EDITOR'S INTRODUCTION

More than twenty years have passed since Thomas S. Kuhn's untimely death. The book that made him famous, *The Structure of Scientific Revolutions*,[1] has achieved the status of a classic: it is indispensable reading for every well-educated person. It is increasingly recognized that Kuhn was not only one of the most important philosophers of science but also one of the most important thinkers of the twentieth century, whose influence reached and, in some cases, thoroughly transformed a number of academic fields.[2] To be sure, some of Kuhn's views are still as controversial as they were in 1962, when *Structure* burst upon an audience still steeped in logical empiricism, but his philosophy is now much better understood than before, and its complexity and nuance are much more appreciated.

This is in no small measure due to Kuhn's own sustained efforts to explain and defend the central claims of *Structure*. In time, however, he became persuaded that further clarifications—however careful—would not do; he came to think that his philosophy of science needed to be revised to some extent, and that it also needed to be situated within a larger, reworked philosophical framework. He published a series of papers in which he presented an overview of the new direction that his philosophy had taken.[3] This work was to culminate in a new magnum opus, a book that was

his main project for more than a decade; sadly, he did not live to complete it.

This volume finally brings to the public eye all of the drafted chapters of this eagerly awaited book, provisionally entitled *The Plurality of Worlds: An Evolutionary Theory of Scientific Development*. This manuscript is preceded by two related texts, not previously published in English: Kuhn's paper "Scientific Knowledge as Historical Product" and his Shearman Memorial Lectures, "The Presence of Past Science." The volume also includes two abstracts, one for the Shearman Lectures and the other for *Plurality*. Although they are editorial creations, the abstracts use Kuhn's own formulations whenever possible. They show, at a glance, the areas of thematic overlap between the two works. In addition, the abstract for *Plurality* sketches the main issues with which the unwritten parts of the book were to be concerned, insofar as these could be responsibly reconstructed.

This introduction to the volume consists of three parts. Part I presents the history of the three manuscripts, their relation to one another, and their state. Part II, intended mostly for readers not thoroughly familiar with Kuhn's post-*Structure* philosophical preoccupations and development, provides that information and context, and sketches the contours of the book *Plurality* was intended to be. It is, in a way, a road map through the complicated, often overlapping, and fundamentally unfinished primary material.[4] Part III of the introduction offers concluding remarks on the nature and contents of this volume.

I. The Contents of This Volume

Sources

In working on this volume, I relied on a number of sources. Although I do not discuss here all of Kuhn's previously published texts, or the rich secondary literature on Kuhn, these works did give my editorial work a necessary background. Some of the arti-

cles that Kuhn published in the late 1980s and the 1990s were especially helpful, since that is where the philosophical project of *The Plurality of Worlds* begins to take shape.[5] Even more important was Kuhn's foreshadowing, in the drafted chapters of the manuscript, of what was to come later in the book. In addition, Kuhn left a rich archive of unpublished texts of various kinds, most of which are kept at the Institute Archives and Special Collections, Massachusetts Institute of Technology. The most important among them, for the purpose of reconstructing Kuhn's unfinished book, are the Thalheimer Lectures,[6] Kuhn's class notes and handouts for his MIT graduate seminars, in which he often discussed his book in progress,[7] and his correspondence with colleagues, especially his exchange of letters with Quentin Skinner in the wake of the Shearman Lectures.[8]

An important source that I relied on when reconstructing *Plurality* is not publicly available, however: the unrevised notes that Kuhn left for each projected chapter of the book.[9] For the most part, these notes are brief and suggestive rather than detailed and explicit; nonetheless, I found them very useful in producing the abstract for *Plurality*.[10] Jehane Kuhn, Kuhn's widow and literary executor, gave me a copy of transcribed conversations among Kuhn, James Conant, and John Haugeland, in which she occasionally participated.[11] The conversations took place in Kuhn's home, June 7–9, 1996, in five working sessions, totaling about seven hours. Kuhn wanted the tapes of the conversations destroyed, and he never meant the transcripts to be publicly available.[12] Out of respect for Kuhn's wishes, I did not use these transcripts as a source of information about his philosophical views, but only to reconstruct the history of his work on the manuscripts published in this volume.

None of the sources provides anything approximating a rough draft of the unwritten parts of *Plurality*. Rather, they give us a sense of Kuhn's general philosophical direction, with very clearly stated reasons, here and there, against a particular misunderstanding of his views, or against a rival philosophical position that might be

mistaken for Kuhn's own. Thus, the available sources throw only a partial, ambient light on the project of *Plurality*, which Kuhn was still thinking through in June 1996. No one can know now what would have been the final, detailed account of his view had he had the time to articulate it fully; but the overall contours of his position can be sketched, and at least some details filled in.

Primary Texts

"Scientific Knowledge as Historical Product" and Kuhn's Shearman Memorial Lectures, "The Presence of Past Science," are both philosophically important on their own and significant as milestones in the development of the ideas central to Kuhn's unfinished book. Arranged chronologically, the three texts show Kuhn's philosophical trajectory from the 1980s until his death, in 1996.

"Scientific Knowledge as Historical Product" was drafted and revised multiple times between 1981 and 1988. Various versions of it were given as invited lectures.[13] In his first Shearman lecture, Kuhn notes that "Scientific Knowledge as Historical Product" is "to appear in *Synthèse*" (meaning *Revue de Synthèse*, a French journal of history and philosophy of science), but it did not appear there.[14] The last version, included in this volume, was given as a lecture in Tokyo in 1986 and subsequently published in *Shisō* in Japanese translation.[15] It offers the best available account of Kuhn's analysis of the origins and commitments of the traditional epistemology of science, the problems that plagued it, and the ways in which Kuhn's developmental understanding of science avoids these problems. Although there is no significant textual overlap between this paper and the opening chapter of *The Plurality of Worlds*, the two texts share the same title and perform the same function of justifying Kuhn's developmental, historically sensitive, practice-oriented philosophy of science. I tend to think of this paper, then, as a proto–chapter 1 of *Plurality*.

"The Presence of Past Science" is a series of three Shearman Memorial Lectures that Kuhn gave at University College London

in November 1987. The lectures explore Kuhn's developmental-historical approach to science and begin to articulate the philosophical consequences of adopting it. Two other lecture series preceded them: the Notre Dame Lectures, "The Nature of Conceptual Change," delivered at the University of Notre Dame in November 1980, which appear to be lost;[16] and the Thalheimer Lectures, "Scientific Development and Lexical Change," presented at Johns Hopkins University in November 1984.[17] The Shearman Lectures are the latest complete version of Kuhn's mature philosophy, and the best available—if imperfect—guide to what his book aimed to accomplish: they sketch the whole philosophical landscape that the projected book was to cover. The last lecture is particularly important in giving us a sense of what would have been the content of part III and of the epilogue of *Plurality*, had Kuhn lived to write these parts of the book.

Kuhn did not publish the Shearman Lectures, nor any other lectures that he gave in the late 1980s and early 1990s. He treated them as more or less successful drafts of his book. He did, however, revise and polish the manuscript of the Shearman Lectures, and he shared it with a number of his colleagues, friends, and students; it is still in semiclandestine circulation in some philosophical circles.[18] The Shearman Lectures thus became a major unpublished textual source for appreciation of Kuhn's later philosophy. Two splendid articles—the first by Ian Hacking and the second by Jed Buchwald and George Smith[19]—analyze and discuss the Shearman Lectures in philosophically stimulating ways, rich in nuance and detail; a full understanding of these articles, as well as of Kuhn's published response to Hacking,[20] requires familiarity with Kuhn's original text. So, since the Shearman Lectures are by now widely discussed but not generally accessible, and since the book that was to supersede them was not completed, Kuhn's literary executors and the University of Chicago Press decided that this important text should be included in this volume despite Kuhn's original intention not to publish it.[21]

The centerpiece of this volume is, of course, Kuhn's unfinished book, published here under the working title at the time of Kuhn's

death: *The Plurality of Worlds: An Evolutionary Theory of Scientific Development*. Had Kuhn lived to complete the book, he would probably have given it a different title. The original working title seems to have been *Words and Worlds: An Evolutionary View of Scientific Development*. This is the title Kuhn proposed in his successful application for a 1989 National Science Foundation grant in history and philosophy of science.[22] It is not clear why Kuhn abandoned this title, which adequately announces the intended content, nor why he did not return to it when he became concerned that his *The Plurality of Worlds* might be confused with David Lewis's *On the Plurality of Worlds* and mistakenly assumed to be, like Lewis's book, about modal logic.[23] Kuhn expressed this concern to Jehane Kuhn, who told me of it in a private communication in 2017. Kuhn's wish to find a new title for his book is also documented in his transcribed conversations with James Conant, John Haugeland, and, in this segment of the conversation, Jehane Kuhn.[24] Speaking about the title, Kuhn said that it should include *worlds*, or *plurality*, but he decided to leave the final decision to Jehane, who did not change the title.

Kuhn's plan for the book was an ambitious one, and the work on it took a very long time.[25] It was to open with acknowledgments and a preface, followed by three substantive parts, each consisting of three chapters: part I, "The Problem"; part II, "A World of Kinds"; and part III, "Reconstructing the World." An epilogue was to be added, and an appendix was to conclude the work. Unfortunately, complete drafts exist of only part I (chapters 1–3) and chapters 4 and 5 of part II; the draft of chapter 6 is unfinished. Kuhn left sparse notes for part III and the epilogue, but no actual text; the preface and appendix are also missing.

Part I is polished, clearly close to the intended final version. It motivates the project of the book as a whole, and outlines the planned chapters ahead. Its focus is on the nature and philosophical significance of historical study of science, vividly introduced through detailed case studies of Aristotle's, Volta's, and Planck's works. Kuhn used these three case studies to show how exactly

history of science must confront incommensurability in order to produce understanding and to pose the important philosophical questions that the last part of the book was designated to address. Although there is a considerable textual overlap between the first Shearman lecture and chapter 2 of *Plurality*, the overall differences between the two works, separated by less than a decade, are also considerable, and very important in revealing the trajectory of Kuhn's thinking and the development of his mature philosophical position. The second Shearman lecture, for example, discusses incommensurability between past and present science, and sketches the contours of theories of meaning and knowledge that would allow us to make sense of historical understanding despite incommensurability. Insofar as this lecture gestures toward an empirically based account of language learning and concept acquisition, it is the germ from which part II of the book was developed; but the actual text and philosophical methodology differ greatly.

In fact, part II—in contrast to part I—will likely be a great surprise to readers familiar with Kuhn's published writings. Kuhn seems to be searching here for a naturalistic foundation of his prospective theory of meaning, which should, in turn, ground his revised idea of incommensurability. He aims to use the results of scientific research in cognitive and developmental psychology as a basis for his theory of meaning and understanding across incommensurably different lexical structures and practices. This important project is advanced, but not completed, however. I suppose that the final version of part II would have updated and compressed the relevant results of scientific research, and then highlighted their philosophical significance, thereby preparing the ground for the philosophically most interesting—but unwritten—last segment of the book.

Part III was to twist together the historical view of conceptual change, on display in part I, and scientific accounts of concept acquisition presented in part II, in order to explain both incommensurability and our ability to understand and communicate in spite of it. *Plurality* treats incommensurability as ubiquitous across

cultures, languages, historical periods, and various social groups; scientific communities divided by incommensurability are but a special—albeit very special—case. Kuhn aimed to explain both the way in which science shares universal patterns of concept acquisition and structuring of lexicons, and the way in which lexical change in science differs from lexical change in natural languages. General philosophical questions about meaning, understanding, belief, justification, truth, knowledge, rationality, and reality were all raised by Kuhn's project, and he meant to address them in part III. The main goal was to develop theories of meaning and of knowledge that would take incommensurability as their starting point, and find room for, first, a robust notion of the world that science investigates, second, for the rationality of belief change, and finally, for the idea that scientific development is progressive.

The epilogue was to return to the question of the proper relationship between history and philosophy of science, which preoccupied Kuhn since *Structure*, and which magnetized both his critics' and his admirers' attention. In his early work, Kuhn passionately argued against presentist (or anachronistic) approaches to history of science, which he saw as characteristic of both logical empiricism and Popperian falsificationism.[26] He was convinced in *Structure* and in his 1977 book of essays *The Essential Tension* that philosophy of science must reject presentist case studies, and rely on responsible, detailed historical work that recovers context, concepts, problems, and intentions of past scientific communities. However, in the late 1980s, Kuhn came to think that presentist historiography has its own irreplaceable function, which he was to explain and discuss in the epilogue to *Plurality*. Fortunately, this central idea for the epilogue is very clearly presented in the last Shearman lecture.[27]

Finally, the appendix was to offer a detailed comparison between the views presented in *Structure*, which remained the source of Kuhn's central philosophical ideas as well as of the main problems that preoccupied him until the end of his life, and *Plurality*, which was to be his final word on these issues.[28] The continuities

and differences between the two works were to be highlighted and explained. Insofar as we can accurately reconstruct Kuhn's last book, we can also imagine what the substance of the comparative appendix would have been.

But to reconstruct Kuhn's unfinished book in sufficient detail is not an easy task. We are obliged to rely on various texts—published and unpublished—outside the manuscript itself. They were written over more than a decade, and it is not always clear which of the ideas that Kuhn explored in this period he intended to fully articulate and defend, and which he would have rejected in the final version of his book.

Insofar as part III can be reconstructed, then, I tried to do so in the abstract that I created for *Plurality*. This still leaves the reader with only a skeletal representation of the centerpiece of Kuhn's book. It is thus important to bear in mind that the publication of the manuscript does not, by itself, fully represent Kuhn's ambitious philosophical project. Its proper appreciation requires interpretive and imaginative efforts different in kind from the efforts that were needed to understand the unfamiliar landscape of *Structure* at the time of its publication; but now as then, the effort will pay.

II. A Guide to Kuhn's Unfinished Project

From *Structure* to *Plurality*

Reacting against philosophical approaches to science dominant in 1962, when *Structure* was published, Kuhn insisted that science should be seen as a historically developing set of traditions, through which knowledge changes and grows. Scientific change is neither uniform nor strictly cumulative; rather, it exhibits a two-phase pattern. Periods of normal science, marked by consensus within the scientific community on all fundamental matters, produce coherent, cumulatively progressive results. When this consensus breaks down under the pressure of accumulated anomalies, the scientific community enters a period of extraordinary science, marked by

competition between proponents of rival, incompatible frameworks for doing science, which Kuhn in *Structure* called *paradigms*.[29] These rivals are incommensurable, and the eventual choice of one among them is not forced by either logic or paradigm-neutral empirical evidence. Scientific revolutions are thus disruptive episodes of fundamental reconfigurations, through which scientific knowledge develops in a noncumulative way.

The reception of *Structure* was not what Kuhn was hoping for. In his view, both his critics and would-be followers seriously misunderstood the book.[30] He was read as a radical relativist, whose views cannot explain scientific change as due to good reasons and evidence, but only as a result of rhetorical, institutional, or political power of the side that ultimately won. Thus, it was argued, Kuhn cannot see science as the paradigmatically rational enterprise that gets us progressively closer to the truth about the world.[31] Moreover, Kuhn's startling claims—that "when paradigms change, the world itself changes with them" and "though the world does not change with a change of paradigm, the scientist afterward works in a different world"[32]—inspired charges of idealism and constructivism. Kuhn rejected such characterizations of his view, while maintaining that some of his paradoxical-sounding claims are actually correct. For the rest of his extremely productive career, he was to return to *Structure* in the hope of making its claims both understandable and plausible.

His post-*Structure* philosophical work can be seen as developing through at least two relatively distinct periods.[33] The first period starts with the 1969 postscript to the second edition of *Structure* and ends in the early 1980s.[34] Kuhn was then responding to numerous mischaracterizations of his book with clarifications, explanations, and new arguments, but without dramatic revisions. He argued that incommensurability does not imply impossibility of communication or comparison, and that scientific choice is not primarily driven by social and political power. Insisting on the communal nature of scientific inquiry, Kuhn highlighted the importance of rigorous, formative scientific training and of the

shared values that guide all scientific research and evaluation.[35] He began to stress that scientific reasoning and practice cannot be separated, and must be understood as products of a scientific group that, through its expert judgment, choice, and practice, constitutes science as a rational inquiry into various aspects of the world. Nonetheless, characterizations of his position as hospitable to radical relativism, irrationalism, and social constructivism persisted; Kuhn's consistent rejection of such characterizations was still rarely taken seriously in this period.

In the mid-1980s, Kuhn's work entered a new phase, which I refer to, interchangeably, as "Kuhn's mature philosophy" or "the late Kuhn." All three texts collected in this volume are from this period, during which Kuhn undertook more radical revisions of *Structure* and considerably widened his philosophical concerns. He came to distinguish among the different perspectives from which working scientists, historians, and philosophers ask their questions about science. This led to a more nuanced, qualified, and precise understanding of incommensurability as ubiquitous but local, and of scientific change as revolutionary only when seen from a great historical distance. Most importantly, Kuhn concluded that his philosophy of science needed a general theory of meaning, a full-blooded epistemology, and a novel take on the debate between scientific realism and constructivism. His main task was then to reconfigure these fields in such a way that his view of scientific development as involving incommensurability between historically distant theories and practices would both make sense and not jeopardize the general perception, which Kuhn wholeheartedly shared, of science as rational and progressive.

Historicism

It is typical for Kuhn to open a philosophical text by stressing the importance of history as its necessary starting point. The first sentence of *Structure*—"History, if viewed as a repository for more than anecdote or chronology, could produce a decisive transformation

in the image of science by which we are now possessed"[36]—could easily be seen as the motto for all of his subsequent work. For Kuhn, philosophical reflection on science needs to be grounded in accurate description of actual scientific practice and of its meandering history, since without a proper understanding of how science works and changes, philosophy of science cannot explain either its successes or its failures.

Kuhn's historicism was in sharp opposition to philosophical projects of logical empiricists and Popperian falsificationists, which were both primarily normative rather than descriptive, and fundamentally uninterested in the history of science.[37] Their goal was to develop and justify a set of methodological rules that reliably lead to increased scientific knowledge, and thus explain progress in science. This tradition had no great use for meticulous historical research but rather relied on simplified, decontextualized descriptions of some episodes in history of science, perceived as crucially important from the present-day point of view. Kuhn thought that this normative-methodological philosophical project and anachronistic, presentist historiography reinforce each other, and jointly create a distorted image of science. This image Kuhn sought to replace with a properly diachronic and descriptively accurate image of his own.

Kuhn's own approach to history was hermeneutic; that is, internalist and contextual. Hermeneutic historical narratives strive for explanatory success through maximal consistency, completeness, and avoidance of anachronistic explanatory categories and distinctions. Passages that seem incomprehensible or obviously false to a present-day reader should be valued as the essential puzzles for a historian to solve. For the late Kuhn, hermeneutic historiography is a kind of retrospective ethnography, which aims to understand concepts, beliefs, and practices that, to the historian, initially appear alien and often absurd.[38] Serious historical narratives may focus on great scientists, important experiments, or momentous discoveries, but they always provide historical context and background. In that sense, they are always about whole

scientific communities, whose concepts and beliefs the historian tries to recover. He must re-create in his narrative the web of commonly shared assumptions and beliefs, typical argumentative strategies, nodes of disagreement, and the intended audience of scientific writings. Most importantly, the historian needs to master the structured lexicon of past scientific communities, a lexicon that is typically incommensurable with his own. Historical understanding is thus akin to learning a long-lost language, with only partial and often misleading connections to the language of current science. The goal is to create a narrative within which past beliefs and choices can be seen as reasonable and plausible, rather than irrational, mistaken, or absurd.

Although *Structure* influenced sociology of science and inspired careful historical research in that field,[39] Kuhn was strongly opposed to the sociological explanatory categories that structured these historical narratives.[40] Sociologists of knowledge represented scientists as primarily engaged in political or social power struggles, and argued that scientific choice must be explained as determined by personal idiosyncrasies, ambitions, and, especially, political interests. Kuhn took this to imply a skeptical conclusion about the cognitive authority of science and rejected such historical narratives as incapable of accounting for the importance of empirical observation and experiment in driving scientific change. Sociologists of knowledge, in Kuhn's view, do not pay enough attention to scientists' self-understanding as explorers of nature, and thus they cannot explain either what scientists do, or why they do it. His own hermeneutic historiography privileges *cognitive* explanatory categories and is strictly internalist and intentionalist.

Kuhn's understanding of philosophical uses of history evolved throughout his career. His last period shows three important developments. First, he gave even greater prominence in his philosophical texts to actual historical case studies. For example, in the Shearman Lectures and in *The Plurality of Worlds*, three case studies—of Aristotle, Volta, and Planck—are foregrounded and presented in much more detail than the historical examples in

Structure. This method of exposition is, for Kuhn, also a method of thinking: his view of science and of incommensurability are not illustrated by case studies, but rather emerge from them. A deeper involvement with specific historical narratives in his mature period allowed Kuhn to locate the sites of incommensurability with much greater precision than in his early works, and to then raise general philosophical questions concerning meaning, rationality, ontology, truth, and progress on firmer grounds than before.

Second (and surprisingly for some), in the last decade of his life, Kuhn recognized that we need presentist historiographical narratives as much as we need the hermeneutic ones. Hermeneutic historiography remains uniquely suitable as the starting point for philosophical reflections on science, as is shown through the case studies that open both the Shearman Lectures and *Plurality*. However, the *motivation* for philosophical reflection on science as a supremely rational and progressive quest for knowledge can come only through presentist narratives.[41] Presentist narratives project present-day scientific concepts, questions, and problems onto the past, and trace precursors as well as obstacles to our own ways of doing science. This does not lead to an understanding of past scientific communities on their own terms—quite the contrary—but it does help us feel *connected* to them. Moreover, the late Kuhn concluded that his analysis of scientific development needs a dose of presentism in order to account for scientific developments as truly *progressive*; they can be seen as such only from the present point of view. Although incompatible with the hermeneutic approach, presentist historiography needs to be done parallel with it, for—as the third Shearman lecture suggests and as the epilogue to *Plurality* was to expand upon—it is only through presentist historiography that the past can be seen as *our* past. The late Kuhn's acceptance of the multiplicity of legitimate kinds and uses of history replaced his earlier belief that only one kind of historiography has real value for philosophers of science.

Finally, the late Kuhn refined his articulation of the *status* that history has in his philosophical project. His historicism was too often mistaken for an empirical theory, in which historical data

are supposed to provide straightforward evidence for his cyclical model of scientific change. He took great pains to distance himself from this interpretation, highlighting instead that the main value of his historiographical work was to help him develop a historical *perspective* on science. A historical perspective is a way of seeing, a sensibility, developed through a deep involvement with internalist hermeneutic historiography, but argumentatively unencumbered by a historian's concern to produce explanatory narratives of particular events. Once acquired, this perspective naturally gives shape to the questions that philosophers need to ask about science, and it also suggests solutions to some of the problems that plagued the reception of *Structure*.

The most significant among them was the problem of explaining the periods of extraordinary science as periods during which rational discourse continues to play a crucial role in scientific work. *Structure* highlighted numerous conceptual, methodological, and practical incommensurabilities among rival paradigms, and asserted that their proponents often talk past one another, relying on different standards of cogent reasons and of empirical evidence. To Kuhn's critics, this image of extraordinary science seemed to collapse into a radical, almost self-refuting relativism. Kuhn was read as saying that incommensurability between rival paradigms is *complete*. Without any shared conceptual, methodological, or evaluative grounds, the ultimate choice of one of the rival paradigms cannot be rational; worse still, in the absence of a common language, the disagreements between the proponents of rival paradigms cannot even be stated. Of course, Kuhn never meant to defend such a position, but he did realize that his description of extraordinary science could be misleading. He concluded that, in his early work, he did not sufficiently distinguish between the perspective of contemporaries in the midst of a fundamental disagreement, and the perspective of a historian writing many centuries after the events he was trying to describe and understand.

From the perspective of the actual historical actors, all trained in the same way, immersed in the same practice, and facing the

difficulties and anomalies that they all recognize as such, it is always possible to understand what an opponent is saying, the late Kuhn realized. At any given time, all members of a scientific community have much in common. Revolutions *appear* to be swift, decisive, and complete changes only from a considerable historical distance, because incommensurabilities between the rival ways of doing science grow over time. From the standpoint of the scientists themselves—as well as for a historian who focuses only on a short, crucial period of extraordinary science—changes cannot but be described as incremental and partial, always justified with an appeal to the shared beliefs, methods, and values that are not, at that moment, called into question.

In his mature period, Kuhn preferred to discuss the *evolution* of scientific knowledge through a process he metaphorically linked to speciation. He no longer identified scientific revolutions as periods in which a new paradigm replaces an old one, but rather, he saw them as periods in which an old way of doing science effectively *splinters* into a number of newly formed specialties: the old domain of phenomena becomes divided among different new disciplines, as do the basic methods, problems, and solutions that survive the revolution. Looked at this way, revolutions should be depicted as the speciation-event nodes on the phylogenetic tree; the resulting specialties are the branches that shoot off from such nodes. The role of incommensurability in Kuhn's new model of scientific change is extended as well: it now obtains not only between the old and new lexical structures and practices, but also among the new specialties themselves. Each will study its own domain of phenomena, with very small areas of overlap with the others; each will develop what Kuhn came to call a complete structured lexicon, incommensurable with the structured lexicons of the other disciplines.[42]

Naturalism

For philosophers who think of historicism and naturalism as polar opposites, the structure of *The Plurality of Worlds* is likely to be

puzzling, to say the least. Kuhn's well-known historicism, on such splendid display in part I, seems to vanish in part II, to be replaced with detailed reports of scientific experiments in cognitive and developmental psychology. Although Kuhn never used the term *naturalism* to characterize his philosophical project, his reliance on results of scientific research does make him a naturalist of sorts.[43] His suggestion that part III will return "to the themes of part I, for which part II attempted a *foundation*," requires an explanation, however.[44] First, it is not clear how empirical results of psychological experiments could provide a foundation for answers to the philosophical problems raised by incommensurability. Second, Kuhn consistently and explicitly rejected epistemic foundationalism. Both as a historian and as a philosopher, he would always start in the middle of things, consider concepts, beliefs, and practices as already in place, and then he would ask what motivates and what justifies a particular *change* to any of them. What kind of foundation could such a situated epistemology need, and whatever for?

Despite the way he described the task of part II of *Plurality*, Kuhn never thought of the research reported in it as providing *epistemic* foundations for his philosophical project. His epistemology is not in search of certainty—it is not even especially interested in distinguishing between belief and knowledge. Rather, by *foundations* Kuhn meant the *starting point* of human cognitive development, and the innate neurological basis that will be activated in all subsequent concept acquisition. All human beings share this biological basis for cognition, and concept acquisition in all of us follows the same developmental trajectory. Kuhn does turn to scientific research to discover what these innate capacities are, how flexible they are, and how they develop from infancy to potentially multilingual adulthood. This does make him a naturalist in one of the many senses in which that label is used among philosophers, but it is important to note that his naturalism is neither reductionistic nor scientistic. It does not intend to replace philosophical questions about meaning and knowledge with a summary of scientific research on early concept formation. Rather, it seeks to

ground and constrain the questions that philosophers can reasonably ask about conceptual change. Had he lived to revise part II and write part III, it would have been evident that he turned to science in exactly the same spirit, and for the same kind of reason, that he initially turned to history.

To see this, recall that Kuhn argued that, in order to understand science, we must understand its history; a changing, evolving practice cannot be properly understood if its diachronic nature is not appreciated. Hermeneutic internal historiography provided the best means of doing so, and Kuhn took it for his starting point ever since *Structure*. This historical approach revealed incommensurabilities among differently structured scientific lexicons. To understand what makes such different lexicons possible and effective, and to what extent we communicate across incommensurability and how, Kuhn needed a descriptively accurate account of our capacities for acquiring, systematizing, using, and changing our concepts. The best source of that information was not history but psychology, and so he turned to the research on categorical perception, cutting-edge at the time, to gain reliable information about biological and developmental aspects of human conceptual capacities. Arguably, had he lived longer, he would have enriched his understanding of lexical structures with relevant research from evolutionary biology and linguistics, especially sociolinguistics. Although scientific research in the relevant fields has considerably developed since the 1990s, when Kuhn was working on *The Plurality of Worlds*, the general structure of his philosophical project is not undermined: it is meant to incorporate *whatever* the best scientific research delivers on human conceptual development and capacities.

Thus, it is not merely the case that Kuhn's historicism and his naturalism are not in tension with each other. In fact, they are but two different ways of respecting the same reasonable requirement: that the phenomena on which a philosopher reflects first be accurately described. History of science describes scientific development and change, recovering in its narratives past problems,

lexicons, canons of reasoning, and other aspects of scientific theory and practice. Scientific research in evolutionary biology, cognitive and developmental psychology, and linguistics describes the capacities and processes involved in creating lexical structures. Kuhn's historicism and his naturalism thus both answer to the descriptive demands of his philosophical project, and constrain the questions that can reasonably be asked about incommensurability, understanding, and, most importantly for Kuhn, the practice of science.

Concepts, Kinds, and Structured Lexicons

The first task of *The Plurality of Worlds* was to develop a theory of meaning, capable of explaining meaning change, the ubiquity of incommensurability, and human ability to overcome the barriers it presents to communication and understanding. Given Kuhn's general philosophical orientation, it is not surprising that his theory was to be structurally different from other available theories of meaning. Instead of asking, as traditional theorists do, What is meaning? Kuhn raised several interrelated *developmental* questions: How are concepts acquired? How are the meanings of words learned? Why do the meanings of some words change over time? What is a conceptual change, and how does it happen? In other words, Kuhn was searching for a dynamic, developmental, and descriptive theory of concept *acquisition* and meaning *change*.[45]

In his mature philosophy, Kuhn already thought of incommensurability as a local phenomenon, reaching global proportions only when seen from a great historical distance. In his last works, he explicitly extended this point from the history of the natural sciences, where he first noticed it, to a general view about human languages, which are frequently locally incommensurable with one another. The late Kuhn argues that the key sites of incommensurability, whether among natural languages or among specialized scientific theories, are to be found in clusters of interrelated *kind terms*. In *Plurality*, Kuhn sought to describe two consecutive developmental

paths that need to be traced if we are to understand the process through which highly specialized scientific kind terms are articulated. The first is the path of individual human cognitive development, from birth to bilingualism; the second is the path of communal development of lexical structures, from kind terms in natural languages to abstract technical terms of mature science.

The biological basis of human capacity to categorize objects into kinds is present from birth in its rudimentary form. In part II of *Plurality*, Kuhn discusses the empirical evidence supporting the view that human infants are born with specific neurological structures that function as modules for acquiring concepts. First in development is a protoconcept from which, at a later stage, the child will acquire the concepts of *object*, *space*, and *time*; after that, concepts of *cause*, *self*, and *other* will follow. The prelinguistic structures for classifying and reidentifying individuals are generally modifiable through experience, so it is perhaps best to think of them as *inborn flexible capacities* for the acquisition of full-blooded concepts.

The innate capacities for learning a language are very broad; they can be activated by any human language, none of which is easier or more natural to acquire than the others. However, these capacities can be activated only through repeated interactions with competent speakers, who support and correct the learner throughout a trial-and-error process of mastering the language's structured lexicon. By *structured lexicon* Kuhn means a framework constituted by sets of projectable kind terms, typically hierarchically organized. Mastering a kind term requires mastering other kind terms in the same taxonomic cluster, as well as mastering contrasting clusters within the same lexical structure. Empirical research on concept acquisition supported Kuhn's Wittgensteinian rejection of the traditional account of concepts as defined by necessary and sufficient conditions.[46] In his view, experiments in the field of categorical perception suggest that recognition of an object as an object of a particular kind does not require knowledge of features shared by all members of the kind, contrary to what

the traditional theory of concepts says. First, for most natural kinds, there simply are no such universally shared features. Second, and even more important, recognition of an object as being of a certain kind depends on *noninferential perception* of relevant similarities and differences, learned on particular examples and entrenched through agreement and corrections by other accomplished speakers.

All members of a linguistic community use the same categories, and they cluster objects in the same way, even if they differ here and there in how they describe the kinds that they use. Structured lexicons are thus essentially collective, but their taxonomies are not universal. Certain similarities and differences are seen as salient in one language, while they may be unimportant in another. Natural languages thus develop structured lexicons that often turn out to be incommensurable with one another. Since the perception of an individual object is inevitably a perception of it *as* an object of a particular kind, and since natural languages have, to some extent, different kind terms and different lexical structures, to master a language is also to become socialized into a particular culture and to see the world through the lens of its natural and social taxonomy. Kuhn always stresses that language and world are learned together: the world is, as it were, unveiled by the acquisition of a language through the mastery of kind terms. This gives a community its sense of what sorts of things exist in the world, and how they behave in it. In Kuhn's words, a structured lexicon gives an ontology to its users, and it greatly restricts what the community members' beliefs could be.[47] This is not always obvious to the language speakers themselves. Although any lexicon provides only a particular, contingent, changeable, and fully replaceable lens through which the world can be seen and interacted with, the categories of one's first language tend to be experienced—at least initially—as natural and inevitable. As language users, we are not always aware of the degree to which our lexicons actively structure—that is, both enable and limit—our understanding of the world.

Incommensurable ontologies stand in the way of perfectly accurate translations. Kuhn insists that this is not at all an insurmountable barrier to either understanding or communication. The inborn cognitive modules that enable us, as infants, to learn our first language continue to provide a basis for mastering new lexical structures: we can all be proficient in more than one language, and if we are, we are likely to sometimes vividly experience difficulties of translation, without being in any way deprived of full understanding. Bilinguals thus have a cognitive advantage over monolinguals: it is easier for them to realize that the natural world does not impose any particular lexical structure on human beings.[48] In their practical lives, however, bilinguals need to navigate a much more complex social world. They must be constantly aware in which linguistic community they are currently participating: their thoughts, speech, and actions are all shaped by the lexical structure in which they think and live, and some aspects of their being in the world—especially the social, communicative world—cannot be simply transplanted from one language to another.[49]

For Kuhn, then, bilingualism is a cognitively demanding but reliable bridge across incommensurability. Whether we are thinking about very different natural languages spoken in different parts of the world, or about now dead languages of times past, or indeed about technical languages of various kinds of specialists, understanding through bilingualism is always possible. Acknowledging Wittgenstein, Kuhn concludes part I of *Plurality* by suggesting that if something is to count as a human language, then it can, in principle, be understood by other human beings. Our neurological equipment for novel concept acquisition provides a slim but serviceable basis for mastering new lexicons; moreover, understanding across incommensurability is aided by our common human biology and the shared environment of our planet. This suggests that some natural-kind terms will, as a matter of fact—that is, not as a matter of necessity—exist in every human language.

To refine his account of structured lexicons, Kuhn began to develop in *Plurality* a taxonomy of kind terms. He distinguished,

first, between natural and artefactual kind terms. Natural-kind terms in ordinary language aim to sort observable objects found in the world by similarity and difference; paradigmatic examples are names of species, such as *ducks* or *swans*.[50] Natural-kind terms are projectable: to master them is simultaneously to accept some claims about regularities of the behavior of their referents. Natural-kind terms cannot overlap in their referents, unless they are related as species to genus; Kuhn called this the *no-overlap principle*. This principle imposes the need to restructure the lexicon when the community comes across an anomalous individual that seems to belong to two different kinds. For example, a warm-blooded furry animal, with a duck-like beak and webbed feet, that lays eggs but then feeds the young with milk produced by its mammary glands, was understandably causing a considerable confusion in the minds of eighteenth-century European naturalists. Was the specimen a mammal, a bird, a reptile, or a hoax?[51] Our present-day ability to confidently classify platypuses as monotremes is due to the taxonomic revolution brought by the Darwinian theory of evolution. Kuhn points out that scientific experts will increasingly emerge as the group responsible for making taxonomic decisions about newly encountered anomalous phenomena, and thus they will sometimes create revisions, or deep restructuring, of the community's lexicon.

In contrast to natural kinds, artefactual objects—paradigmatic cases being everyday human-made objects, especially tools—are not grouped into kinds by similarity and difference of their observable features but exclusively by their function. Moreover, not all artefacts are observable. Some, such as *goodness*, or *money*, are what Kuhn calls unobservable *mental constructs*.[52] They are learned through their relation to other mental constructs within a practice. Some of them are what Kuhn calls *singletons*, in contrast to taxonomic kind terms. Taxonomic kind terms are mastered within a hierarchy, and learned together with their appropriate contrast sets (for example, to learn how to recognize swans, a child must learn that swans are not ducks, but that they are both fowl). The meaning

of a taxonomic kind term is thus bound up with the meanings of the other kind terms in the same set; none has meaning independent of the others. Singletons are not situated on any taxonomic tree, and they do not have contrast sets: they are sui generis. Kuhn sometimes says that both taxonomic kinds and singletons are governed the by no-overlap principle, but there are passages in his notes in which he seems to doubt whether the no-overlap principle really applies to all singletons. At the time of his death, he was still struggling with the proper characterization of singletons. Although they play important roles in natural languages, Kuhn was especially interested in them because of their vital role in mature science. For example, *mass* and *force*, the key terms of modern physics, are singletons: they are neither a genus nor a species on a taxonomic tree, nor does either term have a contrast class. To explain the role of singletons in science, and their enormous importance as the primary loci of incommensurability between historically distant scientific communities, Kuhn offered an account of how structured lexicons of mature science develop from natural languages.[53]

In tracing this developmental path, Kuhn noted that the main purpose of taxonomies in natural languages is to classify objects detectable through the senses, such as plants, animals, or visible celestial bodies. Early science begins with inquiry into the nature of such objects; this results sometimes in reclassification of some of them, sometimes in refinement or sharpening of classificatory boundaries, and sometimes in the creation of new taxa. In the process, early science also creates new artefactual kinds: objects to be used as tools and instruments in the inquiry, and abstract concepts for explanatory and predictive purposes.[54] Lexical structures of mature science develop from all of these resources and achievements of early science. Although mature science continues to discover previously unknown natural kinds (such as new species, materials, or celestial bodies) and to adjust existing taxonomies to accommodate them, it becomes progressively more concerned with artefactual rather than with natural kinds.[55] Structured

lexicons cease to be limited to the classification of pretheoretically individuated objects and instead give the central place to newly forged abstract terms, such as *mass* and *force* in physics, or *gene* in biology. Many of these terms are interrelated singletons, introduced together with one or more universal generalizations, often in a mathematized form. For example, it is impossible to learn the meaning of Newtonian *force* without knowing Newton's second law of motion, $F = ma$. The importance of singletons for Kuhn's mature philosophy is enormous, because these terms are the ones primarily involved in revolutionary conceptual change: Newtonian *mass* is not Einsteinian *mass*, although the two terms are not mere homonyms, either, since the later concept developed from the earlier one, restructuring it completely within the new theoretical framework.

This led Kuhn to believe that, in contrast to members of natural kinds, scientific singletons are never observable.[56] This, however, should not be understood as Kuhn's return to the logical empiricists' distinction between observable and theoretical terms. Kuhn clearly wanted to avoid *that* distinction, with its implied givenness of observation, since he thought of scientific observation as possible only through an already available conceptual structure—even though that structure can, and often does, change. Unfortunately, Kuhn did not live to fully think through the important similarities and differences between his view of unobservable referents of singletons and the logical empiricists' concept of observation terms.

Possible Worlds of Science

The last chapter of *The Plurality of Worlds* was to answer two questions that preoccupied Kuhn since *Structure*: What could a real world be? What, if not correspondence to the real, gives truth its constitutive role in science?[57] Although the extant texts do not give enough information to answer either of these questions on Kuhn's behalf with confidence and in sufficient detail, I will sketch the general direction that I think he wanted to take. I will start

with his question about the world, leaving the question of truth for the next section.

When he wrote in *Structure* that "though the world does not change with a change of paradigm, the scientist afterward works in a different world," Kuhn was fully aware of the paradoxical nature of his claim. "Nevertheless," he immediately added, "I am convinced that we must learn to make sense of statements that at least resemble these."[58] In subsequent papers and lectures, as well as in *Plurality*, he tried to provide a solution to what came to be known as his *world-change problem*: how to explain the crucial role that the world plays in scientific inquiry, while preserving his insight that the world in which scientists work actually changes after a revolution. It is noticeable that the scope of the world-change claim is wider for the late Kuhn than it was for the author of *Structure*. *Structure* discusses world changes only in the aftermath of scientific revolutions; the late Kuhn thinks that world changes occur *whenever* a significant conceptual change happens, especially when it involves the restructuring of old kinds. For example, after a radical conceptual change in political, cultural, or aesthetic discourse, communities live in a new and different world. Science is special not because its development involves dramatic conceptual reconfigurations, for that is a widespread phenomenon; it is special because of the very stringent local criteria that urge, constrain, and justify conceptual change.

It might be helpful to bear in mind that, in trying to explain what he meant by his world-change claim, Kuhn did not want to endorse either straightforward scientific realism or straightforward constructivism. In a similar vein, he tried to develop an account of natural kinds that would avoid both traditional metaphysical realism and traditional nominalism. Of course, there are many differences among those who would consider themselves realists about science in general, and about natural kinds in particular; the same is true of those who see themselves as continuing the constructivist or the nominalist tradition. In rejecting both sides in both debates, Kuhn is certainly rejecting the uncomplicated versions of

these positions. Whether he really rejects all forms of realism, constructivism, and nominalism will depend on how these positions are stated *precisely*. I will not attempt to do this here, however. Since my interest is to outline the contours of Kuhn's position as far as his texts give me a warrant to do so, I will focus on that task. The reader may very well conclude that it is possible to classify Kuhn's position as a peculiar member of one of these families of views, despite his resistance to such classifications.

It is very clear that Kuhn was neither a traditional realist nor a traditional constructivist. It is useful to think of traditional realism with respect to science as having three components. The *ontological component* asserts the existence of the world as a mind-independent reality: it is as it is, independently of our language, categories, needs, or desires. The *semantic component* states that scientific theories aim at truth, where *truth* is understood as correspondence, or isomorphism, between our beliefs and the world. A realist then holds that all scientific statements are true or false in virtue of what the world is like. This, in turn, requires that all nonlogical terms in scientific theories (including kind terms and singletons) are capable of referring to real-world objects and structures. Finally, the *epistemic component* of scientific realism states that mind-independent reality is, at least in part, knowable by us, and that science provides the most reliable way to acquire that knowledge. A scientific theory is *better* than its rival if it is *closer to the truth* than its rival is. Consequently, when a realist thinks that science is progressive, she thinks that its progress consists in the fact that scientific theories of a later date are closer to the truth about the mind-independent world than the earlier theories.

In a similar vein, traditional realists about natural kinds think of these as mind-independent groupings that structure the world prior to, and independently of, human language, needs, or interests. They see the natural-kind terms as aiming to mirror these independently existing groupings, to faithfully capture the real similarities and differences among things in the world. Our concepts justifiably change only when we learn more about the way that

the world is really structured. For example, a realist thinks that, although this was not always known, it was always the case that the Sun is a star and not a planet, that dolphins are mammals, and that water is H_2O. One of the functions of science is to discover *real* natural kinds and their taxonomy; we will then revise our lexicons accordingly.

A constructivist will reject or reinterpret all components of realism, starting with a denial that there is anything that we could coherently call a mind-independent world. Everything that we can say is expressed in our categories, and guided by our expectations and needs. We cannot step outside our concepts to verify whether they adequately represent the world. Thus, we cannot know what the world is *really* like. Forever confined to our representations, we cannot even compare scientific theories to the world, nor scientific statements with facts, nor distinguish between referring and nonreferring terms; we can only compare a theory with other theories, one set of statements with another, one way of categorizing what we call *the world* with another way. All our categories are shaped by our expectations, needs, and desires; some systems of categories serve our purposes better than others, and so we prefer them. Scientific theories aim to satisfy some of our needs: for example, our need for accurate predictions, for successful manipulation of our environment, for a coherent system of beliefs, or for explanations that make sense to us; those theories that satisfy our needs better are better scientific theories overall. It is easy to see that constructivism is hospitable to a traditional nominalist view about natural kinds: a nominalist does not believe than there are any *natural* kinds in the realist's sense. All groupings of things, all kinds into which they are sorted, are human inventions, driven by human needs and interests.[59]

It is clear that Kuhn wants to reject all of these well-known views. Against traditional constructivists and nominalists, he believes that the world is mind-independent and that it imposes constraints on what a useful lexicon can be. The very fact that we encounter some objects that seem to violate the no-overlap

principle, and thus force us to restructure our preexisting taxonomy in order to classify them, suggests that some taxonomic solutions are better than others, not just in terms of our preferences but also in terms of their adequacy. It is not the case that *just any* grouping would do as well as any other, however much our interests and desires may favor it. In a similar vein, Kuhn thought that it makes no sense to think of the world as constructed or created by human beings. In his mature period, he was unambiguous on the subject:

> First, the world is not invented or constructed. The creatures to whom this responsibility is imputed, in fact, find the world already in place, its rudiments at birth and its increasingly full actuality during their educational socialization, a socialization in which examples of the way the world is play an essential part. The world, furthermore, has been experientially given, in part to the new inhabitants directly, and in part indirectly, by inheritance, embodying the experience of their forebears. As such, it is entirely solid: not in the least respectful of an observer's wishes and desires; quite capable of providing decisive evidence against invented hypotheses which fail to match its behavior. Creatures born into it must take it as they find it.[60]

Against the traditional natural-kinds realist, however, Kuhn rejects the idea that the world is already fully structured and divided into kinds, waiting for our most precise lexicon to reflect the divisions in nature. No lexicon *simply* mirrors nature. The categories that we use to orient ourselves in the world are of our own making; the ones that we use now are not the only ones that could enable such an orientation. The world could be differently described and its elements differently categorized, as we can see by examining different human languages. Although the world constrains our lexical choices, it does not favor a *single* one. Multiple, mutually incommensurable lexicons could each give us knowledge about the world. Realist metaphors of correspondence and isomorphism

suggest a one-to-one match between our kind terms and the groupings in the world, and thus they are not apt for conveying a plurality of possible ways in which the world could accurately and usefully be described and organized for action.

To better understand Kuhn's unusual way of thinking about the world and natural kinds, we must start where he does: with the claim that human experience in general, various specific human practices, and science in particular all require *some* categorization into kinds. Kind terms are thus essential for both ordinary language and science.[61] Part II of *Plurality* was to show that human brains are preprogrammed, as it were, to see the world as sorted into kinds. We could not experience the world as consisting of randomly distributed properties, without any objects; nor could we experience it as containing a variety of objects without any significant similarities or differences among them. At one time, Kuhn seems to have thought of inborn capacities for categorical perception as being akin to a Kantian a priori contribution to human cognition. Upon reflection, however, he concluded that the distinction between the a priori and the a posteriori aspects of experience is untenable. In *Plurality*, he sought to characterize categorical perception as a contingent and flexible result of an equally contingent evolutionary process, which tends to favor those features and capacities that turn out to be helpful in survival. In this respect, human lexicons have the same evolutionary basis as the capacities of other animals to categorize the world, but our specifically human languages greatly increase our ability to see the world as a world of kinds.[62]

It is in this sense that a structured lexicon provides an ontology to which our words apply. Within it, our words do refer to objects in the world. Some kinds emerge *as natural* within our lexicon. Kuhn says that this makes our natural-kind terms transparent: we see the world through them.[63] Kind terms enable and guide our interactions with the world, including our observations of it. We do discover various properties of members of natural kinds by direct observation, but, Kuhn insists, *which* properties are in fact observed will depend on the available kind set; and the selection and structure of kind sets are both deeply influenced, although not fully constituted by,

human interest and purpose. However, Kuhn argues, since there is a plurality of possible lexicons, there is also a plurality of ways to individuate kinds and sort objects into them. We can learn to *see* in new ways by mastering new lexical structures.[64]

This is, in fact, what scientists do. Early scientists asked questions in their natural languages, using the available kind terms for particular species, materials, or celestial bodies: they eventually came up with answers that effectively restructured parts of the everyday lexicon in which their original inquiry was formulated. This process of repeated lexical revisions led to mature science, expressible only by means of highly technical terms. In Kuhn's view, every lexicon makes certain questions, beliefs, and practices *possible*. "What one is committed to by a lexicon is not therefore a world but a set of possible worlds, worlds which share natural kinds and thus share an ontology. Discovering the actual world among the members of that set is what the members of scientific communities undertake to do," he writes in the conclusion of the second Shearman lecture.[65] But the set of possibilities allowed by a lexicon is limited. To explain certain anomalous phenomena, and even to ask some novel questions, communities sometimes need to restructure a part of their scientific lexicon to "gain access to worlds that were inaccessible before."[66] One way to characterize normal science for the late Kuhn is to see it as the quest for the actual world among the possible worlds that the shared lexicon allows. Revolutions are then gradual but ultimately radical openings of new sets of possible worlds, unimaginable for ancestral scientific communities. In that sense, it could be said that different scientific communities work in different worlds that they themselves both discover and create. As Kuhn said, we must learn to make sense of statements like this one.

Truth

Kuhn frequently stated that the correspondence theory of truth needs to be replaced by a theory that can make better sense of scientific practice. He hoped to present a new theory of truth in

chapter 9 of *The Plurality of Worlds*, for which he left only sparse notes. Before trying to imagine what his theory of truth would have been, we must ask why he thought that a new theory was needed in the first place.

The correspondence theory is probably the most natural, and consequently the most widely held theory of truth; it has also attracted considerable criticism throughout the history of philosophy. Kuhn, however, did not seem to have any one of the standard objections in mind when he rejected the correspondence theory. Rather, he was dissatisfied with the two ways in which truth—understood as the correspondence theory understands it—figures in a number of general philosophies of science.

First, Kuhn found deeply problematic the widespread view that truth is the goal of inquiry—that science aims to provide true theories about the world, and progresses by ever closer approximations to that goal. In his view, we cannot make sense of the claim that truth pulls the development of science forward, since the ultimate truth is epistemically inaccessible from the standpoint of scientific communities faced with difficult choices. For the same reason, a philosopher of science cannot explain why scientists accepted, rejected, or modified particular beliefs by reference to truth as the ultimate goal of science. Rather, the explanation has to be given in terms of reasons and evidence available to those who made the choice. Approximation to truth would not do, either, since there could be approximations that are mutually incompatible, but equidistant from truth.[67] So, Kuhn concluded, neither correspondence truth nor approximate truth could constitute the goal of science, or explain scientific belief change and progress.

His other reason for rejecting the correspondence theory of truth was that he saw it as implicated in presentist historiographical narratives favored by logical empiricists. Philosophers who asked whether past scientific beliefs were true were, in Kuhn's view, very much misguided about the proper way to understand the past. In his internalist approach to history, the question of truth or falsity of past scientific beliefs arose only as a question

about how past scientific communities distinguished between true and false beliefs. The question of whether their beliefs were *really* true actually makes no sense, according to Kuhn, unless we trivialize it by translating it into the anachronistic question of whether the beliefs in question are true by *our* lights.

Kuhn was equally dissatisfied with all other theories of truth that he considered. The coherence theory of truth cannot give empirical observation the special status that, in Kuhn's view, it needs to have; this is especially problematic when describing scientific debates, in which empirical evidence plays a large, although not always a decisive, role. Kuhn also rejected what he thought of as two versions of the pragmatist theory of truth: truth as warranted assertability, and truth as the ideal end of inquiry. He argued that truth cannot be analyzed as warranted assertability, because this analysis violates the logic of truth statements. Two people, holding logically incompatible beliefs, may each have a warrant, but at most one of them could be saying something true—a situation that the warranted-assertability theory of truth cannot explain.[68] Finally, Kuhn thought that truth defined as the ideal consensus at the end of the inquiry would not help at all in explaining what we do when we *currently* take some beliefs to be true and others to be false.[69] The end of inquiry is epistemically inaccessible, and thus not available to explain the beliefs that were actually held, and the choices that were actually made, by scientific communities.

Kuhn did not live to formulate a new theory of truth, capable of playing a role in his philosophy of science. This is perhaps not surprising, since a philosophical theory of truth is not what his philosophy in fact needed. There are two different contexts in which he needed to *use* the concept of truth, but neither of them required a fully fleshed-out general theory of what truth *is*.

The first is the communicative context of scientific inquirers, members of the same scientific community. Kuhn insists that the logic of communication requires that every discourse has the means of prohibiting contradictions and of marking some beliefs as true and others as false. Evaluation of beliefs as true or false is, for

Kuhn, simply a condition of communication. The criteria that govern this kind of evaluation are shared across the community, but different epistemic communities may develop different criteria for truth. In that sense, the criteria are internal and local. No community will be able to distinguish true beliefs from those that, after the most rigorous scrutiny, *appear* to be true. At the time when a belief is considered, there are no markers of its truth in addition to the markers of its rationality and plausibility, in light of the best evidential and inferential reasons available to the community in question. From an external point of view, the distinction between the rationality of a belief and its truth is both obvious and important, but it is not epistemically available to those who are facing the choice of accepting, revising, or rejecting a belief.

The second context in which Kuhn reflected on the use of the concept of truth is that of the history of science. A historian looks back to a scientific lexicon that long fell out of use; the beliefs, methods, and practices associated with it are alien to the scientific community active in the historian's own time. A statement made in the new lexicon is often a different statement than a statement made in the old lexicon. Most interesting statements of past science elude straightforward translation: Kuhn believes that what they say is *ineffable* in the later lexicons. Since past scientific beliefs cannot be simply restated in a modern vocabulary, they cannot be simply evaluated as true or false, either. The historian's task is thus to explain why past beliefs were reasonable and plausible in their own epistemic context. To use Kuhn's favorite example, a historian discovers that Aristotle had excellent reasons, both conceptual and evidential, for thinking that there is no void. To understand what he really meant, we cannot simply translate his claim into our language; we have to understand it within *his* lexical structure, within the system of beliefs framed by his assumptions; and in that context, it is not merely true but tautological that there is no void. While denying that he was a relativist about truth, Kuhn accepted that he was a relativist about effability: meaning of words and sentences is context-relative, and the larger epistemic

context itself, with its lexical structure, assumptions, beliefs, and practices, cannot be evaluated as true or false. It can be evaluated in other ways, Kuhn points out—for example, for its effectiveness in serving the goals for which it was put to use—but that is an interest-driven evaluation, not an evaluation of truth or falsity.[70]

It is clear that, in making these points, Kuhn focuses on rationality, justification, and plausibility of beliefs. These need to be distinguished from truth, however. The most reasonable and the most scrutinized beliefs of an epistemic community may turn out to be false; and the beliefs it justifiably deems irrational or unsupported by reason and evidence, may be true. Although Kuhn does not deny the importance of the distinction between truth, on the one side, and rationality, justifiability, and plausibility, on the other, and although he does stress that scientists are interested in the truth and not only in the rationality of their beliefs, his philosophy makes *no use* of this distinction. When he examines scientific discourse from the imagined standpoint of its participants, Kuhn notes that the distinction between truth and rationality is not epistemically available for evaluation of beliefs. When he thinks about science as a hermeneutic historian, he is not even interested in the truth of past beliefs, but only in their reasonableness by local lights. He thus seems, on the one hand, to acknowledge the distinction between rationality and truth, but then to undermine it, on the other. This is, I believe, because he recognizes the importance of the distinction only in an abstract philosophical context. As a historian of science, or as an active participant in his own scientific community, Kuhn actually sees *no point* in drawing it. He may very well have been justified in this indifference; but then, it seems, he should also have seen that his philosophy of science has no need for a novel theory of truth.

And in fact, Kuhn does not seem at all to be engaged in the endeavor of formulating and defending such a theory. Nowhere in his writings, published or unpublished, do we find an inquiry into what truth *is*, or what truth-makers are. Instead, Kuhn is interested in *the pragmatics* of discourse that evaluates statements as

true or false, and the specific epistemic requirements and resources that a community has at its disposal to distinguish between the claims it deems true and those it deems false. Kuhn wants primarily to understand how the predicates *true* and *false* are *used* within a communicative practice.[71] It seems that he wanted an account of what scientists in a particular community mean, and what they do, when they say that a statement is true or that it is false. But if these were his questions about truth, then there was nothing abstract and general that he should have offered. He did not need a philosophical theory of truth to replace the correspondence theory. He only needed to reiterate his rejection of philosophical reliance on presentist historiography, as well as his rejection of the idea that truth—however analyzed—is the goal of science. After stating that every community needs to sort beliefs into true or false, and that the logic of truth talk must respect the principle of noncontradiction, he could have left to a historian or ethnographer the search for specific answers about specific communities and their criteria for evaluating beliefs as true or false. This made Kuhn uneasy, but it shouldn't have. In everyday life as well as in scientific communication, *truth* is readily understood and unproblematic.

The difficulties that Kuhn had in articulating a plausible view of the role that truth plays in science are probably one of the main reasons why part III of *Plurality* remains unfinished. I suspect that these difficulties were due to an incongruity between the ways in which questions about the nature of truth are traditionally posed in philosophy, and Kuhn's historicist and pragmatist way of thinking about scientific communities. Perhaps, rather than try to work within a framework alien to his way of thinking, Kuhn should have simply set aside the question about the nature of truth, in the same spirit in which he set aside radical skeptical challenges.

III. Concluding Remarks

The vivid impression that Kuhn was first and foremost a philosopher of scientific practice may be a bit dimmed by his last writings,

focused as they are on language, meaning, and structured lexicons. However, it would be a mistake to conclude that, in his mature period, he came to think of science primarily in terms of its linguistic and theoretical aspects. The absence of explicit discussion of practice in Kuhn's mature philosophy is due to two factors. First, he was satisfied with what he had said about it in his earlier works, and felt no need to improve or expand on that. The focus on lexical structures in his final period was due to his growing sense that incommensurability—the central concept of his philosophy—has not yet been analyzed and explained in sufficient detail. Second, a careful reading of his last works will show that practice remains central to his view of science. It is no longer foregrounded but, rather, woven into the developmental questions that he asks about language acquisition and use; it remains the lens through which he sees all philosophical problems that preoccupy him. For Kuhn, no less than for Wittgenstein, questions about meaning tend to be recast as questions about learning and use. Similarly, to learn a language is to learn how to be in the world: what to perceive, how to organize and report perceptions, what to say, and how to act. This is as true of scientists as it is of everyone else, but *the scientists'* ways of being in the world are mediated by highly complex intellectual lexical structures that Kuhn sought to understand. Throughout, he continued to see practice as crucial, and scientific expertise as consisting in largely tacit knowledge of how to see problems, how to classify phenomena, and how to search for a solution.

The philosophical questions about meaning, reality, truth, and knowledge that preoccupied Kuhn in his last years only apparently take the abstract form characteristic of traditional epistemology and metaphysics. His thinking actually always starts from, and returns to, scientific practice. For example, his lasting insight about incommensurability does not concern only meanings of kind terms or difficulties of translating between differently structured lexicons. As he repeatedly pointed out in his post-*Structure* writings, incommensurability between languages is not an insurmountable

obstacle to either contemporary communication or retrospective understanding. Robust incommensurability in Kuhn's philosophy concerns *doing*, not saying or understanding. Scientific communities divided by the incommensurability of their problems, lexicons, and evaluative standards can still *make sense* of each other's projects, but they cannot collaborate on them—they cannot *do* science together. Had he lived to complete *The Plurality of Worlds*, he would have stressed, in part III, the priority of scientific practice over theory, and the relative independence of the former from the latter.[72]

At the end, a crucial question faces both the editor and the reader of this volume: Can an unfinished work be a successful one? The straightforward answer seems obvious, and negative: Kuhn did not live to complete *Plurality*, and what is published here is not what he wanted to see in print. But the success of his last work need not be measured only by its distance from the intended goal; we can also measure it by the distance from its starting point in *Structure*'s revolutionary ideas. Throughout his intellectually intense and prolific life, Kuhn modified, developed, and restructured these ideas, adding nuance and expanding their applicability. If we take a developmental perspective on Kuhn's last writings, we will see the texts published here as but a moment in his mature rethinking of a young man's valuable insights. We will also see the philosophical method that he developed through this process fully at work in his last writings. The mature Kuhn seamlessly moves between particular, detailed case studies and synoptic philosophical considerations, bringing the latter back to bear on his—thus refined—understanding of scientific practice and its development. Kuhn's dynamic method of perennially searching, restructuring, focusing, and expanding would have never ended in a definite conclusion or the final resting of his case; but that, I think, is what success in philosophy might look like.