SEARCH FOR A NATURALISTIC WORLD VIEW

VOLUME I

Scientific Method and Epistemology

ABNER SHIMONY

Search for a naturalistic world view

VOLUME I

Scientific method and epistemology

ABNER SHIMONY
Professor of Philosophy and Physics
Boston University

CAMBRIDGE
UNIVERSITY PRESS

Published by the Press Syndicate of the University of Cambridge
The Pitt Building, Trumpington Street, Cambridge CB2 1RP
40 West 20th Street, New York, NY 10011-4211, USA
10 Stamford Road, Oakleigh, Victoria 3166, Australia

First published 1993

Printed in the United States of America

Library of Congress Cataloging-in-Publication Data

Shimony, Abner.

Search for a naturalistic world view / Abner Shimony.

p. cm.

Includes index.

Contents: v. 1, Scientific method and epistemology –
v. 2, Natural science and metaphysics.

ISBN 0-521-37352-2 (v. 1), – ISBN 0-521-37744-7 (v. 1 : pbk.)
ISBN 0-521-37353-0 (v. 2), – ISBN 0-521-37745-5 (v. 2 : pbk.)

1. Science – Methodology. 2. Science – Philosophy. 3. Knowledge, Theory of. 4. Metaphysics. I. Title.
Q175.S53483 1993
501 – dc20 92-38168
CIP

A catalog record for this book is available from the British Library.

Volume 1
ISBN 0-521-37352-2 hardback
ISBN 0-521-37744-7 paperback

Volume 2
ISBN 0-521-37353-0 hardback
ISBN 0-521-37745-5 paperback

To Dora Farber Shimony,
with love and gratitude

the pillar of cloud by day, and the pillar of fire by night
—Exodus

Acknowledgments

The pleasantest duty in compiling this collection of essays is to acknowledge a number of people who influenced them in one way or another, by formative ideas, inspiration, discipline, suggestions for research, criticism, and encouragement. I have enjoyed the friendship of three generations, that of teachers, that of fellow students and colleagues, and that of my students. In thanking all of them publicly I hope not only to fulfill my personal obligation to them, but to provide an elucidation to readers that could hardly be accomplished in another way. Although I subjectively regard my world view as a coherent synthesis of many elements, I have sufficient detachment to realize that the reader could easily be surprised and baffled by certain tensions, certain contrapositions of thesis and antithesis, and certain shifts of method in my expositions. I wish the reader not to regard these as inconsistencies or idiosyncrasies, but instead to recognize that complexity is inevitable in a world view to which many diverse influences have contributed.

The philosophers from whom I learned most during my undergraduate years at Yale (1944–48) were Frederic Fitch, Paul Weiss, and Robert Calhoun. Their ideas and styles of thought exercised a direct influence on me, and in addition they introduced me to three profound philosophers: Alfred North Whitehead, Charles S. Peirce, and Kurt Gödel.

Fitch was diffident in manner but rigorous in reasoning. He had developed an elegant formulation of predicate calculus and some demonstrably consistent and mathematically rich systems of logic. But what most impressed me was his application of logic to some traditional philosophical problems: possibility and necessity, the ontological status of mathematical entities, inductive inference, and the existence of God. In one seminar, I recall, he demonstrated the existence of God (in the sense of a proposition that logically implies all true propositions) and then shyly said that if he were now allowed to strengthen his premisses slightly he could demonstrate monotheism. I was already dimly aware of the division of professional philosophy into analytic and speculative subdisciplines, but the example of Fitch consciously or unconsciously strengthened my resolution not to accede to this bifurcation.

Weiss was ebullient and enormously energetic. He is the only philosopher of my personal acquaintance who has deliberately set out to construct a "system." I was greatly impressed by Weiss's book *Reality,* and even though later I became very critical of his mode of philosophizing I never abandoned certain theses of that book: especially, the interdependence of the criteria of coherence and correspondence, the meshing of epistemology and ontology, and the role of adumbration in perception. I am also grateful to Weiss for his encouragement to be daring and to attempt some original (even if grossly premature) ventures with difficult philosophical problems.

Calhoun was the most charismatic person I had ever encountered – deeply religious, politically courageous, dignified without any self-aggrandizement, and wonderfully eloquent. His introductory course in history of philosophy was legendary, and I learned the fascination of the history of ideas more from him than from anyone else. He mainly taught in the Divinity School, and to hear more of his lectures I attended his course on the history of Christian doctrine, which interested me primarily because of his presentation. Once while returning from his lecture I was reviewing in my mind the *homoousia–homoiousia* controversy and was thrown from my bicycle, which taught me (as others had learned previously) that theological disputes can be hazardous to one's health.

Weiss had been Whitehead's graduate student, Calhoun regarded Whitehead as the greatest twentieth-century philosopher, and Fitch was an expert on his and Russell's *Principia Mathematica.* As a result, I studied Whitehead more seriously than any other philosopher. His speculation that the ultimate concrete entities in the universe are protomental seemed to me to be the obvious solution to the mind–body problem, and I still regard it as a deep idea that has not been sufficiently explored. I was impressed (but later with many reservations) by the liaisons he established between his philosophy of organism and modern physical theory. I was convinced then (though not now) that Whitehead's theory of prehensions provided an answer to Hume's skeptical doubts about induction. Whitehead's philosophical methodology, which combines phenomenology and the hypothetico-deductive method (Chap. 1 of the first part of *Process and Reality,* Chap. 15 of *Adventures of Ideas*) seemed then to be admirable and still does.

Weiss had been co-editor with Charles Hartshorne of the first six volumes of the Harvard edition of Peirce's papers. I read Peirce avidly and assented to almost everything that I understood of his semiotics, phenomenology, scientific methodology, pragmatism, critical common-sensism, and evolutionary metaphysics. Peirce's mixture of logical toughness, immersion in the history and practice of the natural sciences, and metaphysical speculation was inspiring to me then and continues to be so.

I heard about Gödel's incompleteness theorem from Fitch without studying it in detail, but we did devote a semester to reading his *Consistency of the Continuum Hypothesis*. This reading helped me to appreciate the philosophical passages in Gödel's articles "Russell's Mathematical Logic" and "What Is Cantor's Continuum Hypothesis?" I was convinced that the propositions of mathematics could not be regarded as tautologies (as held by Ramsey and Wittgenstein) but are analytically true because of internal relations among concepts, that mathematical entities have a Platonic mode of existence, that impredicative definitions are not inherently vicious, that human intuition into mathematical relations is penetrating but "astigmatic," and that the hypothetico-deductive method is an appropriate tool in the foundations of mathematics. Although I claim no expertise on philosophy of mathematics, I continue to be convinced by these theses of Gödel, as well as by most of the reports of his ideas on logic and mathematics in Hao Wang's *Beyond Analytic Philosophy* and *Reflections on Gödel*.

Whitehead, Peirce, and Gödel were all monumental figures in the history of logic, who greatly influenced various branches of twentieth-century analytic philosophy. It was indicative of the unusual character of philosophy at Yale University in the forties that an assiduous student could be somewhat acquainted with the work of these three masters and yet almost entirely unaware of the movements which they affected. Although I did read Wittgenstein's *Tractatus* with Rulon Wells, I barely heard of the Vienna Circle and vaguely recall dismissing what I did hear of it as "nominalism." The news that reached me of the therapeutic linguistic philosophy of later Wittgenstein, Ryle, and Austin seemed to me incredible, and I conflated them with Korzybski and Hayakawa.

Finally, I should mention another kind of influence at Yale. Although I did not take Henry Margenau's course in philosophy of physics, I did take a course in mechanics with him and was made aware that there are some important connections between physics and philosophy. This awareness was strengthened by conversations with Adolf Grünbaum, who arrived as a graduate student at the end of my undergraduate career. Their influence became effective after a few years of delay.

When I went to the University of Chicago (1948–49), Rudolf Carnap influenced me more than any other faculty member. He was an immensely impressive man, who had raised the level of rigor in the fields of logic, analytic philosophy, semantics, and philosophy of science, and he seemed to have at his command an inventory of all the important argumentation in the many fields of his research. I did not become his disciple, mainly because of the conviction of the significance of metaphysical statements that I had contracted from my former teachers and from the writings of Whitehead, Peirce, and Gödel. Carnap did not demand discipleship,

however, and he was generous with his time and encouragement, although he must have been perplexed by my peculiar combination of interests in logic, mathematics, and metaphysics. Aiming at the standards of clarity in expression and argument that Carnap set was a most valuable discipline. His formulation of the problems of probability and induction constituted the framework within which my doctoral research was conducted; and even though I returned to Yale for this work and he left Chicago for the Institute for Advanced Study, he continued to give me excellent criticism and advice.

At Chicago Richard McKeon gave unique instruction in reading philosophical texts, with attention to organization and to details; and he made comparisons of philosophical systems, asserting their "incommensurability" (to use a later term) due to shifts of meanings of crucial terms and differences in modes of reasoning. Reading with John William Lenz, who had been a student of McKeon earlier, was very helpful for learning McKeon's techniques away from the tension of the classroom. I never accepted the thesis of incommensurability, but was disciplined in my later work by attention to his theses and analyses.

After I returned to Yale John Myhill was on the philosophy faculty for two years, teaching splendid courses in proof theory and recursive function theory. I am mainly grateful to him, however, for discouraging my ambition in mathematical logic, therefore effectively exiling me to the world of concrete existence.

In 1955 I went to Princeton to seek a second doctorate in physics. The faculty was extraordinary, and the entire experience was strenuous and revealing. I am most deeply grateful to Eugene Wigner, who directed my doctoral dissertation on statistical mechanics and encouraged my later work on foundations of quantum mechanics. The preponderance of the physics community at that time accepted some variant of the Copenhagen interpretation of quantum mechanics and believed that satisfactory solutions had already been given to the measurement problem, the problem of Einstein–Podolsky–Rosen, and other conceptual difficulties. My decision to devote much research effort to these problems would have been emotionally more difficult without Wigner's authority as one of the great pioneers and masters of quantum mechanics. Equally important was the inspiration of witnessing Wigner's immersion in scientific research and of hearing him say that when one understands a phenomenon one has "an elevated feeling."

I also learned much from the classes of John Archibald Wheeler, from later conversations with him, and from his papers. There is no other living physicist who combines to the same degree the daring to make far-reaching speculations ("geometrodynamics," "superspace," "charge without charge," "mass without mass," "law without law," etc.) with control

of the mathematical apparatus needed for inferring consequences of speculations and making connections with experiment. I do not know whether he would accept the denomination "experimental metaphysician," but he has been an inspiration for me to do so.

Two other great physicists were de facto my teachers without official status. While I was teaching at MIT (1959–68), I took Laszlo Tisza's course on statistical thermodynamics, and I had valuable conversations with him then and later regarding the physics of open systems, the proper ontology of microphysics, the methodology of physical theory, and other matters. The other was John S. Bell, whose theorem on the impossibility of a "local" hidden-variables interpretation of quantum mechanics is regarded by many people, including myself, as the most profound discovery in natural philosophy in our generation, and who was working at the time of his death on the stochastic modification of quantum mechanics, which he felt to be a viable and promising idea. Although he was not formally trained in philosophy, he possessed philosophical virtues more purely than any other person of my acquaintance: intense desire for deep understanding, breadth of perspective, great analytic power, strong endowment of common sense, and complete intellectual honesty. Bell not only posed some of the most important research problems in the foundations of quantum mechanics but set the standards for work in the field.

The person whose influence is most pervasive throughout these essays is not a teacher but a close friend and collaborator since our student days at the University of Chicago, Howard Stein. Because of the similarities in our background and interests, and probably also because of the exchange of ideas over a period of more than four decades, we have arrived at similar opinions about the indispensability of mathematics, physics, conceptual analysis, history of science, and history of ideas to philosophy generally, and especially to philosophy of science. I have drawn upon his expertise in all of these, especially in mathematics and history of science, where his knowledge is much deeper and more detailed than mine. In addition to recognizing all these elements, one must properly combine them, and Stein's philosophical studies of episodes in the history of physics from Galileo and Newton to the present are unparalleled models in this respect. Finally, he has meticulously read a large number of my essays and has given such penetrating criticism that I have come to regard him as a second intellectual conscience.

I have greatly benefited since 1968 from the opportunities provided by a joint appointment in Philosophy and Physics at Boston University and from the stimulation of colleagues in both departments. All have been tolerant of my cross-disciplinary teaching and research, and some have even accepted my thesis that there is no sharp boundary between the fields. There have been continuing lively discussions of naturalistic epistemology,

foundations of quantum mechanics, and reductionism. I am particularly indebted to Robert Cohen, Marx Wartofsky, John Stachel, Charles Willis, George Zimmerman, Armand Siegel, Michael Martin, Judson Webb, Joseph Agassi, James Hullett, Milič Čapek, Jaakko Hintikka, and Sahotra Sarkar.

Long-forgotten conversations with innumerable friends and students have surely left their imprint on these essays in ways that I cannot reconstruct. However, I can at least acknowledge my indebtedness to those I remember: Joel Lebowitz, Bernard d'Espagnat, Richard Jeffrey, Carl Hempel, Andrew Frenkel, Stanley Tennenbaum, Robert Palter, Kenneth Friedman, Penha Dias, Nicolas Gisin, Philip Pearle, Donald Campbell, Don Howard, Martin Klein, David Mermin, Sylvan Schweber, David Bohm, Yakir Aharonov, Herbert Bernstein, Andre Mirabelli, Hyman Hartman, Hans Primas, Paul Teller, Georges Lochak, Michael Redhead, Gordon Fleming, and Louis Mink.

I am indebted to my collaborators in research – Michael Horne, John Clauser, Richard Holt, Anton Zeilinger, and Daniel Greenberger – for their expertise in quantum mechanics, atomic phyics, and optical and neutron interferometry, but much more for sharing the excitement of the hunt.

So far I have only thanked those who affected my professional training and research, but there were earlier influences. Especially the formation I received from Morris and Dora Shimony was permanent and generated a feeling toward the natural world that preserves a kind of religious sentiment. I hope that the arguments and analyses of these essays do not conceal the sense of wonder that animates them.

Abner Shimony is an eminent philosopher and theoretical physicist, best known for contributions to experiments on foundations of quantum mechanics, notably the polarization correlation test of Bell's Inequality and thereby of the family of local hidden-variables theories. *Search for a Naturalistic World View* consists of essays written over a period of four decades and aims at linking the natural sciences, especially physics, biology, and psychology, with epistemology and metaphysics. It will serve professionals and students in all of these disciplines.

Volume I, *Scientific Method and Epistemology,* advocates an "integral epistemology" combining conceptual analysis with results of empirical science. It proposes a version of scientific realism that emphasizes causal relations between physical and mental events and rejects a physicalist account of mentality. It offers a "tempered personalist" version of scientific methodology, which supplements Bayesianism with *a posteriori* principles distilled from exemplary cognitive achievements. It defends the general reliability, corrigibility, and progressiveness of empirical knowledge against relativism and skepticism.

Volume II, *Natural Science and Metaphysics,* widely illustrates "experimental metaphysics." Quantum-mechanical studies argue that potentiality, chance, probability, entanglement, and nonlocality are objective features of the physical world. The variety of relations between wholes and parts is explored in complex systems. One essay proposes that in spite of abundant phenomena of natural selection, there exists no principle of natural selection. A defense is given of the reality and objectivity of transiency. A final section consists of historical, speculative, and experimental studies of the mind–body problem.

"Abner Shimony's work makes signal contributions to every subject his hand has touched in general epistemology and philosophy of science: probability theory, foundations of quantum mechanics, scientific inference, measurement, holism, and many more. He was a pioneer in the transformation of Bayesian statistics into a core resource for philosophical reflection of scientific methodology, as well as in the experimental and theoretical exploration of Bell's inequalities for the possibility of hidden variables in quantum mechanics. His writings are invaluable as both challenge and resource for current research."

Bas van Fraassen, Princeton University

Contents

PART A

The dialectic of subject and object

1
*Integral epistemology**

This essay is both an appreciation of the epistemological contributions of Donald Campbell and a statement of an epistemological program which is different from his in several respects.

In a lecture to the Boston Colloquium for the Philosophy of Science in 1977, he said:

> What I am doing is "descriptive, contingent, synthetic epistemology." . . . I make a sharp distinction between the task and permissible tools of descriptive epistemology on the one hand and traditional, pure, analytic, logical epistemology on the other. Descriptive epistemology is a part of science rather than philosophy, as that distinction used to be drawn by philosophers. It is science of science, scientific theory of knowledge, were those terms not too pretentious for the present state of the art.
>
> While I want descriptive epistemology to deal with normative issues, with validity, truth, justification of knowledge – that is, to be epistemology – descriptive epistemology can only do so at the cost of presumptions about the nature of the world and thus beg the traditional epistemologist's question [Campbell, 1977a, p. 1].

Campbell's resolute restriction of his investigations to descriptive epistemology is both his great strength and his weakness. It is his strength because it frees him, at one stroke, from the slow-paced type of inquiry that dominates the literature of analytic epistemology: for example, "When I see a tomato there is much that I can doubt" (Price, 1932, p. 33). His investigations lead out of the study into the open air. There is a wonderful sweep in his survey of the stages of cognitive development (Campbell, 1974, pp. 422–434). In the perspective that Campbell offers, nature is in no way subservient to humans; however, because of the sequence of adaptations to nature which occurred in the human phylogeny, we are able to achieve something approaching objective knowledge.

The weakness in Campbell's program is that the traditional problems of analytic epistemology continue to be haunting, especially when answers

This work originally appeared in M. Brewer and B. Collins (eds.), *Scientific Inquiry and the Social Sciences,* San Francisco: Jossey-Bass Inc., Publishers, 1981. Reprinted by permission of the publisher.

*The research for this essay was supported in part by the National Science Foundation.

to some of them are postulated as preconditions for his own investigations. He postulates an ontology of independent real objects: that there are entities in the universe which do not depend for their existence upon their being perceived or known by human beings. He accepts without argumentation the correspondence theory of truth: that a sentence is true if and only if the state of affairs which it expresses is the case, so that the truth of a sentence does not depend upon its being believed, or upon the utility of believing it, or upon the existence of evidence supporting it. He postulates a causal theory of perception: that one can understand the content of perceptual experience only by taking into account the causal relations which link the perceiver to objects existing independently of the perceiver's faculties. If Campbell's descriptive epistemology entirely abstained from normative questions, then there would be nothing wrong in principle with such postulation. It would be analogous to putting one's trust in the mathematicians and assuming the correctness of useful mathematical theorems without checking the proofs oneself. Since, however, Campbell wishes to deal with normative questions, especially with the justification of knowledge, he cannot avoid the problem of justifying his postulates.

This essay will propose an *integral epistemology,* in which certain methods of descriptive epistemology (which Campbell espouses) and certain methods of analytic epistemology (from which he abstains) are combined for the purpose of rationally assessing claims to human knowledge. It is anticipated that the results of scientific investigation about human beings will shed light on the reliability of human cognition, and reciprocally that adequate justification can be given for the presuppositions of scientific investigations. The proposed integral epistemology is unequivocally naturalistic, following Campbell not only in his general thesis that a necessary condition for understanding human cognition is to see man's place in nature but also in his insistence that detailed attention to the sciences is indispensable for solving epistemological problems. The proposed approach differs from his in its envisagement of a dialectical structure of epistemology and in its resort to methodological, decision-theoretical, and semantic analysis.

A disclaimer should be made at the outset with regard to novelty, not just because of the usual obligation to acknowledge intellectual indebtedness but because an integral epistemology is a synthesis by its conception. A naturalistic view of human knowledge is at least as old as Aristotle's *De Anima,* though it has been greatly expanded by applications of the theory of evolution; and the thesis that epistemology has a dialectical structure goes back, of course, to Plato. Sustained attempts to incorporate naturalistic epistemology into a dialectical framework are, however,