

ROUTLEDGE STUDIES IN AMERICAN PHILOSOPHY

The Quantum of Explanation

Whitehead's Radical Empiricism

Randall E. Auxier and Gary L. Herstein



The Quantum of Explanation

The Quantum of Explanation advances a bold new theory of how explanation ought to be understood in philosophical and cosmological inquiries. Using a complete interpretation of Alfred North Whitehead's philosophical and mathematical writings and an interpretive structure that is essentially new, Auxier and Herstein argue that Whitehead has never been properly understood, nor has the depth and breadth of his contribution to the human search for knowledge been assimilated by his successors. This important book effectively applies Whitehead's philosophy to problems in the interpretation of science, empirical knowledge, and nature. It develops a new account of philosophical naturalism that will contribute to the current naturalism debate in both Analytic and Continental philosophy. Auxier and Herstein also draw attention to some of the most important differences between the process theology tradition and Whitehead's thought, arguing in favor of a Whiteheadian naturalism that is more or less independent of theological concerns. This book offers a clear and comprehensive introduction to Whitehead's philosophy and is an essential resource for students and scholars interested in American philosophy, the philosophy of mathematics and physics, and issues associated with naturalism, explanation and radical empiricism.

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**Randall E. Auxier and
Gary L. Herstein**

First published 2017
by Routledge
711 Third Avenue, New York, NY 10017

and by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

Routledge is an imprint of the Taylor & Francis Group, an informa business

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Library of Congress Cataloging-in-Publication Data

Names: Auxier, Randall E., 1961– author.

Title: The quantum of explanation : Whitehead's radical empiricism / by Randall E. Auxier and Gary L. Herstein.

Description: 1 [edition]. | New York : Routledge, 2017. | Series: Routledge studies in American philosophy ; 9 | Includes bibliographical references and index.

Identifiers: LCCN 2016048943 | ISBN 9781138700161 (hardback : alk. paper)

Subjects: LCSH: Whitehead, Alfred North, 1861–1947. | Empiricism.

Classification: LCC B1674.W354 A99 2017 | DDC 192—dc23

LC record available at <https://lccn.loc.gov/2016048943>

ISBN: 978-1-138-70016-1 (hbk)

ISBN: 978-1-315-20492-5 (ebk)

Typeset in Sabon
by Apex CoVantage, LLC

Contents

<i>Preface</i>	<i>vii</i>
<i>Acknowledgements</i>	<i>xiii</i>
Introduction	1
1 Reading Whitehead	23
2 Whitehead's Radical Empiricism	39
3 The Logic in Metaphysics	50
4 The Quantum of Explanation	66
5 Extensive Connectedness (The Metaphysics in Logic)	82
6 The Principle of Relativity	98
7 Genetic and Coordinate Division and Divisibility	112
8 The Problem of Possibility	143
9 The Algebra of Negative Prehension	175
10 The Nature of Naturalism	193
11 Synoptic Pluralism and the Problem of Whiteheadian "Theology"	221
12 Possibility and God	240
13 God's Mortal Soul	270
<i>Notes</i>	297
<i>Index</i>	353



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Preface

This book has a long history, more than a quarter century. There is no way to bring something quite so ambitious to fruition without incurring countless debts. We will do our best to discharge some of these debts in the narrative that follows, and others will be mentioned among the notes. This book has the peculiar added feature of having two primary authors. Yet, large parts of this book existed in draft material and even highly developed studies *before* it dawned on the two authors that they were working on the same book. The story of how it came to look as it does, and which of us bears primary blame for its inevitable flaws, may be of at least some transient interest. We both endorse everything the book says, and without reserve. But that is not the story. In fact, we both *wrote* this book, together, and there are many parts regarding which we can no longer recall who produced the initial draft.

We have very different backgrounds and life experience, and we know different things (with large overlaps). Still the book is genuinely *ours*, not just a collaboration but a single view of all the subjects treated here, shared by both of us, without need for exceptions. We had no disagreements to negotiate, although we had to teach one another many things. One could say that Herstein is the “teacher” in the history and philosophy of mathematics and science, while Auxier is the “teacher” in the history of religious and theological thought. Both of us are historians of philosophy and serious in our studies of metaphysics, epistemology, and logic. We both formalize our thought systematically and situate it historically. Our complete lack of disagreement seems improbable, but, as we like to say, everything that is actual is thereby also possible.

The thinking herein and the Whitehead interpretation we offer reach back to our first (independent) readings of Whitehead in the early 1980s, Herstein at Occidental College and Auxier at (what is now called) the University of Memphis. We each had to teach ourselves Whitehead, receiving encouragement, sometimes, from our philosophy instructors, but neither of us had the advantage, or the burden, of a specialist in Whitehead or process philosophy among our instructors. We both had the benefit of outstanding teachers in systematic and historical philosophy, teachers who emphasized intellectual

honesty and scholarly rigor, and who enabled us to recognize our strengths and limitations. Both of us were convinced from our independent reading that if anyone had come close to answering the questions that we couldn't leave alone—time, possibility, order—it was Whitehead.

We both knew that it would take a long time to understand and digest his views, and we went immediately to work on the project of truly understanding Whitehead. We consulted secondary literature, for help, and we found some. This was especially true of Donald Sherburne's *Key* and, for Auxier, also the first edition Elizabeth Kraus's guide called *The Metaphysics of Experience*. Herstein stayed mainly with primary texts during these years as he pursued a career in computer technologies, even taking only one book, *Process and Reality*, on a vacation to Tahiti. Perhaps this is the best beach reading for some tribe of truth-seekers, but the tribe would be small. Although we were too inexperienced to put our fingers on the causes, our intuition was the same: much of the commentary failed to reflect the richness and full intellectual depth and connectedness of Whitehead's ideas. For many years we were thus obliged, independently, to wrestle with the primary texts, and that is what we did.

Although Herstein is the senior in years on earth by about five, Auxier's circumstances enabled him to pursue the standard academic path and hence to arrive somewhat earlier at the threshold of a writing project on these ideas. The earliest portions of what became this book were drafted in 1989 while Auxier was still in graduate school. An essay called "Concentric Circles: An Exploration of Three Concepts in Process Metaphysics" was drafted as part of the "take away" from a seminar on the philosophy of time with Charles Sherover, and it was published in 1991 in the *Southwest Philosophy Review*. It contains the earliest version of the argument about possibility, potentiality, and actuality that constitutes an important part of this book. An examination of that (now ancient) essay will reveal that it is the work of someone unseasoned and too ambitious, but the core view, now both chastened and (one hopes) deepened by experience, reflection, and study, is given here, in chapters 8 and 9.

The argument has grown in prospect since we began working together on these issues in 2000. But we know we are not finished with these ideas. We have begun writing on a project we are calling *The Continuum of Possibility: Models and Modality in Process Metaphysics*. Perhaps we are too ambitious still, but if the reaper spares us, we will offer at some time (when it is ripe) a fuller formalization and working out of the formal sketch in chapter 9 of this book. We intend to make good on the suggestion that algebraic thinking can handle time in relation to possibility just as Whitehead so boldly asserted, and we are audacious enough to believe we can make some progress in developing these ideas in new ways, and to do so by re-reading the history of algebraic thinking.

At Emory, Auxier found professors who allowed him to pursue these topics in a dissertation on process metaphysics. Jude Jones, a student of

Elizabeth Kraus, was slightly ahead of Auxier at Emory, providing a context for exchange and creating conditions for later collaboration on Whitehead. But the topics that interested Jones and Auxier, although both were motivated to investigate metaphysics and value, turned out to be almost without overlap in emphasis at that time. Jones's book *Intensity: An Essay in Whiteheadian Ontology*, based on her dissertation, remains (in our view, although we do not assume Jones would automatically agree) mainly a treatment of the higher phases of experience (and how they come into being) that we can endorse with practically no modification. It is, in our terms, a book on concrescence. The higher phases of experience, exemplified in the human kind of consciousness and self-reflection, is exceedingly rare in the universe and, from the standpoint of cosmology, is of almost no importance, apart from providing evidence for how actuality can achieve astonishing intensity. Yet, intensity and concrescence are everything *to us*, as human beings.

We do not pursue these questions in this book, partly because we think Jones has done an admirable job, and partly because we think philosophers are bad about exaggerating the importance of human experience in the grand scheme of things. One thing we both admire about Whitehead is his unflinching vision of the cosmos as a place that *allows* for experience of our kind, but doesn't necessitate it or do very much to support or perpetuate it. Jones has said what needs saying about this kind of experience and we don't have anything to add, at this point. Still, the project we are working on to follow this volume is a treatment of concrescence that supplements our focus on transition and the "fact of the world," in the study before you now.

Auxier wrote the first draft of chapter 12 in 1992. Both Don Emler and Leo Werneke read versions of chapter 12 and affirmed the direction of the research. However, early exploration into the process community, as it existed then, alerted Auxier that his views went against the grain of the prevailing lines of interpretation. After some correspondence with several opinion leaders in the area, it became clear that it would not be possible to work out these ideas in the existing journals, controlled as they were by people who would demand greater conformity to the current conventions. There was solace in conversation with other young scholars, especially Bill Myers, of Birmingham Southern, and the occasional supportive senior colleague, especially Bill Garland from the University of the South and Pete Gunter from the University of North Texas. It would be necessary to approach the Whitehead community indirectly and by slow degrees. The community of process philosophers was, at that time, small enough to enforce an orthodoxy.

Auxier decided to focus on Hartshorne's thought as an alternative to disputing with powerful people over Whitehead. This turned out to be a fortunate turn. Hartshorne was still alive and vigorous and happily accepted Auxier's invitation to travel to Oklahoma and to speak and teach. Following that adventure in the spring of 1993, Auxier was able to travel to Austin numerous times and carry out his arguments with Hartshorne himself about

how to interpret Whitehead. Hartshorne not only did not demand agreement from younger scholars, he insisted upon vigorous dissent wherever it could be supported by serious argumentation. One result of these exchanges was the essay that became chapter 13 of this book, first written in 1995.

Philosophers who spent serious time on Hartshorne's thought were not numerous, but were welcoming and open-minded. In particular, Auxier found valuable feedback from Don Viney, Barry Whitney, and Dan Dombrowski. Mark Y.A. Davies, whom Auxier had known at Emory, joined Auxier in a collaboration on Hartshorne's thought in 1994, and came to Oklahoma City University in 1996, providing real discussion. These exchanges resulted in a number of articles and the publication of Hartshorne's correspondence with Edgar Sheffield Brightman. In addition, through Davies's connection to Robert C. Neville, Auxier came under the influence and eventually the tutelage of one of the finest critics of process thought and original thinkers of that older generation. Neville generously read and responded to Auxier's correspondence during those years and continues to provide valuable resistance and corrective critique to these ideas.

Herstein's academic career has been what is euphemistically called "non-traditional." Starting at the University of Southern California, Herstein put himself through school by working full time at the Jet Propulsion Laboratory's Space Flight Operations Facility. Herstein's interest in science and mathematics had always been exceptional, and this job was in many ways the perfect opportunity for him. He was privileged to watch the very first images slowly scroll across the monitors in the Mission Control Center during the Voyager 2 encounter at Jupiter, and the Voyager 1 and 2 encounters at Saturn. Because his technical skills liberated him from the common vocational justification for higher education and, in many ways as importantly, confronted him with fundamental and patently concrete issues in the problem of knowledge, Herstein changed his original major from computer science to philosophy. During this time, Herstein had the good fortune to take Bas Van Fraassen's graduate seminar in modal logic, which was Herstein's first encounter with formal reasoning beyond the binary systems he'd worked with in computers. For various personal reasons, Herstein later switched schools from USC to Occidental College.

Herstein's first encounter with Whitehead occurred in the early 1980's, when he was an undergraduate at Occidental College. Herstein's philosophy professor at the time, William Neblett (who taught at Occidental College from 1965 until his retirement in 2004), wrote his Master's thesis on Whitehead. He knew Whitehead's process thought. By luck, a copy of the Corrected Edition of *Process and Reality* appeared in the Occidental bookstore. Herstein purchased it on the spot. Over the next two decades, Herstein carefully studied that volume many times. But because of his life outside of formal academics, he never encountered the secondary literature, and was thus able to form his own thoughts and ideas about Whitehead's metaphysics.

Herstein formally entered the scene in 2000, to work toward his Ph.D. in philosophy. That was the same year that Auxier moved to Southern Illinois University at Carbondale, where Herstein was now enrolled. They met several months earlier at the 2000 meeting of the Society for the Advancement of American Philosophy in Indianapolis. Auxier gave a plenary talk in which he did two things that determined Herstein to meet him: Auxier spoke of knowing what his cats were thinking, and then highlighted Herstein's three favorite philosophers in a single sentence: Dewey, Cassirer, and Whitehead.

Herstein's numerous classes and conversations with Auxier created a focus on Whitehead and his natural philosophy, especially as articulated in the sorely neglected triptych of works on the subject that Whitehead published between 1919 and 1922. Herstein defended his dissertation, with Auxier as the chair of his dissertation committee, in May of 2005. The dissertation, *Whitehead and the Measurement Problem of Cosmology*, was published a year later by Ontos Verlag (later acquired by De Gruyter) as a book by the same title. Herstein left Illinois to pursue an itinerant life as a visiting professor around the country.

While Herstein was at SIU Carbondale, he and Auxier spoke many times about the possibility of a collaborative book addressing some very significant shortcomings in the secondary literature on Whitehead. Ideas were bounced back and forth, which led to papers written and presented at conferences by each of them (providing draft material for a book only vaguely conceived). Finally, with a number of such studies accomplished, structures were proposed and modified by e-mail. But the project never achieved the status of a real outline, and remained little more than a shadow. Difficulties arose due to the size and complexity of the project, not to mention its ambitiousness. Distance was not the issue it would have been in previous decades, but hindsight informs us that we never could have finished this project while living in different places.

Herstein returned to Southern Illinois in 2011, where he could reinvent himself as an initiate in the new mendicant order known as the independent "modern" scholar (that is, homeless except for the patronage of others.) But with the problems of time and space no longer obstructing them, Herstein and Auxier directed their efforts upon the current project. After some struggle, a real plan for the book began to emerge. That initial outline, hammering the completed drafts into an order that made narrative sense, and recognizing what parts remained to be written, survives in large measure into the final book. From the fall of 2011 until the early winter of 2013, Auxier and Herstein met at least once weekly for a full afternoon, with specific assignments in between—they took turns carrying the weight of writing between meetings depending upon whether the subject matter was closer to Herstein's or Auxier's expertise. The first full draft was finished in time for a sizable weekly reading group consisting mainly of SIU graduate students, but also a few who had graduated and other interested parties, who read

and reviewed the manuscript along with a reading *Process and Reality*. This was very helpful in testing the narrative.

Following this experience we were able to work our way back through the completed manuscript during the fall of 2013. We made every effort to digest every article that had a bearing on what we are saying, and we made many adjustments as we read new secondary works. There were several important discoveries for us during this period. Neither of us had read F. Bradford Wallack's book on Whitehead prior to this time, and it turned out to be a tremendous find in the literature. This work had, we believe, been effectively buried by the narrowness of the approaches dominant in the last 35 years, a perception we found confirmed when we contacted Wallack herself. Also added to our reading during this time was Catherine Keller's fine work in process theology, which reminded us of the vitality and relevance of these ideas when taken in a theological light. If we seem dubious about process theology in this book, we want to assure everyone that this impression is due to our own misgivings and not a reflection on the fine work done by so many people in the train of John Cobb, Jr.

Some readers will be curious as to which of us wrote which parts of this book, and indeed, one kind and anonymous reviewer insisted upon such information. We realize that co-authored books in our discipline raise eyebrows: "Surely one or the other is responsible for *this*," (Russell but not Whitehead, Dewey and not Tufts or Bentley, and so forth). It is a question that simply makes us smile, since there are so many parts regarding which we couldn't tell you ourselves who ought to be thought of as the author. This is particularly true of chapter 9, which is perhaps alternating sentences as one or the other of us worked our way through the difficult formalisms. If an accounting is required, Auxier drafted the Introduction, and chapters 1, 2, 7, 8, 11, 12, and 13; Herstein drafted chapters 3, 4, 5, 6, and 10. We truly wrote 9 together, alternating weeks with one or the other being responsible for a section, and it wasn't written in the order it now appears. We did all the editing and revising together, across a table, and no changes were made without the consent of both. We admit that it is peculiar that two such different people should find themselves so much and so easily in agreement on such wide-ranging issues. We have no explanation and we find it remarkable ourselves. Our writing styles (and senses of humor, and penchant for polemical expression) are also similar, almost indistinguishable, which is no less curious to us, since our backgrounds really are quite different. But it is worth repeating that whatever is actual is possible, and this is actual. The mystery lies in over-thinking it, not in the occurrence of it.

Acknowledgements

Herstein: Anyone who has even contemplated a work of this scope and size knows what an almost impossible task it is to acknowledge all of those persons who contributed to it. High on this list are all the members of my dissertation committee: Randy Auxier, Janice Staab, Larry Hickman, Pat Manfredi, Jurek Kocik. They all shared my conviction that the line of inquiry I was pursuing was worthy of the effort. Among the general groups that need mentioning, the Whitehead reading group that helped us out with an early draft of our manuscript in 2013 at SIU Carbondale, and the Society for the Study of Process Philosophy, for their interest and encouragement for papers that later became sections of chapters. Individuals include Michel Weber, Johanna Seibt, Jude Jones, Tim Eastman, Michael Epperson, Ronny Desmet, George Shields, John Cobb, Hank Keeton, among many others.

Finally, very special thanks must be given to Patrick and Antoinette Mulholland, without whose constant support I would never have been able to participate in this project. I dedicate my portion of this work to Patrick, who did not quite get to see it finished.

Auxier: In addition to those listed by Herstein, most of whose names would be repeated on my list, a number of people have read full or partial drafts of this manuscript and have contributed helpful comments that led to its improvement. First and foremost there are the students in the seminars I have run over the last 16 years at Southern Illinois University Carbondale. A number of these persons have gone on to carry out substantial research in process philosophy. Some of the work was completed during a sabbatical supported by SIUC in the spring of 2014. A number of colleagues also read the manuscript, at one stage or another, in whole or in part, and these include Robert C. Neville, David Connor, Bogdan Ogrodnik, Lukas Lamza, Dennis Soelch, Aljosche Berve, Jan Olof Bengtsson, Helmut Maassen, various members of the Institute of American Religious and Philosophical Thought, including Donald Crosby, Wesley Wildman, Charley Hardwick, Nancy Frankenberry and the late Creighton Peden; various members of the Society for the Study of Process Philosophy, including (again) Jude Jones. Also of help were Ted Calhoun, Keith Robinson, Duston Moore, James McLachlan, Gary Dorrien, and Gregory Budzban. The community of

scholars associated with the American Institute of Philosophical and Cultural Thought (especially John Shook and Larry Hickman) and the International Forum on Persons (especially Richard C. Prust, Tom Buford, Richard Beauchamp, and James Beauregard) have been an ongoing source of conversation and encouragement in this work. At different times the Philosophy Departments of Indian-Purdue University Fort Wayne, Luther College, and also the Society for the Study of Process Philosophies have invited our work for presentation and have responded to versions of this work. The Society for the Philosophy of Creativity heard two early chapters and I must thank Pete A. Y. Gunter particularly for responses there and at meetings of the Southwestern Philosophical Society. Many ideas were worked through in conversations with Ralph D. Ellis and Bill Myers (and his former students) over the course of three decades. The Center for Process Studies at Claremont has never failed to provide support and response, especially John Sweeney; Roger Mark Dibben of the Whitehead Research Project in particular has been a valuable conversation partner. And of course, thanks are due to Routledge and Andrew Weckenmann and to the series editors, Henry Jackman and Willem de Vries.

Finally, since in this book I have personally come full circle in the studies that genuinely began when, as child, I listened to my mother, Eileen Gunter Auxier, explaining “creative motion” in music, I dedicate my portion of this work to her memory, and to my father Charles David Auxier, and the beautiful music they made together

Introduction

The central aim of this book is to make an argument, as persuasively as possible, for the concept of explanation—in all domains that human beings study—defended by Alfred North Whitehead. The authors believe, and passionately so, that the central insight of Whitehead’s philosophy has been passed over, misinterpreted, and forgotten even by his most sympathetic followers. The idea is both very simple and hard to keep in mind because it runs contrary both to our native habits of thinking and to our long-established ideas about what constitutes a satisfying explanation. Because its implications are far-reaching, subtle, disturbing, and complex, this approach to explanation has not taken hold, even among process philosophers. That must change.

In this Introduction and the first two chapters of this book, we will be offering an overview of Whitehead’s thought and our path through it. The detailed arguments await later chapters, so we encourage readers to be patient in forming conclusions about the assertions we make early on. Our aim is to bring readers (including advanced ones) into the context and language of process philosophy and only then to offer the rigorous case that serious readers expect. Included is a thorough discussion of issues associated with the theological reading of Whitehead that has played so prominent a role in process philosophy in the last half century. We are neither anti-theological nor anti-religious, and we do not share the views of those who would remove either “God” or “eternal objects” from Whitehead’s ontology. Yet, we are confident that most readers of Whitehead who have applied his ontology to theological problems will find what we have to say here unwelcome. This discussion must be deferred until the more straightforwardly philosophical business has been accomplished, but we do not think of this part of the book as an add-on. Getting Whitehead’s ideas about God right is just as important as getting his ideas right about actual entities and possibilities. Part of “getting God right” involves getting nature, as Whitehead understands it, right, and thus, the discussion of God is deferred until late in the book, since nature is our main focus.

Among the techniques we employ throughout the book is to present various illustrative examples of a qualitative type. Our intentions with these often somewhat “homey” stories are both to cultivate our readers’ intuitions

2 Introduction

around subject-matters that are often extraordinarily abstract and to do so by situating those ideas in more tangibly concrete examples. In this regard, we note at least three different modalities of “making sense” that humans deploy against any puzzle, only two of which are typically called upon in contemporary philosophy: There is what might be called “empirical adequacy”—does observation and experience support what is being claimed in the relevant situation? There is “logical coherence”—do the various claims being asserted hang together logically? But there is also what we will refer to here as “narrative intelligibility”—does the story, *qua story*, make sense? Narrative intelligibility is not what one would normally acknowledge as an “argument,” in the logical or philosophical sense. Rather, it is an illustration that brings the argument to life, concretizes it.

There seems to be an aversion, bordering on anaphylaxis, amongst philosophers (even and especially Whiteheadian philosophers) to turn to this third form of making sense.¹ This strikes us as ironic, since narrative intelligibility was one of the primary modes of philosophical discourse used by Plato. We are here recalling Whitehead’s famous epigram about footnotes to Plato. Yet even Whitehead was generally reluctant to use stories and illustrative examples in his philosophy even though, as his beautiful biographical essays illustrate, he was a lovely storyteller.

We do not pretend for a moment that we are comparable to such storytellers as Plato and Whitehead. We do, however, insist that stories—even *our* stories—are an essential part of making sense of the world, and that includes Whitehead’s philosophy. We appeal here to the authority of Iris Murdoch, and her carefully presented argument that some ideas (especially in metaphysics and morals) are so complicated that the only way to approach them is indirectly, via metaphor and narrative.² One might note here that Murdoch was herself one of the better storytellers of at least the last 100 years.³

Start Me Up

Our central idea is that *concrete existence explains the abstract aspects of experience* and not vice-versa. The unexpected characteristic of our experience is that it abstracts from the flux, not that it flows concretely, which we expect. This sense of the term “abstract” means something like, “creates a stable space,” but spaces are created by the variability in the flux itself. No space is wholly stable, as far we know. Where the pulses of the unfolding creative advance approach light speed, we trade one *kind* of stability for another, the stability of relatively constant acceleration for the stability of repeated vibrations at various rates. But wherever there *is* variability, something like a space is created in the communication of what pulses with greater zest and frequent repetition as compared with what “moves” more slowly.⁴

To illustrate: we can observe the difference between light and sound, taking as a case study the way these two varieties of energistic order are differently propagated through typical earth conditions. Obviously, for all their differences as *organizations* of energy, sound and light are *experienced* together by us, through a synesthesia that our bodies accomplish. Yet, as a general fact about the universe, sonic waves vibrate at a level that is more difficult to propagate, compared with light. Sound is “heavy,” entropic, requires a dense medium for its propagation, and dissipates into the background radiation after a short endurance. Light, by contrast, is economical, lively, relatively easy to propagate, does not require a dense medium for its propagation, and can maintain its physical structure for very long epochs of duration.⁵

When either sound or light interacts with the complex electromagnetic gravitational macrosystem we call “earth,” under the right circumstances, *locations* arise that reveal structures even more fleeting, even less stable than sound itself. The likelihood, in the grand scheme of the universe, of the occurrence of a laser light, multimedia show *with* the music of the Rolling Stones, interacting on some beach in South America, well, let’s just say that arrangement of light and sound energy is cosmically improbable.⁶ No, it is not merely improbable. An infinity of infinities of infinities, raised to the power of the infinite, in terms of possibilities, is needed to bring together just *this* confluence of variable temporalities and their complementary spaces.⁷

A Bigger Bang

We choose this example because some people claim that the February 18, 2006 concert by the Rolling Stones in Rio de Janeiro, was the largest rock concert in history, attended by some 1.5 million people. All shows in “The Bigger Bang” tour began with a huge multimedia screenshow, and lights and pyrotechnics, depicting the Big Bang and tracing all of time and the creation of every actual space from the beginning down to the improbable moment when the first chord of the song “Start Me Up” is struck on Keith Richards’ Telecaster, in the dark, and what follows is a silence, a pulse, a repetition, a count, a drum roll, and, well, a Bigger Bang, as the lights explode in a blinding flash and Mick Jagger is illuminated in the midst of a leap as the masses erupt into an ecstatic presence that really defies description. As they say, “you had to be there” (not that we were).

This is an “event” in the best Whiteheadian sense. It is complex, but it is also a unity, an enjoyment, and a satisfaction of all sorts of variable pulses of light, sound, gravitational influence, electromagnetic pattern, inertial eddies in the flux that gather in the actual world to which they belong, evaluate that world, and add to it a unique synthesis. In this case, the “event” involves over a million human beings, some very loud sounds and very bright lights, a beach, the edge of a continent, a city, and a durational epoch, ragged at

4 Introduction

the edges but definitely describing a span.⁸ But the point is that one does not, and indeed, *never could* explain all that was absorbed and released, in all of its temporal, spatial, physical, and conceptual modes, at that time and place by appealing to some collection of abstract ideas.

The Big Bang, as a concept, is *explained by* the Bigger Bang, the event on the beach, and not the other way around. Notwithstanding our habitual appeals to the abstractions of science for the meaning of the word “explanation,” the *true* explanation of *any* physical reality *is* the concrete event that it surrounds. The reason to adopt this path of explanation is very simple: *whatever is actual is possible*. That is the reason that explanation really *has to* proceed from the actual to the possible, at least to the extent we can expect to explain things beyond our ken, such as the character of possibility *as such*.

One does not need an “event” so complex as the Rolling Stones’ Bigger Bang to make the point about explanation. Something as simple as dropping the pencil from one’s hand to the ground is equally (and uniquely) an “event.” While we are in the habit of appealing to, for example, the “laws of gravity” to “explain” what happened, the real story goes the other way around. The unique event *is the reason* for our appeals to abstract and general ideas, such as “laws,” insofar as those general ideas *have* an explanation—and it is they, *not* the falling of the pencil, that *need* an explanation. It is hard to get used to this “appeal to the concrete” as *the* explanation, and one might complain that subsuming concrete events under general categories just *is* what “explanation” *means*. But this view is empirically indefensible. There is no denying the importance of the uniqueness and unrepeatability of any concrete event. Simply to set aside, in advance, everything that makes an event unique, singular, and hence universal, is to treat as concrete that which is abstract and vice-versa. It is not explanation.

The Poverty of Philosophy

It is true that we don’t ever understand concrete actuality in its fullness, but we can get at what is actual with greater confidence than we can expect to gain access to some sort of universal necessities that *make* a unique event come to pass *just as it has*. That latter quest is a fool’s game. Universality, so far as we have immediate access to it, has to do with the logical meaning of what is singular, unrepeatable, unique. The problem of finding the universal and necessary is tricky, as every philosopher in the West since Plato has known (and those in the East have known it still longer). Given the limits of understanding with which we begin, it is wiser to generalize with the greatest care than to leap on a floating universal and proclaim it the ground of all existence. That kind of God, or principle, or law, or force is no ground at all. It is a fiction, a puff of human desire adrift in a cosmos indifferent to human depth, need, and yearning. It is, as Socrates reports in the speech of Diotima, a vagrant at the doorstep of Being. It is *not* an explanation.

No one has ever been as careful to avoid bad generalization and floating universals as Whitehead was. Existence, in its uniqueness and full concreteness, *is* what it is, and no matter how simple the event is (and the Stones' Bigger Bang is pretty complex, for an event, with nests and nests of temporal eddies and ephemeral tensions), the simplicity or complexity wouldn't change the main issue. The "event" could be the shedding of an electron by a radioactive element, or something simpler still. "Events," in Whitehead's sense of the word, are not of any particular size, complexity, simplicity, or duration. In all cases of the event, its uniqueness places it beyond the reach of the abstractions to which it gives a ground, just as such uniqueness places it beyond the full comprehension of any other event. As far as we can tell, empirically, the cosmos seems to be made up of events. They can be explained in as many ways as we can devise to generalize from them and across them, but those generalizations are more likely to lead us astray than to lead us toward the best kinds of conclusions, unless explanation moves from the concrete to the abstract. The best explanations are those that invigorate and add intensity to our experience, and that sort moves thus.

We think that our main point bears repeating. *What is actual is possible.* This is the first law of metaphysics. And the actual is our best guide to the possible, but it is still a poor and unreliable guide, because generalizing from the "event" in February of 2006 to explain the Big Bang is *easy* compared to answering the question about *what else* was genuinely possible that *did not* happen on that day or any other day (or eon, or cosmic epoch). Our access to the structure of possibility is usually mediated by our powers of abstracting from the concrete in ways that respect the limitations imposed upon us, and our desire for explanations, *by* the actual. We face a trilemma: either (1) deny the reality or existence of possibility, or (2) reduce possibility to the likely or the inevitable, and then try to get our most general concepts to serve as explanations, or (3) treat the mode of existence of the possible as essentially abstract. All of these ways of handling the problem of possibility have been tried in the history of metaphysics. None has succeeded.

A Fourth Conception of Being

Whitehead suggested a fourth way, a way that leaves the relation of the possible and the actual fruitful, creative, dynamic, interesting, and open: the actual, in its full concrete uniqueness, *is* the explanation of anything and everything that can be explained. The actual offers us a glimpse of the possible, its structure and its meaning, if not all of its determinations. The Bigger Bang, or any other "event," rightly understood, rightly situated in its own actual world, *is* the reason for that world, insofar as that world *has* a reason. In explanatory power, the event we have called "the Bigger Bang" beggars the concept of the Big Bang. The Big Bang is just an idea to guide how we may *think about* what happened in the unimaginably remote past. The Bigger Bang actually happened in February of 2006.

6 Introduction

But how do we get at The Bigger Bang, or any other “event,” and *use it* to explain its “world”? The limitations are, unhappily, more numerous than the opportunities, but the most important limitation is self-limitation. Favoring just one type of generalization, such as counting or measuring, or formalizing in some sort of natural or devised language, and insisting that this or that method is right for answering *every* kind of question, is a great failure of self-limitation. If such a perfect method of generalization exists as will answer to every variety of our *desire* for explanation, it has not been discovered, and it is not likely to be discovered by claiming we already possess it when clearly we do not. Such exaggeration is intemperate and unwise. But Whitehead found a way to secure our norm of self-limitation, while yet asking the profoundest question: given that there is no single method of generalizing from the unique event to its world, is there not, accessible to our imaginations and reasonings, a basic *unit* of explanation? Is there not something irreducibly common to every desire for every sort of knowledge? Whitehead answers in the affirmative. *That unit is the actual entity.* This is what we mean by calling it “the quantum of explanation.”

Explanation and Its Discontents

This has been a hard pill for philosophers after Whitehead to swallow. They insist upon thinking of measurement, and “laws of nature,” and other numerical devices as “explanations,” when in fact it is simple common sense to recognize that *what is unique*, as every fully concrete actuality is, *cannot be explained*, and that means that if it is explanation we seek, then the *explanans* must be the unique event, and the *explanandum* the world to which the event belongs. We do not have to give up scientific and traditional “explanations,” but these explanations are not fully concrete—they are general, abstract. They are *not* universal. The universal, insofar as it plays a role in genuine explanation, *is* the singular event that concretizes its entire world from one perspective, exhibiting in a definite way one genuinely possible example of order in our cosmic epoch.

Thus, what stands in need of explanation is not the way existences and the flux pass, it is why *anything* in the flux is sufficiently stable for a difference to arise in its “passage” between its “transition” from one condition to another, on one side, and its “concrecence,” its internal “valuation” of the “factors” it takes in from its “actual world,” and then “grades for relevance,” judges, in many modalities, and finally “expresses” in its “achievement.” The quantum of explanation, i.e., the actual entity, does the main part of the work in helping us analyze and evaluate all this.

We draw on a vocabulary here that Whitehead developed in the course of numerous writings over 40 years. This vocabulary has confused, daunted, and deterred readers, and it has otherwise prevented his ideas from settling into the culture at large. These important ideas haven’t even entered the more rarified discussions of physicists and mathematicians and philosophers,

except in pockets and nooks. The words are more like the ornaments on a Christmas tree of prose than ideas we can pin down. What, after all, is this chap on about? There are good reasons for the specialized vocabulary Whitehead chose and refined. It is not easy to understand, still harder to learn and use, and once mastered, sadly effective at cloistering the exchange of ideas and keeping serious discussion limited to the initiates. We cannot, in this book, wholly reverse 80-plus years of scholastic specializing. But we aim to provide a guide that will enable reasonably devoted readers to follow our discussion as it moves increasingly into the world of Whitehead's curious language.

A Linguistic (Re)Turn

The language is not the only challenge. Whitehead's ideas are themselves both novel and difficult, conceptually speaking. A good grasp of the history of science, mathematics, and logic is needed for a thorough understanding of Whitehead. We cannot wholly remove this barrier, but we have supplemented our arguments with extensive examples and illustrations of the most difficult points. Yet, we really must stress that Whitehead's concept of the "actual entity" is not a bit of physical existence. It is a conceptual tool that helps the inquirer arrest temporal passage and the flux of the physical universe.

The concept of the actual entity is the most important in a collection of logical tools doing this work of holding the object of inquiry in stasis while it is analyzed. That "holding" cannot be achieved without some distortion entering the picture, but nothing will yield to analysis without some means of rendering it an object of study. How the inquirer achieves this condition of "arresting the object" has a great influence upon the success or failure of an inquiry. Whitehead's approach to the problem is original and worth understanding. The logical and analytical tools he develops have certain virtues not possessed by those of his predecessors in natural philosophy and cosmology. His tool kit is also adaptable to problems further removed from the areas with which he was best acquainted, and he brought them to bear on questions of religion, civilizational development, the history of science, education, and a few other areas in scattered essays. But his abiding concern was the study of the physical universe and the development of analytical tools for that kind of study.

Clouds of Mystery Pouring

Unfortunately, the majority of Whitehead's interpreters have been confused about what Whitehead was doing and how he was doing it. Most insist that the "actual entity" is a part of the physical universe, the universe of *events*. They usually do not grasp that the "actual entity" is a philosophical concept set out, along with others ("eternal objects," "prehensions," and "God"

8 Introduction

being other principal concepts, but one might add nexus, and the ontological principle) for the sake of *analyzing* the physical universe, and especially analyzing *events*. The actual entity is not a unit of change. The event *is*.⁹ The event is impossible to study without some kind of abstraction because it is unique, and yet, in its uniqueness is a logical singularity, and singulars function as universals in logic. Every event has an explanatory power, and in analysis, the “actual entity” conceptualizes, irreducibly, that explanatory power. Every event is *more* (indeed, infinitely more) than the actual entity that is used to analyze it, but properly limited, the actual entity introduces a minimal and non-vicious kind of distortion into the event. With proper self-limitation, the event will be recoverable from the analysis, intact, recognizable, meaningful, and now seen in some of its modes of generality, implication, promise.

Some interpreters have gone so far as to claim that Whitehead’s ontology of events was abandoned and replaced by an ontology of actual entities. This is unsupportable on the basis of the text. Many *ad hoc* hypotheses, speculations, and assertions must be maintained in order to argue that Whitehead has two different ontologies, while massive amounts of clear evidence must be ignored and distorted to read Whitehead this way. The simple truth is that those who assert such a view haven’t understood *what* Whitehead was doing and *how*. That is a forgivable mistake. Whitehead is hard to understand. But the relation between an event and the actual entity isn’t that difficult to understand, if taken alone; still the logical tools Whitehead develops for his analysis are organically related, and in fact there is far more to the event than *any* set of logical tools can hope to describe. And even with Whitehead’s best tools, we get at only a limited collection of characteristics of an event. Fortunately, since some problems are more pressing than others, we don’t need the event in its concrete fullness for most of our purposes. So long as we can come by results that answer to our most immediate needs for knowledge, the philosophy of organism has served its purpose.

Thus, with the inquiry into cosmology that is entitled *Process and Reality*, Whitehead takes on his biggest project. His analytical tools have been developed over nearly 40 years. They are brought together in a way that leaves intact the aspects of the event that are most salient for metaphysical description, and secondly for the study of physical nature as a system of order. The outcome is a description of the cosmos as a “creative advance.” These analytical tools, most importantly the actual entity, the actual world, the eternal objects, prehensions, God, propositions, generic contrasts, and the principles by which they are related, are *chosen* by the inquirer, *not necessitated* by the physical universe.

Confusion on the Ground

Assessing the event suggests (rather than demands) a tool kit and a path of inquiry. The norms of excellent inquiry vary according to the kind of

knowledge the inquiry is expected to produce and its purposes. All successful inquiries intensify our experience and are “adventures,” but no inquiry, for Whitehead is measured by the achievement of some kind of certainty or closure. We want the event because the event *is* experienced. We are wise when we grasp, in advance, that the event explains the world, not the other way around. Thus, in a metaphysical description of cosmological order, the actual entity explains its actual world, not vice-versa. The actual entity is not, however, the *whole* explanation of the event, considered as a part of the cosmic order. Indeed, we strive, as a norm in inquiry, for parsimony, and we find that our desire for explanation requires not only the actual entity, but those other entities listed above, along with a number of principles and limitations. If we should develop and employ a single unneeded tool for the inquiry, the inquiry would fail in parsimony and elegance, and might also introduce undesirable complexities into our descriptions. So we do our best to develop and employ the optimal tools, which means the fewest and the best adapted to the demands of the event, considered as a part of, and an explanation of the physical universe *as a cosmos*, a system of order.

None of the tools of analysis Whitehead uses in *Process and Reality* is entirely new for him. Most of his analytical tools were developed in the course of his career. Some he adapted from other inquirers. Many interpreters have not paid close enough attention to the genesis of these tools, while others have not understood how the tools change when adapted to new inquiries and other purposes. Similar names for these tools of analysis across inquiries lead philosophical interpreters to look for a development and deepening of Whitehead’s understanding of his own philosophical concepts through the decades. It does not occur to most readers that Whitehead’s level of “commitment” to his analytical tools is limited to their usefulness *in a given inquiry*.¹⁰ He was a mathematician. For such people, concepts can be defined and redefined as context and purposes require. Philosophers simply don’t understand: “First, let the actual entity be the event in its actual world; *now*, we adopt a rule that only one actual entity is fully concrete, and the rest are occasions; *now*, let there be a limit to the actual world in two modes, God as the limit of its actuality and eternal objects in the mode of possibility. . . .” Such is mathematical reasoning. We are now in a position to ask “what is the event?” by asking “what is the actual entity and how is it the reason for its actual world?” That is math.

It is useless to ask: “Are there *really* actual entities?” Clearly, in one sense yes and in another sense, no. They exist as analytical tools, and that is a *real* existence. But they aren’t little temporal atoms or puffs of energy that *make up* the physical universe. That is a silly way to think about the universe and it confuses the order of analysis with the order of existence. Both are real, but one is the thing to be explained and the other is the tool of explanation—and the world explains the tool. Yet, the choice of tools is not arbitrary. The success of inquiry, the norms of inquiry, the choice of analytical tools, and the aptitude of the inquirers are all tied to a real universe

that will not yield to just any old hypothesis or assertion. This is not child's play. The universe is patient of analysis and indeed the discovery of tools *for* that analysis thrives on errors and on the discovery of error, as indeed all development does, but our logical tools, especially, are refined only with great effort and care. We attend to the finest shades of relevance, applicability, adequacy, rigor; and with effort, insight, and good fortune, we do better rather than worse in achieving our purposes. Humility before the enormity of the task is *de rigueur*.

Over the course of many inquiries, we begin to learn something about the relations between our analytical tools and the universes of meaning that explains them. There is something that ties our processes of thinking, inquiring, and learning to the whole we are trying to grasp, in fits and starts. We don't achieve much, but we wouldn't get anywhere at all if the connection between our efforts to know and the objects of our knowledge were not linked in a sympathy not of our making. Knowledge, for all its fallibility and pluralities, is both *real* and *of* the real. This dawning awareness is not an occasion for beating our chests in triumph. But it is a nice reason to say that "every atom belonging to me, as good belongs to you," so let us sound our barbaric yawps and then "loafe" and invite our souls. *That* is success in inquiry. The connection of our thinking to what is real, including us, is our song of ourselves, and *it is enough*. We don't have to be gods. Let us see whether we can even succeed in being decent *animals*, shall we?

A Different Look

There are a number of features of our book that distinguish it from all predecessors. The first is the central idea that gives the book its title, and which we have just rehearsed in preliminary form: the actual entity *is* the quantum of explanation, and not just in *Process and Reality* or in Whitehead's other inquiries, but in *all* inquiries that are essentially logical or mathematical; wherever we seek order, there *will be* a quantum of explanation, and it *will be* some version of the actual entity uniquely situated in its actual world. This is a very great discovery Whitehead (with a few others) made, a permanent advance in science and philosophy, and a way to overcome 2500 years of confusion that has haunted natural philosophy and most other sorts of explanatory thought. We now know how to avoid taking our abstractions for concrete events, but even Whitehead's followers have mostly failed to understand this most important discovery. Because his interpreters have failed, the wider world has not learned of Whitehead's achievement. It is a matter of indifference to us whether Whitehead gets *credit* for this, and we think he wouldn't have cared either. What is important to us is that the world of explainers should *wake up* to the fundamental requirements of successful explanation, so far as the human race has yet discovered those requirements. The work has been started, both by Whitehead and a number of other inquirers, all of whom could easily carry the title of "radical empiricists."

The second distinguishing feature of our book, and hence the subtitle, is both an interpretation of Whitehead as a radical empiricist and a defense of radical empiricism itself. Along with William James, Dewey, Bergson, and to a great extent Cassirer, Peirce, and Royce, we situate Whitehead with a group of thinkers all of whom could easily accommodate Whitehead's results without introducing any great alteration of their own inquiries. In the cases of Bergson, Cassirer, Peirce and Royce, the (mathematico-logical) habits of inquiry are even similar, if less formalized. We offer no extended discussion of any of these radical empiricists and quasi-radical empiricists here, but we have discussed and defended them elsewhere and will continue to develop these historical theses as time and life permit. Within these pages we have attempted to document exhaustively both what radical empiricism is and how Whitehead is committed to it. We are far from the first to notice Whitehead's radical empiricism, or his kinship to the list of thinkers above in philosophical orientation. But this book is by far the most extensive treatment of the thesis and seeks to settle the question.

The third distinguishing trait of this analysis is its defense of what we are calling Whitehead's "radical realism," especially as connected with the method of extensive abstraction and his lifelong concern with the problem of space. Whitehead's objections to Kant's reduction of the problem of space to the transcendental conditions of presentation in cognition have not been well understood or widely discussed. Part of the reason is that one has to spend a good deal of time with Kant first, and the secondary literature is of little help, since Whitehead didn't know that literature and read Kant on his own. His readings of Locke and Descartes and Leibniz and Plato and Aristotle are similarly untutored and thus unencumbered with the categories and schools of interpretation that filter the educations of nearly every philosopher these days. But Whitehead's objection to Kant is especially important because Kant initiates a style of thinking about space that has placed it under artificial restrictions relative to the genuine reach of our analytical tools. A wide reading of Kant, beyond the first *Critique*, shows that the limitations of scientific knowledge are not as severe as the Kantians have generally argued, but that doesn't matter, since Whitehead really *is* concerned with the scientific and philosophical act of knowing, and that act of cognition *is*, according to Kant, limited by the *a priori* conditions of space as the empirical form of outer sense intuition and also by the formal constraints of space as a pure intuition in the *analysis* of sense. This view is what Whitehead criticizes.

Whitehead has the criticism right, in terms of understanding Kant, and he objects that Kant's constraints are too severe. Yet, to see where the problem lies with Kant and his dubious gift to his successors, one must make a clear distinction between extension and space, granting "space" more or less to Kant (although there is more to the form of space than Kant expected), and looking for something prior to the scientifically mediated processes of counting and measuring, but also for something still thoroughly intelligible to the finite mind. As with the quantum of explanation, the discovery of the

irreducibility of “extension” in every inquiry contributes something permanent to our adventures in knowing. But there is a difference. Where the actual entity is an analytical tool, extension is the real and existing continuum that gets analyzed by any and every tool. If there is any old-style ontological claim in Whitehead’s philosophy, it is that the extensive continuum *exists*, but even here he circumscribes the claim by “our cosmic epoch,” which is the hypothetical whole, characterized as the “undivided divisible” (another name for extension), which is the presupposition of our cosmic epoch. Whitehead’s concern to theorize extension as a strategy for handling “the problem of space” was a permanent feature of *all* of his theoretical work (not just his philosophical writings).

The final version of the theory of extension ends up as Part IV of *Process and Reality*, after having been drafted, using various tools of analysis, several times over Whitehead’s career. It was first projected as Volume Two of his *Universal Algebra*, then as Volume Four of *Principia Mathematica*, but Whitehead was never satisfied with his analysis. He ended up expressing it as a fairly simple axiomatic system in Part IV of *Process and Reality*, but there were still problems with it (which we will discuss in some detail). But even with those problems solved, as they have been, the true importance of Whitehead’s theory of extension hasn’t been understood at all by philosophers (although some computer scientists and mathematicians have seen promise in it). But philosophers have treated this theory as a sort of incomprehensible “add-on” to *Process and Reality* and have failed to grasp that the first three parts of that book exist *for the purpose of* situating the theory of extension as a piece of natural knowledge. Combined with the natural philosophy in Whitehead’s three books between 1919 and 1922, the theory of extension is asserted as a real piece of natural knowledge. Although Jorge Nobo has preceded us in understanding how the theory of extension belongs with and to Whitehead’s cosmology, his account is limited to the condition that the world be a solidarity, which is one of the analytical constraints of *Process and Reality*, but with importance for all of Whitehead’s inquiries into the natural world. Thus, we defend a version of Whiteheadian realism that stands alone both in the field of Whitehead interpretation and also in the philosophy of science itself. We make bold to suggest it may supplant the mainly verbal debate between those who call themselves realists and those who call themselves anti-realists in the present.

A fourth feature of our interpretation that is new is our way of distinguishing the levels of generality in Whitehead’s major philosophical works. We believe that many readers have not noticed that the theory of prehension, the theory of perception, the theory of transition and concrescence, and the theory of cosmic epochs are different *layers* of theory, with different rules and results and constraints, and operating at different levels of abstraction. The organic character of Whitehead’s philosophical inquiry can disguise the real differences in his complementary and mutually inter-dependent lines of reasoning. And his habit, as a writer, of reminding and digressing and

hopping around to point out an implication in his current line of reasoning for something he has said earlier, will say later, or has discovered during a different inquiry, adds to the confusion. Yet, Whitehead's use of terms is quite precise. There are reasons, as we will explain, for his habits. They frustrate not just the casual reader but also the seasoned and devoted ones. We will provide the needed guide in our early chapters for recognizing the different roles played in the philosophy of organism, as in Whitehead's other inquiries, by this kind of multi-layered approach to generalization.

The explanation of these relatively simple differences in levels of generality yields a clearer understanding of Whitehead's genuinely difficult philosophical method of genetic and coordinate analysis. A fifth feature of our book not found in others is a thorough explanation of how this kind of algebra actually works in *Process and Reality*. It works similarly in Whitehead's other inquiries, but our presentation here assumes that if this method can be understood in the most challenging instance, which is *Process and Reality*, then seeing how it operates in Whitehead's other books will not be as difficult. We do not have space here to carry out a full exposition of the method of genetic and coordinate analysis in all of Whitehead's books, but we hope other researchers will find occasion and energy to do so, and indeed we may also do some of this work in our own future efforts.

Finally, there are numerous suggestions, assertions, surmises, conjectures, and opinions contained in this book that are ours rather than Whitehead's. We have not been shy about commenting on the philosophy and science of our own time, and indeed, the *reason* we read and write on Whitehead at all is for the sake of adding something to the adventure of knowing for *our* time and for the future. Hence, there is (for example) contained here a thorough, and we hope devastating, critique of contemporary model-centric thinking in the interpretation of science. We believe Whitehead would agree with all of our assertions, but of course they have to be considered on the weight of our lesser authority. Still, we think that we are making an addition of some merit to our own context. The same may be said for the original parts of the account of possibility both in cosmology and in theology contained here. We have tried to be explicit when we speak for ourselves and not as interpreters of Whitehead.

About Whitehead Scholarship

This brings us to the aspect of the book that some readers may find least appealing, which is the situating of our work within the context of Whitehead scholarship. In an earlier draft of this book, we had far more extensive (and critical) engagement with that literature. However, we think that the summary treatment that survives in our final edit should suffice for scholarly purposes. Following the references in our notes, a motivated reader can glean how we depart from the main lines of interpretation, and from some more than others. We have here contented ourselves with a summary

of what we once had pounded out in great detail. Such are the realities of publishing in the twenty-first century.

We conclude this Introduction with a summary of how our efforts stand with regard to the major works of Whitehead scholarship. Readers who are not concerned with this part of the chore should skip to chapter 1.

The Contemporary Revival

Whitehead's thought has been enjoying a widespread revival. A sizable group of specialists in Continental philosophy has been engaged in studying and writing on Whitehead's connections with Bergson and Gilles Deleuze¹¹ in ontology, Bruno Latour in the philosophy of technology and critique of culture, and Isabelle Stengers, whose unusual combination of concerns and talents has made her the soul of the revival within these circles.

Also there have been independent rumblings by such writers as Steven Shaviri, who imaginatively reconstruct a world in which Whitehead, who *deserved* the role (in Shaviri's view) that was accorded to Heidegger instead.¹² Also from this domain comes the "object-oriented" philosophy and "speculative realism" of Graham Harman. Whitehead has successfully entered the blogosphere and the world of new media.¹³ Shaviri and Harman also press the relation between Whitehead and contemporary Continental thought. There are numerous young scholars operating within and at the edges of the traditional academic institutions who are doing exciting and novel work.¹⁴

Finally, we mention Roland Faber's appointment as Executive Co-Director of the Center for Process Studies at Claremont and his various projects (the Whitehead Research Project, especially), and the emergence of Catherine Keller as a major voice in feminist theology and in social ethics.¹⁵ They have influenced and reinforced the initial (Continental) direction of the Whitehead revival. Also, Whitehead Societies have appeared in Germany, France, and several Central and Eastern European nations, and interest has always been lively in Belgium, supplementing the strong interest that has existed for over 3 decades in China, India and Japan. In short, Whitehead is on many lips at many meetings and is being widely studied, referenced and re-introduced into teaching and discussion. We are encouraged by all this activity.

From a Logical Point of View

Isabelle Stengers rightly argues (but does not always remember) that Whitehead's general *approach* to philosophy is more closely akin to the methods of philosophers before Kant than after Kant, but he has the added advantage of access to more updated science and a greater number of mathematical and logical tools (some invented by Whitehead himself) than the Moderns possessed. The idea that philosophy ought to be approached by creative

formalization of its problems is an old-fashioned idea, these days, and philosophers are rarely trained in dealing with questions of the foundations of mathematics and logic that animated not only Whitehead's time, but the two centuries between Descartes and Kant.

Unhappily, several generations of Whitehead's interpreters have been trained in a narrow logic and a version of the history of philosophy according to norms that would fall significantly below those common in Whitehead's day, tempting interpreters to concentrate on the parts of the text that interest them, while leaving the parts they do not understand to *different* specialists. There is no harm in this, in the retail sense, it being like the ancient Indian fable of the blind men and the elephant, except that if no one can see the whole elephant at all, this leaves no one to *tell* the story.¹⁶ Similarly, then, Whitehead's *philosophical* methods are also poorly understood, especially the relation between the tools of genetic and coordinate analysis, on one side, extensive abstraction on the other, and the role played in both of these methods by creative formalization, in the quest for *philosophical* knowledge (which is quite distinct from other kinds of knowledge, for Whitehead).

Developmental Challenges

Whitehead's *development* as a philosopher is also a matter of confusion due to much semi-professional biographical research and associated speculation (sources are regrettably slender), coupled with a basic failure on the part of such historical researchers to understand Whitehead's *permanent* philosophical concerns with the problem of space, and with the various versions of a non-metrical theory of extension he worked toward his entire life.¹⁷ Thanks to off-handed, inaccurate, and irresponsible remarks made along the way by Bertrand Russell, many interpreters have acquiesced in Russell's "authority" and distorted the way Whitehead thought about the relation between mathematical order and knowledge.¹⁸ Very few interpreters grasp how Whitehead's investigations in the foundations of mathematics led him to favor algebraic over geometrical explanations (although Stengers has this right, in our view). But many interpreters, and nearly all *casual* readers of Whitehead, still confuse the narrow logic of *Principia Mathematica* with the broader logic of metaphysics and thus exaggerate Whitehead's commitment to the project of reducing mathematics to an axiomatic system of logic—a project that Whitehead recognized as a failure from an early date and from which he withdrew his energies. Indeed, Whitehead became one of the ablest critics of subject-predicate logic before the third volume of *Principia* was ever published and he maintained that criticism for the rest of his life.¹⁹

And finally, Whitehead's readers, from students to the most informed teachers of his texts, have not understood Whitehead's actual achievement in formalizing a non-metrical theory of extension, and how his other methods in *Process and Reality* have contributed to all sorts of subsequent

advances in computer science, abstract mathematics (Whitehead is the true pioneer of mereotopology), and the critique of General Relativity. At the same time, Whitehead avoids the conflation of space with extension that has dogged almost all philosophy since Kant.

Pie in the Sky

In this book, we address and (we believe) *solve* each of these deficiencies in the understanding and application of Whitehead. We make the case that Whitehead's thought, properly understood, is not only *relevant* to a host of contemporary philosophical problems, but also offers both formal and critical tools for addressing serious problems in the contemporary interpretation of science, with applications to every branch of theoretical knowledge. In this book we sketch a formalization of his views of possibility and actuality in ways that may open up empirical research on questions of time and non-local energy as they relate to the idea of possibility and the physical world.²⁰

Thus, the importance of this book, we would argue, lies not only in the correction of a long history of misreading, but contains guidelines for much more effective reading and application of Whitehead, which also makes it possible to *teach* his books with less confusion (see chapters 1–5). In addition to these contributions, it is hard to predict what importance may be accorded to our constructive applications of Whitehead's ideas to problems in the interpretation of science and the relations among philosophy, empirical, knowledge, and nature. Obviously we hope these ideas are found to be important and that they do some good in the world.

We hesitate to say that our ideas in the middle chapters are fundamentally “new,” since the vast majority of what we say is found somewhere in Whitehead, or in his background sources, or in the history of science and the history of mathematics he assumed, as well as elsewhere, but we will take credit—or blame—for the arrangement and presentation of these ideas here, which *is* without precedent, either in Whitehead scholarship or in any other philosophical work. The *effect* of our ideas will be new, we hope, if they receive any attention. This middle part of the book culminates with a “new” account of philosophical naturalism that would actually *settle* the current naturalism debate in both analytic/pragmatic and Continental philosophy, if it were to be considered in the context of the philosophy we defend here. We realize how bold this claim is, but we have aimed high and hope to attain some of what we aim for.

Theological Questions

The final chapters of the book (chapters 11–13) complete the account of naturalism and address the important traditions of process theology and theological naturalism that have developed among intellectuals drawn to process thought as a way of re-articulating spiritual traditions and experience

among humans. Much creative work in this domain has been done since Whitehead's death, although we think most of it has little *directly* to do with Whitehead's own philosophical concerns or with his actual achievements. As Stengers rightly points out in *Thinking with Whitehead*, it was Charles Hartshorne, and American philosophical theology, that preserved the strands of interpretation that have become today's revival. Auxier has addressed his development in previous writings.

Much of what we have to say in these final chapters is aimed at *extracting* Whitehead from this discussion that has now spanned some four generations, leaving, we hope, both the achievements of process theology and Whitehead's own thought intact. The tendency among process theologians to venture into scientific metaphysics and to associate their results with Whitehead's name has had the effect of deterring other serious interpreters of science and philosophers of science from the study of Whitehead, due to a common (although far from universal) scientific superficiality in the theological books and essays, and due to an aversion on the part of philosophers of science to pursue any kind of theological discussion. Some of the theologically oriented process literature is very good, scientifically and mathematically, such as the work of Wesley Wildman, but others are not so good. No one's misinterpretations of Whitehead are repeated more frequently than those of the theologian Lewis S. Ford. We want it understood that animus toward *his views* expressed sometimes in our main text is not indicative of any personal disdain. His viewpoint is basically theological and his method of interpretation is an adaptation of New Testament biblical criticism. It is misguided, and it has misled others who are even less well prepared than Ford to deal with the systematic and technical aspects of Whitehead's philosophy.

Due to the wide reading Ford received, many people simply start studying Whitehead wherever he sets them, with a full set of assumptions in place that, in our view, impairs a person's ability to understand much of what is plainly before him or her in Whitehead's text. That situation needs to change, and so Whitehead *as* a natural philosopher, cosmologist, and philosopher of mathematical order needs to be separated from the theological tradition he helped to start. Whitehead's concerns and achievements are not of a sort that contributes very much to theological discussion, *except through extrapolation*. These days, the interpretive tradition in process theology is so well established, with its own fine elders (John Cobb, David Ray Griffin, Marjorie Hewitt Suchocki, and others), that younger theologians and advocates of natural religion are not often aware of the extent of their own extrapolation from Whitehead, and thus, some of their work is passed off as Whitehead "scholarship." It usually is not. This needs to be corrected and situated rightly in the literature. Theological thinking in a process vein is valuable and ought to be pursued vigorously. Still, our last two chapters do the work of sorting out process theology (which is never "Whiteheadian" in any strict or even fair sense) from genuinely Whiteheadian ideas

about God. We draw attention to some of the most important deviations in this tradition from Whitehead's thought and we show some of the reasons to press for a Whiteheadian naturalism that is for the most part independent of theological concerns.

Thinking with Whitehead

Isabelle Stengers' *Thinking with Whitehead* is currently, one might say, "the book to beat" in Whitehead interpretation. Stengers really is only *thinking with* Whitehead. Her work is not Whitehead scholarship, nor is it intended to be. She leaves that work to others. Whitehead interpreters are very much divided by the position they take regarding Lewis Ford's "compositional analysis," as an interpretive approach to Whitehead. Compositional analysis is, as we have said, essentially an application of the methods of New Testament higher criticism to the question of Whitehead's development (with this supposed "development" limiting and determining interpretation). We absolutely reject "compositional analysis," and we find Ford's work to be a house of cards, highly speculative, implausible, and damaging to the understanding of Whitehead. Stengers not only endorses Ford's method and his results, but does so "unequivocally" and even suggests her book wouldn't exist without Ford's results.²¹

This changes everything, even though Stengers acknowledges that her basic problems are different from Ford's. Rather than argue with Stengers at every turn, or highlight the places where we agree with her (and there are many), we will set aside her interpretation here and argue mainly along our own line. We leave it to others to decide whether Stengers' insights can be extricated from the Fordian web.²² Our interpretation of Whitehead stresses the continuities and confluences of his thinking as part of his life as lived. We reject major breaks and sudden discoveries of the sort Ford depends on, and, unfortunately, Stengers allows to influence her understanding.

The common distinction among Whitehead interpreters, first offered by John Cobb, is, or has been, a threefold distinction of "genetic" interpreters, "systematic" interpreters, and the partisans of "compositional analysis." Our book is both "genetic" (chapters 1–5) and "systematic" (chapters 6–13), but we do not accept anyone's account of Whitehead's development (Lowe especially), and no one else has quite the same view of "system" that we defend, although we find in work by Jorge Nobo, James Bradley, F. Bradford Wallack, and several other "systematic" interpreters, much we can endorse and little with which we disagree.

Systematic Interpretations

Among the systematic interpreters, there has not been another book on Whitehead as ambitious as this one since William Christian's *An Introduction to Whitehead's Metaphysics*.²³ Christian's isn't really an introductory

book at all, in spite of the title. It is a good book, but limited by the fact that Christian does not seek to coordinate Whitehead's mature thought with his earlier writings and, as a result, offers an interpretation that forms a semi-stable island in the much larger sea of Whitehead's thought and his historical context. Christian's book is the only one that could easily be compared with ours on the whole, but even it is not nearly as comprehensive.

There are several studies that combine shorter systematic treatments with the aim of "introducing" Whitehead. Ivor Leclerc's *Whitehead's Metaphysics: An Introductory Exposition*,²⁴ is one such, but it suffers from the same overemphasis on *Process and Reality* as Christian's book, and also fails as an introduction (being too difficult to read). It has the advantage over Christian of situating Whitehead more astutely in the history of philosophy (emphasizing only those figures Whitehead actually studied), but this virtue eventually becomes a vice due to an over-emphasis of the same. Leclerc tends to reduce Whitehead to Plato or Aristotle or Leibniz in the course of discussion and to play the great philosophers off against one another, a comparison in which Whitehead is usually the loser, according to Leclerc. Thus Leclerc fails to present Whitehead's true intellectual context as belonging to the mathematics and physics of his own day.

In terms of the actual systematic, total interpretation of Whitehead, carried out in our middle chapters, our book is most similar to Jorge Nobo's *Whitehead's Metaphysics of Extension and Solidarity*.²⁵ We agree with much of what Nobo has to say. He is one of the few interpreters of Whitehead careful enough to get huge chunks of the philosophy of organism right, in our view. His book is very ambitious, but not nearly as comprehensive as ours. It also suffers from being more difficult to read than Whitehead himself. When one has done the work to figure out what Nobo is actually saying, one finds his book illuminating, helpful, in places brilliant (both intellectually and from a scholarly viewpoint). But Nobo's influence has been blunted both by the difficulty of his book and by constant negative representations from Lewis Ford's powerful perch as founder and editor of *Process Studies*.

Apart from Nobo, there is no total attempt at an interpretation of Whitehead similar to ours, but there are several books that investigate vital parts of the philosophy of organism. The most important of these are John Lango's, *Whitehead's Ontology*,²⁶ F. Bradford Wallack's *The Epochal Nature of Process in Whitehead's Metaphysics*,²⁷ and Judith A. Jones, *Intensity: An Essay in Whiteheadian Ontology*.²⁸ These studies have a good deal to recommend them, and their results can be used to supplement ours, but they do not attempt total readings.

Genetic Interpretations

Among genetic interpreters we need only mention Victor Lowe's *Understanding Whitehead*.²⁹ Lowe was one of Whitehead's last students and

became his reluctant biographer, although his colleague Jerome Schneewind actually had to edit Lowe's extensive notes and writing into the two-volume biography that every Whitehead scholar now reads and relies upon. But Lowe's 1962 book is actually a summary of Whitehead's development as a thinker from 1891 into the early 1940s, when Whitehead really stopped writing. Lowe does, therefore, connect the island of *Process and Reality* to the rest of Whitehead's own development, but unfortunately Lowe had no serious training in the history of science or the history of mathematics, and, in our opinion, not much ability as an intellectual historian (something Lowe repeatedly admits himself; he did all this work because *someone* needed to do it and no one was stepping up).

Lowe's 1962 book, like his biography, is misleading on many crucial points. His concern was to save Whitehead from criticisms that were popular among narrow-minded positivists and other language analysts during the time after the Second World War. He distanced Whitehead from anyone who might kill his influence among such people.³⁰ He essentially tried to make Whitehead respectable for analytic philosophy, to the extent he could, given the style and dogmas of analytic philosophy during that time. The context has changed in our time.

Verbal Disputes

As for guides to Whitehead, especially Whitehead's language, there are two well-known companions to *Process and Reality* by Donald Sherburne and Elizabeth Kraus, and there is John Cobb's *Whitehead Word Book*.³¹ These works could be seen as competing with and complementing both our method of reading Whitehead and our systematic analysis of *Process and Reality* in the middle chapters. Indeed, our middle chapters, if correct, would largely work against Sherburne's book as a viable guide, and our account and renders Kraus's book valuable only for parts of her commentary. But neither of these books attempts the total interpretation offered in our book. We will address ourselves to Sherburne and Kraus in the notes as circumstances warrant, and along with Cobb, these sorts of interpretations can be classed as "genetic," but limited in scope to a given book.

Out on a Limb

There are many studies applying aspects of Whitehead's thought to various problems he did not himself address. There are also numerous books that attempt to "update" Whitehead to bring his ideas to bear on the problems in one discipline or another. The results are very mixed. A good deal of success has been achieved in religious philosophy (see Wesley Wildman's numerous works), and also especially where religious experience touches on social experience (for example, Catherine Keller) and the experience of nature (see Richard Weidig and Ralph Pred, for instance³²). Our book does

not address directly this sort of study, since science, mathematics, ontology, logic, and the tools of analysis and knowledge are our primary concerns. Our reading has *implications* for these sorts of books, of course, but only to the extent that it may suggest these various authors are working with ideas *they* believe to be Whitehead's, but are not Whitehead's. We are not purists and are untroubled by the good use of good ideas wherever they may be found, but putting Whitehead's name to those ideas can be misleading.

The only direct competition regarding this aspect of our book comes from those Whitehead interpreters who seek to apply Whitehead to science in light of more recent developments in physics, especially, after Whitehead's lifetime. In this domain, our work, if we are right, invalidates the approach of Michael Epperson in *Quantum Mechanics and the Philosophy of Alfred North Whitehead*.³³ This earlier work of Epperson's was especially problematic in that it slipped from employing aspects of Whitehead's metaphysics as interpretive tools in the philosophy of physics, to making more broadly exegetical claims about Whitehead's metaphysics itself, claims which do not hold up under a careful reading of Whitehead's texts. However, the more recent work by Epperson and Zafiris, *Foundations of Relational Realism: A Topological Approach to Quantum Mechanics and the Philosophy of Nature*, does not suffer from that weakness.³⁴ In this work, Epperson (who handled the specifically philosophical parts of the discussion) maintains a much cleaner focus on the philosophy of *physics*, and thus on *applying* Whitehead's thought rather than going into deeper interpretations *of* that thought. But precisely on that account, Epperson and Zafiris are not offering an account that competes with the argument presented here. Rather, their work supplements and complements what we are doing, or so we believe.

In particular, it is worth highlighting two salient features of Epperson's and Zafiris's work. The first of these is the "relational realism" from which the book gets its title. One of the most profoundly unfortunate ideas in contemporary physics is the "multiple universes" claim, an especially unhappy piece of nonsense for which we will have some choice words later in this book, especially in chapter 10. This sort of groundless speculation on the part of physicists is driven, at least in part, by a failure by physicists to take relations *seriously*, while treating their mathematical formalisms as somehow ultimate. Thus, we agree with Epperson and Zafiris when they say that, "when elegance of formalism . . . trumps empirical applicability, the measure of scientific progress begins to derive from the measure of its appeal, rather than its appeal deriving from its progress."³⁵ But Epperson's and Zafiris's insistence that relations should be treated as having a genuine standing of their own, and not as merely parasitic upon their *relata*, makes their work one of the most important contributions in the philosophy of physics in recent years.³⁶ The second point to highlight is the use by Epperson and Zafiris of category theoretic ideas, especially that of a "sheaf," both as an interpretive tool and a primary formal technique applied to quantum mechanics.³⁷ As we will be arguing throughout this book, "algebraic"

modes of thinking (which includes category theory) are of vital importance in understanding Whitehead's relationalism.³⁸

In other areas, we tend to agree on many points with the book by Murray Code, *Order and Organism: Steps to a Whiteheadian Philosophy of Mathematics and the Natural Sciences*,³⁹ but Code has revised his view on much of what he said in that book, especially the parts we think he had right. We will note our reasons for this view in our notes as the book unfolds.

Our approach tends to agree with the results of the plasma physicist Timothy E. Eastman, who has published many articles on Whitehead and physics, and has gathered together some of the principal contributors to this discussion in his *Physics and Whitehead: Quantum, Process, and Experience*,⁴⁰ but one problem we encounter repeatedly is that such interpreters do not rightly understand what Whitehead means by "quantum" and they wrongly assume it is close to what contemporary physicists mean by that word. One challenge for our book will be the displacement of this habit of thinking. What Whitehead means by "quantum" is far more radical, and far more important, than what contemporary interpreters of science suspect.

1 Reading Whitehead

The order in which the parts should be studied will depend upon the psychology of the reader. I have placed them in the order natural to my own mind, namely, general principles, particular applications, and finally the general exposition of the mathematical theory of which special examples have occurred in the discussion of the applications.

—Whitehead, *The Principle of Relativity* (vi)

Difficult Reading

Whitehead is difficult to read, and there can be little doubt that the challenge of his language is partly responsible for limiting his influence. The difficulty, however, is not just mastering a new vocabulary. The problems also have much to do with the unfamiliarity, the novelty of the individual thoughts and relations among the ideas Whitehead describes, and this situation is not so much linguistic as intellectual. The ideas themselves are not easy to *think*. But in addition, it is not always easy to grasp the structure of Whitehead's *exposition* because it operates simultaneously at several levels of abstraction (or generality), and Whitehead is in the habit of moving from one level to another with little warning he has done so. He kindly overestimates his readers and under-estimates the subtlety and elusiveness of his thinking. Whitehead does define his vocabulary carefully and he does clearly describe the various levels of generality among which he hops, and he is very conscientious about laying out the scope, limits, and aims of every inquiry. But he asks too much of us.

The effort to understand Whitehead is further complicated by the organic character of his thought. Each part of his philosophy, every level of generality, every term, and every goal, is immanent in and achieved through all of the others. To understand clearly any given passage in one of Whitehead's books requires an understanding of the rest of the book. Whitehead is not one to waste words, so unpacking the full meaning of even a single sentence, in light of the work that sentence does in the book, can require a long narrative. Organicity in a philosophy is familiar to readers of Hegel, Bradley, Bergson, Royce, Heidegger, and numerous others, but the problem

is especially pronounced in Whitehead's most important works, since the order of exposition is often very different from the order in which the ideas would be traced if the exposition were linear. As Whitehead says, "In the presentation of a novel outlook with wide ramifications, a single line of communications from premises to conclusions is not sufficient for intelligibility. Your audience will construe whatever you say into conformity with their pre-existing outlook."¹

In addition to these problems, there is also a great difficulty in understanding how one work by Whitehead, whether an essay or a book, relates to or bears upon others in the full corpus. Here we have to confront not only issues of the development of Whitehead's thought, but also the *unity* of it. Many incompatible interpretive theses have been defended by various scholars over the decades, but the most influential theses usually involve the idea that Whitehead's thought culminates in his 1929 work *Process and Reality*, which is by any standard the heart of Whitehead's philosophy, and that all other works are to be measured by the content and aim of that work. This prevailing view is neither correct nor helpful in learning to read Whitehead, so we will not assume it in what follows.

Whitehead's Lexicon

To begin the daunting task of "reading Whitehead," it is a good idea to start with a discussion of terminology and how it is deployed in service of systematic inquiry. Whitehead organized his inquiries in the way mathematicians do, defining terms clearly but flexibly and generally, and redefining them when he changed from one inquiry to another. Thus, for example, what he *calls* "eternal objects" in *Process and Reality* has a close relation to what he calls by the same name in *Science and the Modern World*, and both are close to what he calls "ideal forms" in *Religion in the Making*, but there is no reason to assume an identity of meaning for technical terms across different books. Indeed, the meaning of technical terminology develops and deepens more *within* the context of a single inquiry than across books, so that there is no reason to assume that a technical term, such as "ideal form," means exactly the same thing from one occurrence to the next within even the *same* book, let alone across books. For example, in *Religion in the Making*, the term "ideal forms" is used more or less interchangeably with the terms "ideal entities," and "abstract forms" and all are closely related to the term "ideal world."²

Whitehead says, "The fate of a word has to the historian the value of a document."³ To be a reader of Whitehead is to be a historian of a sort. But Whitehead's writing style tempts one to treat individual occurrences of technical terms as though they might serve as fixed definitions. He has a habit of saying things like "an actual entity is the outcome of a creative synthesis, individual and passing."⁴ But elsewhere he may say something like "to be an actual entity is to have a self-interest,"⁵ which seems to have no clear