispute between classical mathematics and intuitionism is viciously circular. For Carnap's application of the principle of tolerance to this case involves raising the question, in a syntactic metalanguage, whether to adopt the classical or intuitionist logical rules in a particular object-langauge—in this case, the language of total science (mathematics plus physics). We weigh the relative safety (from the possibility of contradiction) of the intuitionist rules against the greater fruitfulness and convenience (in physics) of the classical rules and then make our choice. But if the intuitionist, as he claims, cannot even properly understand the rules of the classical framework—and cannot, *a fortiori*, understand the necessarily even stronger classical metalanguage in which we describe these rules—then it would appear that our entire procedure simply begs the question against the intuitionist.

This argument is certainly tempting, and I must confess that I myself have succumbed to the temptation more than once.[5] I now think, however, that it misses the essence of Carnap's position. In particular, Carnap begins from the presupposition that classical mathematics, as it is standardly practiced, is well understood. Indeed, classical mathematics, for Carnap, is a model or paradigm of clear and exact—scientific—understanding, and there is no room for raising doubts about our understanding of this framework on independent, purely philosophical grounds. To be sure, the foundations crisis sparked by the discovery of the paradoxes, and the failure of Hilbert's proof theory, raise serious technical questions regarding the consistency of the classical framework, and this is precisely why, for Carnap, we should now take intuitionism seriously. To take it seriously, however, means that we entertain the proposal, starting from within the classical framework, that we should weaken its rules to make inconsistency less likely. There is nothing in Carnap's position blocking a classical mathematician from entertaining this option or even deciding then to adopt it. Carnap has therefore not begged the question of the choice between classical and intuitionist mathematics as he understands this question. That an intuitionist mathematician cannot understand the choice as Carnap understands it is irrelevant, for the situation in which we in fact find ourselves has arisen within the paradigmatically well-understood practice of classical mathematics itself.[6]

It was in 1931, as Carnap was preparing the manuscript of *Logical Syntax* for publication, that he first met the twenty-three-year-old Willard Van Orman Quine. Quine (1971/1990, 465) describes the importance of this encounter as follows: "It was my first experience of sustained intellectual engagement with anyone of an older generation, let alone a great man. It was my first really considerable experience of being intellectually fired by a living teacher rather than by a dead book. I had not been aware of the lack."[7] Indeed, it appears that it was this encounter with Carnap and *Logical Syntax* which first sparked Quine's serious interest in philosophy, as opposed to the more narrowly technical questions in logic on which he had focused so far. In matters of philosophy, after this encounter, Quine "was very much [Carnap's] disciple for six years" (1971/1990, 464)—until after the publication, that is, of "Truth by Convention."[8]

The main fruit of Quine's philosophical thinking during this period of discipleship were three lectures on Carnap's *Logical Syntax* delivered at Harvard in the fall of 1934.[9] The philosophical payoff, for Quine, is the idea that philosophy can be replaced by the logical syntax of language, so that traditional metaphysical controversies—about meanings, modalities, universals, numbers, and so on—can now be avoided. Of particular interest, in this connection, is Quine's first lecture, on "The *A Priori*." Quine begins (47) with Kant's statement that an a priori judgment "has the character of an inward necessity." Kant also held, according to Quine (47–48), that "[a]nalytic judgments are consequences of definitions, conventions as to the uses of words[; t]hey are consequences of linguistic fiat." But, Quine continues, "the development of foundational studies in mathematics during the past century has made it clear that none of mathematics, not even geometry, need rest on anything but linguistic conventions" (48). So, in conclusion, our syntactic critique of metaphysics extends to the synthetic a priori as well: the modern (Carnapian) view "has the importance of enabling us to pursue foundations of mathematics and the logic of science without encountering extra-logical questions as to the source of the validity of our *a priori* judgments . . . [, and] it shows that all metaphysical problems as to an *a priori* synthetic are gratuitous" (66).

Already here, however, there is a subtle misplacement of emphasis—which, in time, gives rise to a quite fundamental misapprehension of Carnap's position. Quine, in the 1934 lectures, makes no mention at all of the principle of tolerance, and he makes no mention, in particular, of the dispute between classical mathematics and intuitionism.[10] Quine confines his attention, instead, wholly to classical logic and mathematics, and he views Carnap's conception of analyticity as an alternative account of the "inward necessity" Kant had originally ascribed to the mathematical a priori. Later, in "Carnap and Logical Truth," Quine begins with Kant's question how synthetic a priori judgments are possible, replaces this question (in light of the Frege-Russell reduction of mathematics to logic) with the question, "How is logical certainty possible?" and asserts that "[i]t was largely this latter question that precipitated the form of empiricism we associate with between-war Vienna—a movement which began with Wittgenstein's *Tractatus* and reached its maturity in the work of Carnap."[11] The answer it found, according to Quine, was "the linguistic doctrine of logical truth":

> What now of the empiricist who would grant certainty to logic, and to the whole of mathematics, and yet would make a clean sweep of other non-empirical theories under the name of metaphysics? The Viennese solution of this nice problem was predicated on language. Metaphysics was meaningless through misuse of language; logic was certain through tautologous use of language. (1963, 386)

By the end of his paper, moreover, Quine makes it clear that this "linguistic doctrine of logical truth" is identical with the view that logical truths are true solely in virtue of linguistic convention. So it is no wonder that, as we already observed, Quine (1986) dates the beginnings of his "apostasy" to "Truth by Convention." For the main critical point of that paper is that further reflection on what it might mean to say that logical or analytic truths are "*consequences* of definitions," "*consequences* of linguistic fiat," risks depriving the notion of linguistic convention of "explanatory force"—as an explanation, that is, for precisely the "inward necessity" which, following Kant, is customarily ascribed to both logic and mathematics.[12]

Yet Carnap's own emphasis on the importance of the analytic/synthetic distinction is by no means derived from an 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. Rather, according to precisely the principle of tolerance, the point of viewing the statements of logic and mathematics as analytic lies in *our freedom to choose* which system of logic and mathematics best serves the formal deductive needs of empirical science. Classical mathematics, for example, is much easier to apply, especially in physics, than intuitionist mathematics, while the latter, being logically weaker, is less likely to result in contradiction. The choice between the two systems is therefore purely practical or pragmatic, and it should thus be sharply separated, in particular, from all traditional philosophical disputes about what mathematical entities "really are" (independent "Platonic" objects or mental constructions, for example) or which such entities "really exist" (only natural numbers, for example, or also real numbers, that is, sets of natural numbers). Carnap aims to use the new tools of metamathematics definitively to dissolve all such metaphysical disputes and to replace them, instead, with the much more rigorous and fruitful project of language planning, language engineering—a project which, as Carnap understands it, simply has no involvement whatsoever with any traditional epistemological program.[13]

Quine's self-professed "apostasy" became very clear during discussions between Carnap, Quine, and Alfred Tarski at Harvard during the academic year 1940–41—in which, as has long been known, both Tarski and Quine disputed Carnap's views on analyticity and logical truth (as expressed, at the time, in Carnap's manuscript for his forthcoming *Introduction to Semantics*). However, as examination of Carnap's notes at the Pittsburgh archives by several scholars has recently shown, the main topic of discussion was an attempt to construct a nominalist version of arithmetic.[14] The idea, as promoted especially by Tarski and Quine, was to develop a nominalistically acceptable conception of mathematics by viewing it as a purely formal uninterpreted calculus which could nonetheless be useful for calculations in empirical science in the form of purely syntactic transformation rules. But we know from Gödel (and Carnap) that syntax is essentially arithmetic, so the problem then arises of giving a nominalistically acceptable interpretation of arithmetic. Both Tarski and Quine represent the position that full, infinitary classical arithmetic is not meaningful or understandable [*verständlich*] in the strictest sense, and the project they set themselves is to develop a version of finitary arithmetic assuming the existence of nothing other than concrete physical objects—which, for both Tarski and Quine, are paradigmatic of *Verständlichkeit*. Carnap, for his part, does not share at all in these nominalist philosophical ambitions, but he is interested, as always, in the purely technical problem of seeing how far one can go in the development of calculi or linguistic frameworks subject to various requirements and constraints.

For Quine, the results of these discussions culminated in "Steps Toward a Constructive Nominalism," published in 1947 with Nelson Goodman (who had also participated in some of the discussions in 1940–41). This paper begins with the ringing declaration: "We do not believe in abstract entities" (1947, 105); and it goes on to answer the question why the authors "refuse to admit the abstract objects that mathematics needs" by the statement (ibid.): "Fundamentally this refusal is based on a philosophical intuition that cannot be justified by anything more ultimate." Nevertheless, further light is shed on their philosophical motivations by the preceding paragraph:

> Renunciation of abstract objects may leave us with a world composed of physical objects and events, or of units of sense experience, depending upon decisions that need not be made here. Moreover, even when a brand of empiricism is maintained which acknowledges repeatable sensory qualities as well as sensory events, the philosophy of mathematics still faces essentially the same problem that it does when all universals are repudiated. Mere sensory qualities afford no adequate basis for the unlimited universe of numbers, functions, and other classes claimed as values of the variables of classical mathematics. (1947, 105)

A footnote to the penultimate sentence then refers us to Goodman's 1941 Harvard dissertation, *A Study of Qualities*, which was largely inspired by Carnap's *Aufbau* and which eventuated in *The Structure of Appearance* (1951).

Both Goodman and Quine consistently understood the *Aufbau* as a version of empiricist foundationalism, in the tradition of Locke, Berkeley, and Hume. Thus Quine, in "Two Dogmas of Empiricism" (1951), famously considers Carnap's *Aufbau* as the culmination of the "radical [empiricist] reductionism" developed by

Locke and Hume—the doctrine that "every idea must either originate directly in sense experience or else be compounded out of ideas thus originating" (1951/1953, 38). Carnap reformulated this radical empiricist program using the formal devices of modern logic, and, in these terms, he almost succeeded (39): "He was the first empiricist who, not content with asserting the reducibility of science to terms of immediate experience, took serious steps toward carrying out the reduction." Similarly, in his paper on Carnap's *Aufbau* in the Schilpp volume, Goodman (1963, 558) says: "It belongs very much in the main tradition of modern philosophy, and carries forward a little the efforts of the British Empiricists of the 18th Century." And this suggests that the ultimate philosophical motivations for adopting nominalism, for both Goodman and Quine, derive precisely from the British Empiricist tradition.

This suggestion is confirmed by lectures on Hume's philosophy Quine presented at Harvard in the summer of 1946.[15] Quine begins with an outline of the history of epistemology very similar in spirit to the sketches he later presents in such published works as "Two Dogmas of Empiricism" (1951) and "Epistemology Naturalized" (1969). Epistemology "begins as a quest for certainty," "with the philosophical urge to find a bed-rock of certainty somewhere beneath the probabilities of natural science" (180–81). This quest culminates, in the modern period, with the rationalism of Descartes and Leibniz based on clear and distinct ideas of reason (as paradigmatically exemplified in mathematics) innately implanted in us by God. Fortunately, however, "Locke made a clean sweep of the whole theory of innate ideas," resulting in the much healthier and more "candid" doctrine of empiricism: here we find the "bed-rock of certainty" in our "direct sense impressions," and the program then becomes one of showing how all "[f]urther ideas are formed from these by combination" (187–88). We thus arrive at the program of "radical [empiricist] reductionism" Quine attributes to Locke and Hume in "Two Dogmas."

In his 1946 lectures, Quine's discussion of Hume, in particular, takes an especially interesting turn. Quine gives special emphasis to the circumstance that "Hume is a nominalist[; h]e does not believe in universals" (202), and Quine then connects this nominalism with Hume's arguments, in the *Treatise*, that space and time are not infinitely divisible. Quine suggests that a modern version of an "ideal of empiricist construction"—modeled on Carnap's *Aufbau* but not committed to "a logic which presupposes universals"[16]—yields the conclusion that "Hume's condemnation of [geometrical] space remains valid" (209). More precisely, the "sophisticated," modern construction assumes only propositional connectives, first-order quantification, identity, and "indefinitely many *empirical* predicates"; Hume's questions about infinitely divisible space then become the questions whether all geometrical statements can be expressed in this "empirically acceptable vocabulary," and whether, so expressed, "the propositions of infinite divisibility become true" (209–10). Moreover, "there is an equal problem, not recognized by Hume, in the infinite divisibility of the numbers themselves—and even in the infinite generability of the whole numbers." Quine concludes (210): "In *all* these problems, the answer—even for the sophisticated notion of construction—is very likely *no*." In sum, from Quine's point of view, Hume has indeed raised a genuine problem about the meaningfulness of classical mathematics (213): "[T]he problem is still alive, and worth reconsidering now from the point of view of an enlightened empiricism—empiricistic and nominalistic as before, but armed with the sophisticated conception of construction." There can be very little doubt, therefore, that the standards of meaningfulness or *Verständlichkeit* motivating Quine's pursuit of a nominalistic arithmetic in the Harvard discussions of 1940–41—and, quite likely, his work with Goodman in 1947 as well—are precisely those of Humean empiricism (now construed in Quine's "sophisticated" way).

I noted that Carnap, in the Harvard discussions, does not accept the standards of meaningfulness or *Verständlichkeit* appealed to by Tarski and Quine. More generally, he is never attracted to the conception of meaning derived from Lockean and Humean empiricism, according to which only terms directly referring to immediately given concrete sensory data are paradigmatically meaningful. On the contrary, Carnap's conception is quite distinct from traditional empiricism, in that sense experience, on his view, has significance for science only if it is already framed and structured within the abstract forms supplied by logic and mathematics. Indeed, this, as already suggested, is one of the main themes of the *Aufbau*, and, as late as his preface to the second edition in 1961, Carnap describes his conception accordingly:

> For a long time, philosophers of various persuasions have held the view that all concepts and judgments result from the cooperation of experience and reason. In principle, empiricists and rationalists agree in this view, even though the two sides differentially estimate the significance of the two factors, and often obscure the essential agreement by carrying their viewpoints to extremes. The thesis which they have in common is frequently stated in the following simplified version: The senses provide the material of cognition, reason works up [*verarbeitet*] the material into an organized system of cognition. The task thereby arises of establishing a synthesis of traditional empiricism and traditional rationalism. Traditional empiricism rightly emphasized the contribution of the senses, but it did not recognize the significance and peculiarity of logico-mathematical formation. Rationalism had certainly grasped this significance, but it had believed that reason could not only supply form, but could also produce new content out of itself ("a priori"). Through the influence of Gottlob Frege, with whom I studied in Jena, but who was universally recognized as a preeminent logician only after his death, and by studying the works of Bertrand Russell, I had become clear, on the one hand, about the fundamental significance of mathematics for the formation of the system of cognition, and, on the other, about the purely logical, formal character of mathematics on which rests its independence from the contingencies of the real world. These insights formed the basis of my book. (1961/1967, v–vi; my translation)

Here, in terms strongly evocative of Kant, Carnap formulates a version of empiricism which, on the one side, is fundamentally committed to the central role of mathematics in empirical knowledge from the very beginning, and, on the other, also recognizes that this role is only possible, in turn, in virtue of its analyticity or complete independence from all factual content.

From Carnap's point of view, therefore, there is no room for empiricist doubts about the meaningfulness of classical mathematics. Empiricism, for Carnap, simply amounts to a commitment to the methods of our best empirical physical science, which, for him, constitutes a paradigm of clear and exact—scientific—understanding. The essential application of classical mathematics in this science therefore counts as paradigmatically clear and well understood by the standards of Carnap's empiricism, and it is in virtue of precisely the same standards, moreover, that classical mathematics itself counts as paradigmatically clear and well understood. So Carnap's response to nominalism, in the end, is the same as his response to intuitionism. It certainly makes sense, from the point of view of classical mathematical physical science, to envision a weakening of its logico-mathematical rules: just as the intuitionist can propose to replace Peano arithmetic with the weaker rules of primitive recursive arithmetic, the finitist nominalist can propose to go so far as to weaken the fundamental rules governing the successor function. But it does not make sense to give "external," purely philosophical reasons for making such proposals: just as it does not make sense, from Carnap's point of view, for the Kantian-inspired intuitionist to question classical unbounded existential quantification on the basis of a prior conception of the necessarily incompleteable character of the iterability of ideal mental operations in pure intuition, it does not make sense for the Humean-inspired nominalist to question the classical rules for successor on the basis of a prior conception of the necessarily particular and concrete character of immediately given sensory impressions.

The main point of Carnap's "Empiricism, Semantics, and Ontology," published in 1950, is to articulate a distinction between "internal" questions, which can be raised and settled within a given linguistic framework introducing this or that type of entities as values of its variables (numbers, physical things, space-time points, and so on), and what Carnap calls "external questions, i.e., philosophical questions concerning the existence or reality of the total system of the new entities" (1950a/1956, 214). With respect to the latter questions, Carnap remarks, "[m]any philosophers regard a question of this kind as an ontological question which must be raised and answered *before* the introduction of the new language forms[; t]he latter introduction, they believe, is legitimate only if it can be justified by an ontological insight supplying an affirmative answer to this question" (ibid.). Carnap's view, on the contrary, is that, although there is certainly a practical question of which such linguistic frameworks to adopt, there is absolutely no corresponding theoretical question (ibid.): "Above all, it must not be interpreted as referring to an assumption, belief, or assertion of 'the reality of the entities'. There is no such assertion. An alleged statement of the reality of the system of entities is a pseudo-statement without cognitive content."

Carnap applies this distinction, in particular, to the case of ontological questions about the existence or reality of numbers, as raised, in this case, by the nominalist:

> The linguistic forms of the framework of numbers, including variables and the general term 'number', are generally used in our common language of communication; and it is easy to formulate explicit rules for their use. Thus the logical characteristics of the framework are sufficiently clear (while many internal questions, i.e., arithmetical questions, are, of course, still open). In spite of this, the controversy concerning the external question of the ontological reality of the system of numbers continues. Suppose that one philosopher says: "I believe that there are numbers as real entities. This gives me the right to use the linguistic forms of the numerical framework and to make semantical statements about numbers as designata of numerals." His nominalistic opponent replies: "You are wrong; there are no numbers. The numerals may still be used as meaningful expressions. But they are not names, there are no entities designated by them. Therefore the word 'number' and numerical variables may not be used (unless a way were found of translating them into the nominalistic thing language)." I cannot think of any possible evidence that would be regarded as relevant by both philosophers, and therefore, if actually found, would decide the controversy or at least make one of the opposite theses more probable than the other. (To construe the numbers as classes or properties of the second level, according to the Frege-Russell method, does, of course, not solve the controversy, because the first philosopher would affirm and the second deny the existence of the system of classes or properties of the second level.) Therefore I feel compelled to regard the external question as a pseudo-question, until both parties to the controversy offer a common interpretation of the question as a cognitive question; this would involve an indication of possible evidence regarded as relevant by both sides. (1950a/1956, 218–19)

The position ascribed to the nominalist corresponds rather closely to that earlier defended by Tarski and Quine at Harvard—and therefore, as we have seen, to that defended by Goodman and Quine in 1947. Carnap, from the point of view of our best empirical physical science, entirely rejects the ontological question—taken as theoretical—such nominalists are attempting to raise.

Meanwhile, however, Quine had developed his own account of ontological questions in "On What There Is," published in 1948. Quine here decisively breaks with the Humean-inspired nominalism lying behind his joint paper with Goodman,[17] and he articulates, instead, a pragmatic and holistic version of empiricism according to which all elements of our conceptual scheme—ordinary physical objects, theoretical entities in physics, *and* mathematical objects (numbers, sets, and so on)—are to be viewed as postulated entities in our overall empirical theory of the world:

> Our acceptance of an ontology is, I think, similar in principle to our acceptance of a scientific theory, say a system of physics: we adopt, at least insofar as we are reasonable, the simplest conceptual scheme into which the disordered fragments of raw experience can be fitted and arranged. Our ontology is determined once we have fixed upon the over-all conceptual scheme which is to accommodate science in the broadest sense; and the considerations which determine a reasonable construction of any part of that conceptual scheme, for example, the

> biological or the physical part, are not different in kind from the considerations which determine a reasonable construction of the whole. (1948/1953, 16–17)

In the case of mathematical objects, in particular, there is no more reason, on empiricist grounds, to reject them in favor of an ontology containing only concrete physical objects than there is to reject physical objects, in turn, in favor of a purely phenomenalist ontology containing only the sensory evidence we are now attempting to systematize:

> A platonist ontology [of classes] is, from the point of view of a strictly physicalistic conceptual scheme, as much a myth as that physicalistic conceptual scheme is for phenomenalism. This higher myth is a good and useful one, in turn, in so far as it simplifies our account of physics. Since mathematics is an integral part of this higher myth, the utility of this myth for physical science is evident enough. In speaking of it nevertheless as a myth, I echo that philosophy of mathematics I alluded to earlier under the name of formalism. But an attitude of formalism may with equal justice be adopted toward the physical conceptual scheme, in turn, by the pure aesthete or phenomenalist. (1948/1953, 18)[18]

Quine concludes, clearly echoing Carnap, that, as far as the choice of ontology is concerned, "the obvious counsel is tolerance and an experimental spirit" (19).

Carnap, in a footnote to "Empiricism, Semantics, and Ontology," quotes this last remark with approval. In the same footnote, however, he observes that Quine's attitude toward ontological questions remains fundamentally different from his own, "because according to [Quine's] general conception there are no sharp boundary lines between logical and factual truth, between questions of meaning and questions of fact, between the acceptance of a language structure and the acceptance of an assertion formulated in the language" (1950a/1956, 215 n. 5). Carnap therefore recognizes that, despite their common commitment to a tolerant and pragmatic version of empiricism, Quine's rejection of the analytic/synthetic distinction implies a parallel rejection of Carnap's distinction between external and internal questions. Indeed, Quine (1948/1953, 17) had already anticipated this situation by concluding the penultimate paragraph quoted above as follows: "To whatever extent the adoption of any system of scientific theory may be said to be a matter of language, the same—but no more—may be said of the adoption of an ontology."

The final paragraph of the last section of "Two Dogmas of Empiricism" (1951, § 6, "Empiricism without the Dogmas") emphasizes 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" (1951/1953, 46). 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 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 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. Thus Quine concludes: "Each 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" (ibid.).

The difference between Carnap's position and Quine's at this point is rather subtle. For, in a crucial section of *Logical Syntax* (1934, § 82, "The Language of Physics"), Carnap makes two claims that sound rather similar to Quine's. First, Carnap adopts a holistic view of theory testing he associates with the names of Duhem and Poincaré: "*the testing concerns* in principle not a single hypothesis, but *rather the whole system of physics as a system of hypotheses* (*Duhem, Poincaré*)" (1934/1937, 318 [246]). 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") obtained by deduction from "certain physical principles," "some change must be undertaken in the system," we always have, nonetheless, a choice of precisely where to make the needed revisions (317 [245]): "one can, for example, change the P-rules [of physics] so that these [physical] principles are no longer valid; or one can suppose that the protocol-sentence is not valid; or one can even change the L-rules [of logic and mathematics] used in the deduction"—and, Carnap adds, "[t]here are no fixed rules for the kind of change that is to be chosen." 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 definitively secured; all rules are laid down with the reservation that they may be changed depending on the circumstances, as soon as it seems expedient. This holds not only for the P-rules, but also the L-rules, including those of mathematics. In this respect, there are only differences in degree; it is more difficult to decide to give up certain rules than others. (318 [246])

Where, then, does Carnap's pragmatism, in Quine's words, "leave off"?

Immediately following the last quoted passage, Carnap draws the line this way:

> If, however, one assumes that a new protocol-sentence appearing within a language is always synthetic, then there is this difference between an L-valid, and therefore analytic, sentence $\mathbf{S}_1$ and a P-valid sentence $\mathbf{S}_2$, namely, that such a new protocol-sentence—independently of whether

> it is recognized as valid or not—can be, at most, L-incompatible with $\mathbf{S}_2$ but never with $\mathbf{S}_1$. In spite of this, it may come about that, under the inducement of new protocol-sentences, one changes the language so that $\mathbf{S}_1$ is no longer analytic. (318–19 [246])[19]

In other words, although both types of change in our total system induced by what Quine would call a "recalcitrant experience" are possible, and both involve broadly pragmatic considerations about the optimal overall arrangement of this total system, there is, for Carnap, a fundamental difference between the two: one involves changing the analytic sentences of the language, and thus the rules of logic and mathematics, whereas the other involves merely the synthetic sentences of empirical physics. Only the latter, on Carnap's view, have genuine factual content, and only the latter, accordingly, are the exclusive concern of the empirical scientist—here the physicist.

But now Carnap's position may easily begin to look arbitrary. If we admit that our ultimate epistemological criteria, for both analytic and synthetic sentences, reduce to broadly pragmatic considerations about the optimal overall arrangement of our scientific system, why in the world should we persist in maintaining a fundamental distinction between them? Are we not simply attaching arbitrary labels to different sentences, with no remaining epistemological significance? Are we not then ineluctably driven to the "more thorough," and apparently more radical, pragmatic empiricism defended by Quine?

It is just here, however, that the true philosophical radicalism of Carnap's position emerges. In 1936, at the very beginning of his semantical period, he published "Von der Erkenntnistheorie zur Wissenschaftslogik" (from epistemology to the logic of science), the point of which is to argue that *all* traditional epistemological projects, including his own earlier project in the *Aufbau*, must now be renounced as "unclear mixtures[s] of psychological and logical components" (1936, 36). Whereas the broadly pragmatic and holistic epistemology Quine develops under the rubric of "empiricism without the dogmas" is intended as a replacement for, or reinterpretation of, what Quine takes to be the epistemology of logical empiricism (i.e., the *Aufbau*), Carnap (despite Quine's persistent attempts to associate him with varieties of epistemological foundationalism) is breaking decisively with the entire epistemological tradition. *Wissenschaftslogik* is in no way concerned with either explaining or justifying our scientific knowledge by exhibiting its ultimate basis (whatever this basis might be); it is rather concerned, instead, with developing a new role for philosophy vis-à-vis the empirical sciences that will maximally contribute to scientific progress while, at the same time, avoiding all the traditional metaphysical disputes and obscurities which have constituted (and, according to Carnap, continue to constitute) serious obstacles to progress in both philosophy and the sciences.[20]

The first major publication of Carnap's semantical period was *Foundations of Logic and Mathematics*, appearing in English in 1939. Here Carnap presents an especially clear and detailed account of the application of logic and mathematics in empirical science and, in particular, the central importance of the analytic/synthetic distinction therein. The application of logico-mathematical calculi in empirical science principally involves experimental procedures of counting and measurement (§§ 19, 23), whereby quantitatively formulated empirical laws yield testable statements about particular numerically specified outcomes via intervening logico-mathematical theorems. The scientific theory in question (in physics, for example) can thus be represented as an axiomatic system containing both logical and descriptive terms, where the logico-mathematical part of the system (containing only logical terms essentially) is, in its standard interpretation, analytic or L-true (in the semantical sense); and, because of the key role of numerical terms (including terms for real numbers) in the experimental procedure of measurement, this logico-mathematical part is most appropriately formulated as a higher-order system (§ 14, 18)—as opposed to an elementary or first-order logical system (§ 13)—containing a sufficient amount of arithmetic and analysis.[21]

Since Carnap is well aware, of course, that such higher-order logico-mathematical systems can and do lead to controversy, he immediately inserts a section on "The Controversies over 'Foundations' of Mathematics" (§ 20, compare § 15). Carnap's response to these controversies, not surprisingly, is the principle of tolerance, now formulated in a clearly semantical way:

> Concerning mathematics as a pure calculus there are no sharp controversies. These arise as soon as mathematics is dealt with as a system of "knowledge"; in our terminology, as an interpreted system. Now, if we regard interpreted mathematics as an instrument of deduction within the field of empirical knowledge rather than as a system of information, then many of the controversial problems are recognized as being questions not of truth but of technical expedience. The question is: Which form of the mathematical system is technically most suitable for the purpose mentioned? Which one provides the greatest safety? If we compare, e.g., the systems of classical mathematics and of intuitionistic mathematics, we find that the first is much simpler and technically more efficient, while the second is more safe from surprising occurrences, e.g., contradictions. (1939, 192–93)

As we have already seen, therefore, Carnap's main reason for regarding interpreted mathematics—arithmetic and analysis in their customary interpretations—as analytic or devoid of factual content is that doing so shifts our attention away from "correctness" or "truth" and toward the purely pragmatic or technical problem of language planning (compare note 13 above, together with the paragraph to which it is appended).

The case of geometry, however, is essentially different (§ 21). Here, although it is perfectly possible to give a logical or analytic interpretation of a geometrical calculus (within analysis, for example, in terms of real number coordinates), the standard or customary intepretation is descriptive or synthetic—as a theory of actual space. But the great lesson of Albert Einstein's general theory of relativity (§ 22) is that the geometry of actual (physical) space is an empirical question and, in particular, that it is therefore necessary sharply to distinguish between mathematical geometry (given some logical interpretation) and physical geometry (under the customary descriptive interpretation). The latter, as Einstein clearly shows, is a posteriori and synthetic, whereas the former is a priori but purely analytic. Moreover, since physical geometry is a quantitative empirical theory like any other, the appropriate logico-mathematical framework within which it is to be axiomatized must also contain sufficient arithmetic and analysis. For Carnap, therefore, it follows from Einstein's work that the key difference between geometry, on the one side, and arithmetic and analysis, on the other, is that the former is synthetic (a posteriori) in its standard or customary interpretation while the latter are analytic.[22] And it is this situation Carnap has foremost in mind in his repeatedly expressed conviction, characteristic of his semantical period, that the distinction between analytic and synthetic truth "is indispensable for the logical analysis of science," so that "without [it] a satisfactory methodological analysis of science is not possible" (see 1942, xi; 1963b, 932; 1966, 257).[23]

The critical question, however, concerns what exactly Carnap means by a "satisfactory methodological analysis of science." And the point I most want to emphasize, once again, is that what Carnap has in mind is the logic of science ("the logical analysis of science"), not any *epistemological* project. In particular, Carnap is not concerned, as is Quine, with developing a very general empiricist conception of justification or evidence simultaneously embracing scientific knowledge, common-sense knowledge, and logico-mathematical knowledge. Carnap is specifically concerned with the mathematical physical sciences characteristic of the modern period, which are themselves only possible in the first place if we presuppose a certain amount of sophisticated modern mathematics—arithmetic and analysis—for their precise articulation and empirical testing (compare note 16 above). And the point of the logic of science, moreover, is not so much to describe the nature of science or scientific method as it has been practiced so far as to open up the possibility for a new kind of ongoing philosophical interaction with the sciences, which, in Carnap's eyes, promises to be particularly fruitful for both. Armed with the new logico-mathematical tools of modern logic (especially the new tools of metamathematics), the philosopher—that is, the logician of science—can participate, together with the scientists themselves, in the articulation, clarification, and development of formal inferential frameworks for articulating empirical theories and testing them by experimental methods. Unlike the empirical scientist, however, the logician of science, as such, is not concerned with then actually testing empirical theories within such inferential frameworks. Moreover, unlike the applied mathematician (who also develops formal methods for use in the empirical sciences), the logician of science has a characteristically philosophical interest in developing a systematic method for defusing unresolvable metaphysical controversies which, in Carnap's view, constitute an ever-present obstacle to progress in both the sciences and philosophy. Indeed, it was precisely this enterprise—and not any epistemological project—that Carnap already had in mind in *Logical Syntax* when he famously asserted (1934/1937, § 72, 279 [205]) that

"*Wissenschaftslogik takes the place of the inextricable tangle of problems one calls philosophy*."[24]

Carnap's mature philosophical position therefore provides us with an echo of Kant, insofar as Carnap simply (and rightly) takes it for granted that the kind of empirical knowledge paradigmatically exhibited by modern science is itself only possible in the first place on the basis of a prior formal structuring of our knowledge claims by modern mathematics. And Carnap views such prior structuring, accordingly, as empty of empirical content—just as Kant, for his part, had earlier asserted that the only objects of knowledge are empirical objects ("appearances"), so that mathematics, strictly speaking, has no actual objects of its own.[25] Finally, Carnap views his conception of logic and mathematics as the other side of the coin, as it were, of a characteristically philosophical enterprise aiming to defuse all unresolvable metaphysical controversies once and for all—just as Kant, for his part, had earlier held that his explanation of how synthetic a priori knowledge is possible is the other side of the coin of the claim that the resulting "critique of pure reason" finally puts philosophy "on the secure path of a science" and sets aside all "mock combats" of the traditional metaphysical schools (B xiv–xv). But precisely here, as we have seen, the parallels end. Kant's "critique of pure reason" is certainly an epistemological project, addressed to the question how synthetic a priori knowledge is possible. For Kant, moreover, the enterprise of transcendental philosophy, wherein we pose and answer this question, takes place at a fundamentally different level from the mathematical and empirical sciences themselves. The logic of science diverges from Kant in both of these respects; and, in this sense, it is a truly revolutionary and distinctively Carnapian project, with no antecedents in the history of philosophy at all.

Quine, as we have seen, never fully appreciated the deeply original character of Carnapian logic of science. He assimilated it, instead, to a program in traditional epistemology, one which begins with the Kantian question how synthetic a priori knowledge is possible, replaces it with the question "How is logical certainty possible?" and concludes with the "linguistic doctrine of logical truth" as the supposed answer to this epistemological question (see the paragraph to which note 12 above is appended). Moreover, Quine's own approach to an empiricist epistemology echoes the earlier empiricism of Locke and Hume, insofar as Quine, like Locke and Hume before him, is simply blind to the essential constitutive role of modern mathematics in making modern empirical physical science possible in the first place. Indeed, a particularly striking example of this occurs in Quine's 1946 lectures on Hume: "I believe more good than harm has come to subsequent philosophy from Locke's ignorance of mathematics; the hypnotic effect of contemplating the miracle of mathematical certainty was a danger to which Locke was immune[; and] the result was beneficial even for purposes of an eventual clearer understanding of the nature of mathematical knowledge itself" (187, see note 15 above, together with the paragraph to which it is appended). What Quine has in mind by this last remark, as we have seen, are the nominalist doubts about the very content of mathematics first raised by Hume in the *Treatise*—doubts which, according to Quine, now have their counterpart in a more "sophisticated" nominalism formulated within modern (first-order) logic and soon to be published by Goodman and Quine (see the paragraph to which note 16 is appended).

Of course Quine very quickly abandoned this nominalist program, and he thereby decisively transcended, in particular, the extremely narrow limits of Humean empiricism. The resulting holistic and pragmatic epistemology is in fact distinctively Quinean, with no real antecedents in any earlier form of empiricism. Nevertheless, Quine's holistic empiricist account of logic and mathematics (which, according to Quine himself, is equivalent to the rejection of the analytic/synthetic distinction)[26] is the most distinctive and original feature of Quine's mature epistemology, and this account, in turn, is Quine's response, as we have seen, to the failure of his early nominalism (see note 17 above, together with the paragraph to which it is appended). So there is still a sense in which even Quine's mature epistemology—despite its undoubtedly much greater subtlety and power—provides us with an echo of Hume.

From Carnap's point of view, however, Quine's mature epistemology represents just as much of an externally motivated, purely philosophical intrusion into the ongoing progress of empirical science and the logic of science as Quine's earlier defense of nominalism. Accordingly, Carnap's impassioned admonition at the very end of "Empiricism, Semantics, and Ontology" still applies:

> The acceptance or rejection of abstract linguistic forms, just as the acceptance or rejection of any other linguistic forms in any branch of science, will finally be decided by their efficiency as instruments, the ratio of the results achieved to the amount and complexity of the efforts required. To decree dogmatic prohibitions of certain linguistic forms instead of testing them by their success or failure in practical use, is worse than futile; it is positively harmful because it may obstruct scientific progress. The history of science shows examples of such prohibitions based on prejudices deriving from religious, mythological, or other irrational sources, which slowed up the developments for shorter or longer periods of time. Let us learn from the lessons of history. Let us grant to those who work in any special field of investigation the freedom to use any form of expression which seems useful to them; the work in the field will sooner or later lead to the elimination of those forms which have no useful function. *Let us be cautious in making assertions and critical in examining them, but tolerant in permitting linguistic forms.* (1950a/1956, 221)

Here Carnap has specifically in mind Quine's empiricist doubts about the use of abstract entities (properties, modalities, intensions, and the like) in semantic theory, but the moral is much more general. Quine's rejection of the analytic/synthetic distinction on the basis of a holistic version of empiricist epistemology rests, from Carnap's point of view, on nothing more nor less than a fundamentally "irrational" *philosophical* "prejudice"— and, in particular, on the need for a more liberal empiricist response to the same qualms about the epistemic status of mathematics that had originally motivated Quine's earlier nominalism.[27] This form of empiricism, if adopted, cuts off the logic of science at its root. We thereby permanently cut ourselves off, Carnap believed, from the one remaining possibility for an ongoing progressive interaction between philosophy and the empirical sciences, and, what is worse, we reopen the door to the intractable obscurities and fruitless controversies of traditional metaphysics. Posterity will judge whether Carnap was right.

NOTES

An earlier version of this paper was presented on April 7, 2006, as the fifth annual Howard Stein Lecture in the Philosophy of Science at the University of Chicago. I am especially indebted to discussions on this occasion with Howard Stein and André Carus. The conclusion for which I argue is basically the same as one already argued (in relation to Quine) by Stein in his important paper "Was Carnap Entirely Wrong, After All?" (1992, 275): "that Carnap is a far subtler and a far more interesting philosopher than he is usually taken to be." But my argument is complementary to Stein's. Whereas Stein (1992) concentrates on the first public airing of the Carnap/Quine debate in 1950–51, and on its aftermath, I concentrate on developments leading up to these events—on Carnap's intellectual development from his student days at Jena to his mature philosophical position, and on Quine's development from his self-professed "discipleship" under Carnap in the early 1930s to what he calls his completed "apostasy" in "Two Dogmas of Empiricism."

1. Bruno Bauch was a leading member of the Southwest School of neo-Kantianism founded by Wilhelm Windelband. At Jena he was a close colleague and associate of Gottlob Frege's. After the Great War, for example, Frege joined Bauch's conservative *Deutsche Philosophische Gesellschaft* and published his last three papers ("Logical Investigations") in the official journal of this society, *Beiträge des deutschen Idealismus*. For Bauch and his relationship to Frege, see Sluga (1980, 1993). For Carnap's relationship to Bauch and neo-Kantianism more generally—including discussions of *Der Raum*—see Richardson (1998), Friedman (2000).
2. For extended discussion of this "formal structuring" by modern mathematical logic in the *Aufbau*, see Friedman (1987/1999, 1992a/1999), Richardson (1998); for its relationship to Kantian and neo-Kantian ideas see, in addition, Sauer (1985).
3. As we shall see below (note 22, together with the paragraph to which it is appended) "logico-mathematical truth," for Carnap, does not include geometry (in its customary interpretation).
4. See Carnap's official formulation of the principle of tolerance in § 17 of *Logical Syntax* (1934/1937, 52 [45]): "*In logic there is no morality*. Everyone may construct his own logic, i.e., his own form of language, as he wishes. Only, if he wants to discuss it with us, he must clearly indicate how he wishes to construct it, [and he must] give syntactic rules instead of philosophical arguments." All translations from *Logical Syntax* are my own—the page numbers in brackets are those of the (1934) German original. (Otherwise, I follow the convention on citations involving multiple editions of note 7 below.)
5. See, for example, Friedman (1999, chapter 9, especially §§ 6–7).
6. This understanding of the choice between classical mathematics and intuitionism is suggested by Carnap's reply to Evert Beth in the Schilpp volume. Carnap first explains how he understands, in general, the use of a metalanguage, whether syntactic or (as in his post-*Syntax* period) semantic (1963b, 929): "Since the metalanguage *ML* serves as a means of communication between the author and the reader or among participants in a discussion, I always presupposed, both in syntax and in semantics, that a fixed interpretation of *ML*, which is shared by all participants, is given. This interpretation is usually not formulated explicitly; but since *ML* uses English words, it is assumed that these words are understood in their ordinary senses." And it is clear, from the context, that the "fixed interpretation" in question involves the standard interpretation of classical arithmetic. Moreover, Carnap then applies this point, in particular, to the choice between classical

mathematics and intuitionism (929–30): "It seems to be obvious that, if two men wish to find out whether or not their views on certain objects agree, they must first of all use a common langauge to make sure that they are talking about the same objects. It may be the case that one of them can express in his own language certain convictions which he cannot translate into the common language; in this case he cannot communicate these convictions to the other man. For example, a classical mathematician is in this situation with respect to an intuitionist or, to a still higher degree, with respect to a nominalist."

7. When I give a citation listing both an earlier and a later edition, the page reference is to the later edition: in this case, the reprinting of Quine (1971) in Creath (1990).
8. Quine (1986, 16) describes "Truth by Contention" as containing "the seeds of my apostasy" from Carnapian discipleship. Quine (1971/1990, 463) begins by describing Carnap as "a towering figure," "the dominant figure in philosophy from the 1930's onward." Quine then describes *Logical Syntax*, in particular, as follows (463–64): "The book is a mine of proof and opinion on the philosophy of logic and the logic of philosophy. During a critical decade it was the main inspiration of young scientific philosophers. It was the definitive work at the center, from which the waves of tracts and popularizations issued in ever widening circles. Carnap more than anyone else was the embodiment of logical positivism, logical empiricism, the Vienna Circle."
9. Quine (1986, 16) describes these three lectures, in contrast to "Truth by Contention," as "uncritical." The lectures are published in Creath (1990, 45–103)—page references in the text are to this volume.
10. It is important to note, however, as André Carus has emphasized to me, that the first draft of *Logical Syntax*—which Quine (1986, 12) reports he read in 1931 "as it issued from Ina Carnap's typewriter"—also does not mention the principle of tolerance or the dispute between classical and intuitionist mathematics. So this fundamental breakthrough, for Carnap, was made between the first draft and the published version of 1934: see Awodey and Carus (forthcoming) for discussion of the emergence of the principle of tolerance between 1931 and 1934. Nevertheless, it appears that Quine's exposure to the first draft of *Logical Syntax* decisively shaped his own understanding of Carnap ever after.
11. This paper was written in 1954 for inclusion in the Carnap Schilpp volume; and I cite it from this volume—here Quine (1963, 385). It appears, by this time, that Quine had begun to recognize that his construal of Carnap does not perfectly match Carnap's own views, for he begins with a striking disclaimer (ibid.): "My dissent from Carnap's philosophy of logical truth is hard to state and argue in Carnap's terms. This circumstance perhaps counts in favor of Carnap's position. At any rate, a practical consequence is that, though the present essay was written entirely for this occasion, the specific mentions of Carnap are few and fleeting until well past the middle. It was only by providing thus elaborately a background of my own choosing that I was able to manage the more focussed criticisms in the later pages. Actually, parts also of the earlier portions correspond to what I think to be Carnap's own orientation and reasoning; but such undocumented points are best left unattributed." This disclaimer does not appear in later reprintings, e.g., in Quine (1966a).
12. "Truth by Convention" was first published in 1936 in a volume in honor of A. N. Whitehead. Much of the text corresponds rather closely to passages from the first lecture, on "The *A Priori*," from 1934. Section III, in particular, makes it clear that the Kantian "character of an inward necessity" is precisely what needs to be explained. Quine then raises doubts about whether the idea of linguistic convention (which had apparently satisfied him in 1934—see the paragraph to which note 9 above is appended) does, after all, provide the needed explanation.
13. Compare note 4 above, together with the paragraph to which it is appended. See also Carnap's discussion of "Language Planning" in § 11 of his autobiography. Carnap reports that this idea "did not immediately occur to [him]" when he first studied logic with Frege, but rather evolved gradually (1963a, 68): "Only later, when I became acquainted with the entirely different language of *Principia Mathematica*, the modal logic of C. I. Lewis, the intuitionistic logic of Brouwer and Heyting, and the typeless system of Quine and others, did I recognize the infinite variety of possible language forms. On the one hand, I became aware of the problems connected with the finding of language forms suitable for given purposes; on the other hand, I gained the insight that one cannot speak of 'the correct language form', because various forms have different advantages in different respects. The latter insight led me to the principle of tolerance. Thus, in time, I came to recognize that our task is one of *planning* forms of languages."