Introduction

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We live in an age in which the word "positivism" is used mainly as a term of abuse, both by philosophers and by workers in many other disciplines in the arts and sciences. It is gleefully declared that we live in a "postpositivist age." In a certain sense, this claim is obviously true; the logical positivism that flourished in the Vienna Circle of the 1920s and 1930s has clearly been superseded. Even Hans Reichenbach, who led the group of scientific philosophers in Berlin before Hitler took power in 1933, published his opposition to this brand of logical positivism in *Experience and Prediction* (1938). Nevertheless, two considerations underlie the recent usage of "logical empiricism" to include both the Vienna and the Berlin groups. First, the widespread misunderstanding of "positivism" strongly suggests the wisdom of abandoning this term. Second, the underlying unity of method and spirit that has developed from these early roots firmly supports a comprehensive label. Thus, in this introduction, we follow the precedent of contemporary Viennese scientific philosophers in using the term "logical empiricism" to denote a philosophical movement that grew from nineteenth-century roots early in the twentieth century and that progressed to the scientific philosophy we pursue at the dawn of the twenty-first century. The present book is devoted to a deep investigation of the historical development and present status of this tradition. The reference to contemporary perspectives in the title emphasizes the fact that the majority of the essays involve theoretical considerations as well as historical scholarship.

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For decades, logical empiricism has been characterized by the opposition between two distinct philosophical outlooks, which have frequently been called "Continental philosophy" and "analytic philosophy." This terminology is unfortunate for various reasons. First, the English Channel is not a philosophical distinction; it is a geographical fact of nature. To talk of the opposition between "Continental" and "analytic" philosophy is a category mistake.[1] Second, many of the most important roots of "analytic" philosophy grew in Continental soil, especially Vienna and Berlin, where logical empiricism was born.[2] Another major root is, however, in British soil; the empiricist tradition of John Locke, David Hume, John Stuart Mill, and Bertrand Russell also contributes importantly to "analytic" philosophy. Thus, the distinction is geographically unsound. Third, what is generally regarded as "analytic philosophy" split into two distinct branches. In the Anglo-American world, much of "analytic philosophy" took the form of "ordinary language analysis," an approach often at odds with the scientific orientation of logical empiricism. Very roughly, it might be said, logical empiricism found inspiration in the early work of Ludwig Wittgenstein (the *Tractatus Logico-Philosophicus*), while ordinary language analysis related quite directly to his later works (especially *Philosophical Investigations*).[3]

Although we cannot avoid the "Continental/analytic" terminology, a major purpose of this book is to override this inaccurate and inappropriate distinction by examining in detail the development of important twentieth-century movements in philosophy. There are, of course, certain philosophers who are almost universally taken as outstanding representatives of so-called Continental philosophy—for example, Edmund Husserl and Martin Heidegger. Certain others—for example, Moritz Schlick and Rudolf Carnap—obviously represent so-called analytic philosophy (of the scientifically oriented variety).

The essays in part 1, "Turning Points and Fundamental Controversies," lay out some of the main historical features of the philosophical developments to which this book is devoted. They furnish the big picture. Michael Friedman takes us back to Immanuel Kant in order to exhibit the emergence of two distinct versions of *neo*-Kantian philosophy. One of these developed into "Continental philosophy," the other into "analytic philosophy." Gottfried Gabriel pursues a similar theme. Both of these essays deal extensively with the conflict between Carnap and Heidegger. Roberta Lanfredini analyzes the opposition between Schlick and Husserl with regard to the form versus content issue in scientific knowledge. Paolo Parrini's essay in part 7 deals with the closely associated issue of the relationship between reason and perception, a vital problem for post-Kantian philosophy.

Not all roots of "analytic" philosophy grew on Continental soil. The work of Bertrand Russell was greatly admired by logical empiricists on the Continent.[4]

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Recall that the opening epigram of Carnap's *Logische Aufbau* is Russell's famous "supreme maxim of scientific philosophizing"—namely, "Wherever possible, logical constructions are to be substituted for inferred entities." A key element of the logical empiricist tradition is the criterion of cognitive significance; its intent is the elimination of traditional metaphysics.[5] This aim has been expressed in a great variety of ways ever since the days of the medieval philosopher William of Ockham. Both Hume and Russell share this goal.[6]

In general, logical empiricists took the term "logical" very seriously. They were strongly influenced by Gottlob Frege and by Whitehead and Russell. Alfred Tarski and many other Polish logicians were influential. Kurt Gödel firmly established results of great significance. S. Awodey and A. W. Carus deal with a dispute between Carnap and Gödel. Like the Carnap-Heidegger controversy, the Carnap-Gödel debate centers on deep metaphysical issues, in particular, the reality of abstract entities. These authors maintain that Gödel's objections do not constitute a decisive refutation of Carnap's views.

Part 1 deals essentially with external relations between logical empiricism and other philosophical movements; part 2, "On the Origin and Development of Logical Empiricism," is internally oriented. Thomas Uebel urges us to take account of the *anti*-Kantian—as opposed to *neo*-Kantian—orientation of "the first Vienna Circle" and its contribution to the later Vienna Circle. The philosopher-scientists of the first Vienna Circle (especially Hans Hahn, Otto Neurath, and Philipp Frank) were positively influenced by such other philosopher-scientists as Ernst Mach and Henri Poincaré. The influence of Kant was overwhelmingly negative. Uebel takes the admission of the German scientific philosopher Carnap to the group as the dividing line between the first Vienna Circle and the later one. George Reisch investigates a deep division within logical positivism—namely, the conflict between Carnap and Neurath. Gereon Wolters, citing an important unpublished statement by Carl. G. Hempel, provides further elaboration of this internal division.

Logical empiricists were influenced by many philosophers who cannot be classified as members of their movement. Wittgenstein is an outstanding example. The logical atomism of Russell and Wittgenstein was taken very seriously by the "second Vienna Circle." Stern deals in depth with Wittgenstein's *Tractatus* and with the exceedingly wide variety of interpretations it has enjoyed over many decades since its publication. The unique influence of the *Tractatus* deserves to be singled out in a part of its own—part 3, "The Riddle of Wittgenstein."

The essays in part 4 take up some of the main themes of part 1, but they do so in the context of technical physics. In particular, the essay of T. A. Ryckman is closely associated with Friedman's; Michael Stöltzner's essay bears a close relation to Uebel's. According to Friedman and Ryckman, Ernst Cassirer is a focal point.

Friedman concludes that Cassirer is an appropriate starting point for understanding the relation between "Continental philosophy" and "analytic philosophy"; Ryckman takes up the issue at that point and studies in detail the conflicting paths taken by Cassirer and Reichenbach (whose relationship to Einstein was closer than that of any other logical empiricist).[7] Our attention is drawn to their conflicting interpretations of the general theory of relativity. Individuals with an interest in history and philosophy of physics, and with some sophistication in physics, would find it profitable to read the contributions of Friedman and Ryckman in direct succession.

Uebel and Stöltzner discuss developments in Vienna, where the influence of Ernst Mach was strong. Unlike Ryckman, Stöltzner focuses on microphysics—that is, the kinetic theory of gases and quantum mechanics. He shows that, before the advent of quantum mechanics as developed by Schrödinger and Heisenberg, an indeterministic world picture was emerging. The work of Ludwig Boltzmann on kinetic theory showed that the second law of thermodynamics is a statistical law that appears deterministic only because of the large numbers of molecules in any sample of gas we might study. In cases where much smaller numbers were involved, the second law might actually be violated. Brownian motion, which had been known for most of the nineteenth century, seemed to be a case in point. While some physicists, for example, Max Planck, resisted an indeterministic interpretation, others, like Philipp Frank, came to accept indeterminism. On this issue, Stöltzner argues, there was no conflict between Mach and Boltzmann. Reichenbach and Richard von Mises strongly supported the indeterministic approach even though they had serious disagreements regarding the concept of probability itself.[8] The arrival of quantum mechanics greatly strengthened the indeterministic position. Stöltzner introduces Franz Serafin Exner as a pivotal participant in the transition from deterministic to indeterministic physics in Vienna. "Exner's synthesis between Mach and Boltzman paved the way to accept genuine indeterminism in physics without any reference to quantum mechanics" (this volume, 199). Individuals with strong interests in history and philosophy of physics, and a modicum of sophistication in physics, would do well to read Uebel's and Stöltzner's essays in direct succession.

Physics was not the only science to which logical empiricists directed their attention; psychology was also a subject of major interest. Indeed, it may be said that Cartesian mind-body dualism posed serious challenges. The essays in part 5, "The Mind-Body Problem," deal with problems in this area. Michael Heidelberger argues against the view that the contemporary debate of the mind-body problem emerged independently in the United States and Australia in the late 1950s. Going back to Gustav Theodor Fechner in the middle of the nineteenth century, he shows how

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the articulation of the doctrine of psychophysical parallelism "marks a turning point in the history of experimental and quantitative psychology, but also . . . in the history of the mind-body debate" (this volume, 236). The ensuing discussions of psychophysical parallelism led eventually to the neutral monism of Mach and Russell. Moreover, in the early decades of the twentieth century, Schlick and Carnap struggled with exactly the same problems. Just as contemporary philosophy of physics grew from nineteenth-century roots, so also did contemporary philosophy of psychology.

Jaegwon Kim takes up the mind-body problem in the work of logical positivists in the first three decades of the twentieth century—in particular, Schlick, Carnap, Hempel.[9] After pointing to the early phenomenalistic theories of the world, especially in Carnap's *Logische Aufbau,* he discusses the logical behaviorism and physicalism that followed. While logical behaviorism construes the realm of the mental in terms of overt behavior, physicalism admits neurological facts as well. This latter move opens the door to mind-brain identity theories. Kim then points out that in Carnap's work in the 1930s we find a clear anticipation of contemporary functionalist theories. Carnap construes mental events in terms of *dispositions* to exhibit certain types of behavior in certain circumstances, but he also voices the theory that the dispositions themselves may, on the basis of advances in neuroscience, be identified with neurological states. Kim concludes, "Reading the literature again, I was impressed by the metaphysical depth and sophistication in the positivist philosophers, especially Carnap" (this volume, 277).

Scientific rationality, the subject of part 6, was obviously a major focal point of interest for the entire movement of logical empiricism. Carnap and Reichenbach, in particular, saw rationality as intimately connected to probability. Reichenbach's doctoral dissertation (1915) was devoted to this concept,[10] as were several of his later works—most important, *Wahrscheinlichkeitslehre* (1935), *Experience and Prediction* (1938), and *The Theory of Probability* (1949).[11] Carnap turned his attention to probability in the 1940s, and his work of this period culminated in *Logical Foundations of Probability* (1950) and *The Continuum of Inductive Methods* (1952). As Maria Carla Galavotti explains, Reichenbach steadfastly maintained until his death in 1953 that the frequency interpretation is the only legitimate interpretation of the probability calculus. He distanced his conception from that of another logical empiricist, Richard von Mises, who also admitted only a frequency interpretation. Carnap, too, supported the frequency interpretation, but, unlike the others, he firmly denied that it is the only satisfactory concept. Instead, he developed in great technical detail a logical interpretation that he identified with degree of confirmation.

During the 1920s, as Galavotti points out, two important figures who were not identified with logical empiricism began developing a subjective interpretation

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—Frank Ramsey in England and Bruno de Finetti in Italy. Both Ramsey and de Finetti made important direct connections between probability and rational decision theory. Reichenbach never took the subjective approach seriously. Carnap, in his later works on probability, was strongly influenced by subjectivists, though he never actually adopted any thoroughgoing form of subjectivism.

Martin Carrier discusses nonprobabilistic theories of confirmation—in particular, the qualitative approaches of Hempel and Clark Glymour. Although Hempel's 1945 theory came to grief on a number of issues—including some substantial difficulties exposed by Carnap (1950)—Carrier shows how Hempel's fundamental notion of confirmation by instantiation was explicitly adopted in a much improved form in Glymour's bootstrapping theory. Carrier explains how the Hempel-Glymour approach contradicts the hypothetico-deductive method as well as the Bayesian theory. Carrier emphasizes both the continuity and the progressive nature of the logical empiricist movement.

Gürol Irzik brings Thomas Kuhn's famous challenge to the logical empiricist concept of scientific rationality into the limelight, and he considers with great care the real versus the merely perceived conflict between Kuhn and Carnap. He exposes common misconceptions of conflict between Kuhn and Carnap showing —roughly speaking—that Kuhn was less of a relativist and Carnap more of a relativist than they have traditionally been pictured. He exposes the inaccuracy of charges of irrationalism leveled against Kuhn, especially those appearing soon after *The Structure of Scientific Revolutions*. He shows how both Carnap and Kuhn differ from Karl Popper regarding the degree of normativity of principles of scientific methodology.

The final section, "Nonlinguistic Empiricism," contains the essays by two of the editors. Paolo Parrini takes denial of the existence of synthetic a priori knowledge as the basic tenet of empiricism. (His coeditor Wesley Salmon agrees.) Looking at Kantian and neo-Kantian defenses of synthetic a priori knowledge, as well as arguments of empiricists against such knowledge, he concludes that the key epistemological issue is the relation of dependence or independence between reason and perception. According to Kant, reason and perception are not independent, because reason imposes general conditions on perceptual knowledge. The role of the synthetic a priori is precisely to characterize these conditions. The problem for the empiricist is to explain how perceptual knowledge can exist without prior constraints of reason.

The early logical empiricists failed to deal adequately with this problem, fearing, perhaps, that careful examination of perception would lead to psychologism —a position they staunchly rejected. Failure to address this issue opened the door to critiques of empiricism by such philosophers as Kuhn, Feyerabend, and Hanson.

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Answering such challenges has not been easy. Yet, if one desires to defend empiricism, one must come to terms with this basic issue. Because of the standard account of scientific theories that emerged among logical empiricists, the issue turned into a linguistic one. According to this account, we have two separate languages, the theoretical language and the language of perception. Scientific theories are conceived as axiomatic systems, which, as uninterpreted systems, say nothing about the world. A link to the world is achieved via correspondence rules that connect the perceptual terms to the terms of the theory. The strongest attack against this conception of scientific theories was made by those who claim that all scientific terms, including the so-called observational terms, are theory-laden.[12]

Parrini argues that the fundamental epistemological problem of perception cannot be resolved strictly within a linguistic context. A relationship between language and reality requires something akin to ostensive definition. Citing Schlick's *Allgemeine Erkenntnislehre,* he points out that the kind of knowledge involved is not acquaintance *(kennen)*—that, for Schlick, is not knowledge at all—but rather recognition *(wiedererkennen).* This requires that humans recognize different objects as being of the same kind—it amounts to the discovery of identity within diversity. How this is achieved is a matter for psychology. The crucial epistemological point is that we are able to do it. This is a matter of fact. The answer avoids psychologism because it leaves the how question to psychology. It turns out, then, that the question of the relation between reason and perception cannot be settled a priori. The answer to this question takes us out of the realm of language and provides the basis for a nonlinguistic form of empiricism. It answers a question that logical empiricists largely left unanswered—namely, How can we establish the independence of perception from reason, thereby sustaining the conclusion that there is no synthetic a priori knowledge?

Wesley Salmon's essay discusses the grounds on which the notorious criterion of cognitive significance was quite generally rejected by logical empiricists and suggests that it occurred mainly for the wrong reasons. He points out that Alonzo Church's famous refutation of A. J. Ayer is actually *totally irrelevant* to the significance criterion; instead, it refutes Ayer's characterization of verification. Salmon's chief complaint—directed at several criticisms—is that confirmation (in the context of verifiability to some degree) was construed exclusively in terms of deductive relations. This is the underlying problem in Ayer's case. Deductive chauvinism strikes again!

One frequent criticism directed against the criterion is that, if applied to itself, it classifies itself as meaningless. This criticism is entirely misguided. The criterion does not pretend to be a cognitive statement; it is intended as a regulation or a rule of procedure. Accordingly, the nonapplicability of empirical evidence is irrelevant;

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fundamental rules of this sort require vindication in terms of pragmatic considerations, not validation on the basis of empirical evidence. The justifiability of the criterion hinges on issues of intellectual responsibility. The thesis that the verifiability principle must be considered, not as a cognitive statement, but as rule of method and that, as such, had to be defended on the basis of considerations regarding the type of intellectual culture they were trying to promote—responsible, free, intersubjective, etc.—was defended in Italy by the philosopher Giulio Preti (1911–72) in his numerous essays on logical empiricism. Salmon maintains that knowledge of unobservable objects (frequently designated by the unfortunate term "theoretical entities"—another category mistake) can be achieved by analogical and causal reasoning that depends on the nature of the physical world. Both Salmon and Parrini attempt to show how a viable empiricism is dependent on how the world actually works.

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Logical empiricism dominated epistemology—in philosophy of science specifically and in philosophy more generally—throughout the twentieth century. It has been embraced by some philosophers and rejected by others, but it has served as the main point of reference throughout this time. Its most severe crisis arose around midcentury from the work of such postpositivist philosophers as Kuhn, Hanson, Feyerabend, and Lakatos. Even if we consider their attacks decisive—a point of view we do not consider conclusively established—we believe that empiricism survives at the beginning of the twenty-first century in its nonlinguistic form. In the past thirty years, we have become progressively more aware that the crisis of logical empiricism cannot be considered a crisis for empiricism as such. We hold, moreover, that this nonlinguistic form of empiricism need not be as restrictive as van Fraassen's nonlinguistic empiricism; our view sanctions empirical knowledge of unobservable objects. For logical empiricists and those who hold opposing views, the papers collected in this volume should be proof of the influence exercised by the philosophical spirit that animated the protagonists of logical empiricism.

Notes

1. This point is articulated clearly in Gottfried Gabriel's contribution to this volume.
2. This point is elaborated in Gereon Wolters's contribution to this volume.
3. David Stern's essay on the *Tractatus* searchingly investigates Wittgenstein's influence on "analytic philosophy."
4. We should not forget the role played by the English philosopher Alfred North Whitehead in the authorship of *Principia Mathematica*. Whitehead, not Russell, is the first author of this work.

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5. Maria Carla Galavotti's essay exhibits a deep relationship between the criterion of cognitive significance and the work of Carnap and Reichenbach on the concept of probability.

6. David Hume provides the point of departure for Wesley Salmon's essay on the verifiability principle in this volume.

7. Schlick and Reichenbach held closely related interpretations of general relativity, and they interacted constructively on this issue.

8. See Maria Carla Galavotti's essay in part 6 for further information regarding this conflict.

9. The above-mentioned distinction between "scientific analytic philosophy" and "ordinary language analysis" became especially significant in philosophy of psychology. The former approach takes account of empirical work in psychology; the latter attempts to eliminate confusions in our discourse on mind and matter. Kim's essay brings out the distinction between these approaches in his analysis of the distinction between two senses of "definition" found in these two schools of thought.

10. In his "Autobiographical Sketches for Academic Purposes," in M. Reichenbach and R. S. Cohen, eds., 1978, vol. 1 (Dordrecht: Reidel), Reichenbach says, "I came to explore the validity of the laws of probability for reality. . . . Although I had used Kantian philosophy to dress up the solution I had offered for the problems, I am still convinced that the basic idea of this work is very essential; it is one of the foundations of my present conception of the problems of probability" (1). At the time he wrote his dissertation, he was familiar with the ideas of Johannes von Kries.

11. This is an English translation of the 1935 book with much added material.

12. In the mid-1940s, I (W.C.S.) was employed as a laboratory technician at the University of Chicago Metallurgical Laboratories (later Argonne National Laboratory). One of my tasks was to build a galvanometer pier; the instrument we were using was extremely sensitive to external vibrations, such as those caused by trucks passing on the street. My goal was to build a structure that would dampen such vibrations. I began by getting a large wooden box, which I filled almost completely with sand. On the sand, I piled a layer of concrete blocks, and on top of that, a thick layer of newspapers. I continued to make several alternate layers of concrete blocks and newspapers. On the top layer of concrete blocks I put some sort of tabletop (perhaps a piece of plywood; I can't recall). The galvanometer stood on top of the whole thing. While the term "galvanometer" is obviously theoretical, I cannot find any interesting sense in which "wooden box," "sand," "concrete block," "newspaper," and "plywood" are theory laden.