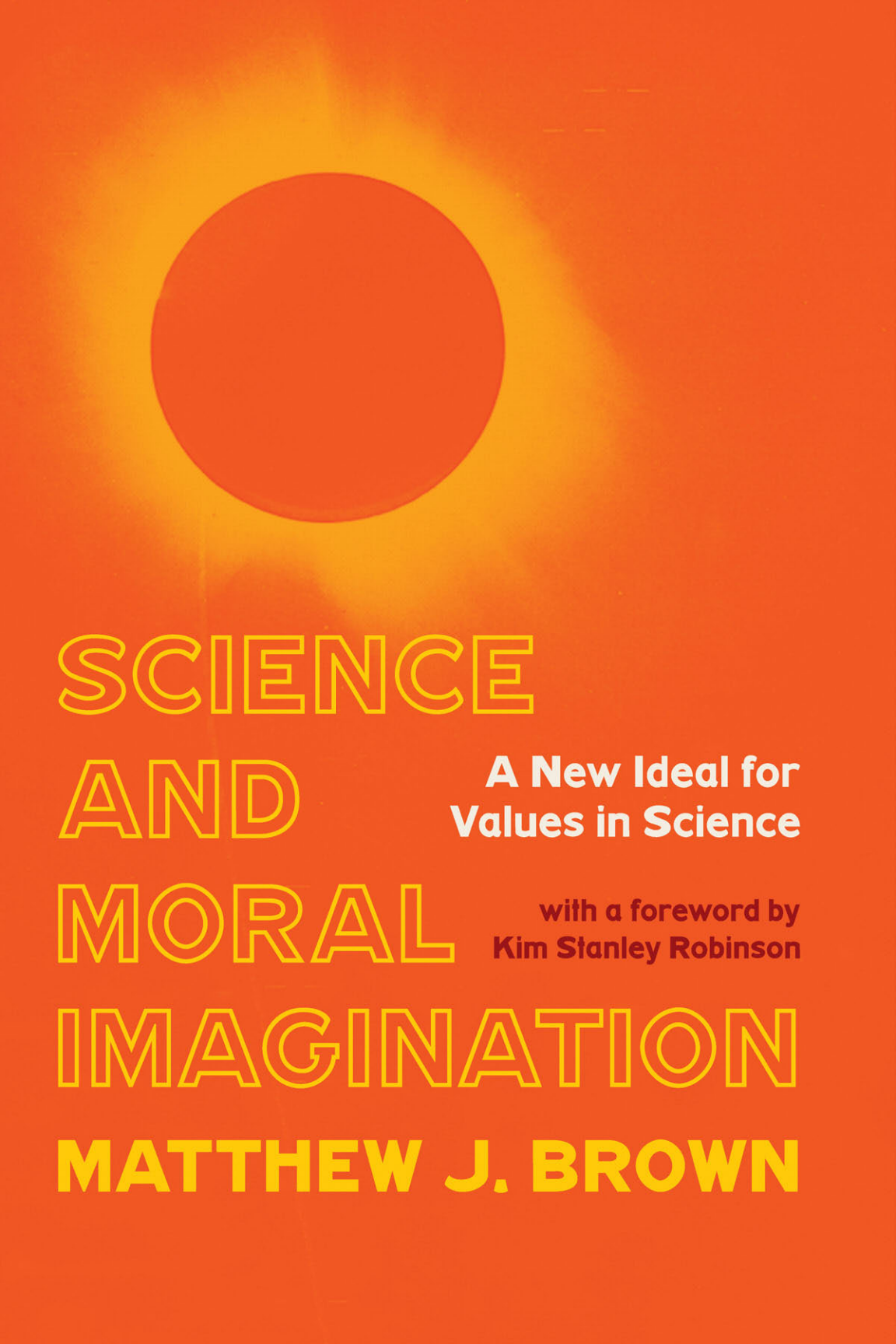
SCIENCE AND MORAL IMAGINATION
A New Ideal for Values in Science
with a foreword by Kim Stanley Robinson
MATTHEW J. BROWN

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SCIENCE, VALUES, AND THE PUBLIC

Heather E. Douglas, Editor

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University *of* Pittsburgh Press

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DEDICATED TO THE MEMORY OF

Jon Jolyon Johnston

Michael Joseph Brown

Susan Lynn Mitchell Brown

Let me be a seeker of knowledge,
Let me travel uncharted paths,
And let me use my creativity
To make the World a better place
In which to live.

—**The Odyssey of the Mind Pledge**

What after all, has maintained the human race on this old globe despite all the calamities of nature and all the tragic failings of mankind, if not faith in new possibilities, and courage to advocate them.

—**Jane Addams, *Peace and Bread in Time of War,* 149.**

Because we're going to have to imagine our way out of this one.

—**Kim Stanley Robinson, *Green Earth*, 1044.**

CONTENTS

FOREWORD

Some problems never go away. How we act on what we know is surely a problem that predates *Homo sapiens*, and over our long history one aspect of that problem has evolved into the vexed relationship between science and values, which has puzzled philosophers from the ancient Greeks on. In various manifestations, such as the is/ought problem or the fact/value distinction, it has been discussed by many writers, and has remained one of the most important philosophical problems we have. Indeed now that our powers of action in the world have grown so much, by way of the application of science as a set of tools, this area of thought is more important than ever.

But over the course of the twentieth century, philosophy became theory. This shift began with thinkers like Nietszche, Wittgenstein, and Gödel bringing into question the bases of philosophy itself, and it gained momentum in the second half of the century when an immense intellectual pressure was exerted on all received ways of thought, including language and cognition. Entire academic disciplines dissolved at their foundation under this intense interrogation of first principles, and fields like anthropology and history have had to struggle ever since to understand what they are and where their validity lies, if anywhere.

For the field called philosophy of science, the shift to theory manifested as what we now call science studies. What before had been regarded as a nearly

independent history of ideas, based largely on mathematics and therefore almost metaphysical in nature, became radically historicized and situated in the particulars of the social contexts in which science arose and evolved. Science was now understood as a particular kind of praxis, meaning a political-social-economical-instrumental intervention into relations of power among human groups, and between humanity and the rest of Earth's biosphere. As such, science studies blossomed in a period of detailed phenomenological inquiry into a fractal array of historical circumstances that had never been properly investigated before. In this garden of forking paths, philosophy of science became much more history of science; using one of the last great models out of philosophy of science, Thomas Kuhn's paradigms, we might say that the old paradigm of science itself broke apart under the impact of theory's radical questioning of language, history, power, and cognition.

One result of this paradigm breakdown was that academic science studies became more and more technical and ingrown, such that only other practitioners of science studies could understand the context and import of new work. The academic field plunged down rabbit holes; it got lost in the weeds, such that its use value to working scientists and the general public, or let's just say everyone interested in science, which really ought to be everyone alive (there's that word ought again, but let's keep it), can no longer get much use out of the discipline. And yet the big problems of science and society remain, and are even growing more pressing as we move into an era of unprecedented scientific-technical powers and unprecedented ecological damage. More than ever we need a solid sense, if we can make one, of the relationship between facts and values, between our actions and our hopes. Maybe you could say we are between paradigms and need a new one, if this now old-fashioned formulation has any residual power to clarify things.

This is the situation I think Matthew Brown is taking on in his very interesting book. His is an attempt at paradigm construction by way of clarification, in a moment when clarity is both difficult and crucial. To achieve that clarity, he uses aspects of the scientific method itself, which in a philosophical discussion of science is recursive but also effective and pleasing. Among other aspects of the scientific method deployed here, we see a kind of structuralist description of the problem, de-stranding conglomerate realities in hopes of finding causes and effects; also reductionism, where the problem is contained to the point where it can be understood and discussed—even Occam's razor, by which I mean that Brown has decided to trust the language to convey commonly agreed-upon meanings.

This is crucial, because after the stupendous and no doubt useful work of

linguistic deconstructionism, which turned the lens of philosophical inquiry onto language and cognition itself, one now has to work with a level of uncertainty concerning the level of discourse one wants to use to make the points one wants to make. Everyone now has to acknowledge that words are mysterious bags of allusions and connotations, completely contingent on their placement in sentences and in history. Fine, undeniable. But what then? In this moment, which used to be called postmodernism, and now is maybe better called the Anthropocene, choices have to be made about the level and mode of one's discourse. High modernism in literature, which was may be another kind of theory devoted to tightly focused case studies of subjectivity, was famously dense and obscure, difficult and challenging, a mode which supposedly reflected the actual nature of thought. In that model the common parlance of popular culture and ordinary people was seen as a degraded commercial product, thus a kind of false consciousness. This was the famous high/low split in modernist aesthetics, but what if it was wrong in its basic assumptions? In any case, in postmoderism, in the age of theory, that divide collapsed, and all aesthetic forms had the potential for artistic distinction, and any individual artist could choose any style from the past and do something interesting with it. This is one of the greatest (one of the only?) strengths of postmodernism as an aesthetic, as it represented an opening up of possibilities, acknowledging that different styles are appropriate to different purposes, with no hierarchy of better or worse applicable to the choices made.

How that has played out in science studies is harder for me to see. There are dense networks of technical literature, difficult to the point of being esoteric; there are also shorter and longer forms of popular nonfiction, explaining various aspects of science to the general public. These are the extremes, but there is also a realm in between the two, which is maybe just a way of saying that philosophy persists, despite all. And philosophy, to be effective in the world, has to be comprehensible. Sometimes it's appropriate to chase an idea into depths where only a few dozen fellow specialists can understand you. Other times it's appropriate to speak in registers that will reach the widest audience possible. And the more important the topic, the more important it is to communicate widely and effectively about it.

In this case, concerning the relationships between science and value, where the problems are central to the fate of human civilization and affect every person alive, it makes sense to try for clarity. It's a choice that has been made many times before in philosophy, and often when science is the subject of inquiry. Philosophers like William James, John Dewey, and Alfred North Whitehead

made this choice, and their school of philosophy was called pragmatism partly as a result of that choice. Brown references them here, and his book is in their tradition. Science, value, and all these vast words that contain entire worlds in them, are here defined for their particular use in this particular text—the definitions are provisional; they constitute a kind of hypothesis or supposing in and of themselves. Then these words are used in a structured argument that is called out in advance, in the introductory material and the early chapters. It's as if we are being shown the architectural blueprint for a house before being walked through it. The walk-through then includes all the particular historical examples and the details of the case Brown is making, for this is a book that intends not just to clarify but to persuade. The book's explanatory notes give it the feel of a transcript of a lecture which includes the lecturer's added interpolations and clarifications; this is both aesthetically pleasing and easier to understand. The foregrounded structure of the argument is a rhetorical and aesthetic choice; there's a pleasure in seeing a clean line of thought, just as there is in a well-wrought stone wall or the nimble, swift surfing of a wave.

So this is indeed a pragmatic book, and as such it is made to be used. All scientists working in their various fields need to have a better philosophical grasp of the ramifications of their work, which is rapidly taking civilization into uncharted waters, both in human history and the history of the biosphere. Scientists need to become imaginative political actors at all levels of policy; they are going to have to better imagine both their values and the actions called out by those values. This book can help them with that part of their project, and that will make them better scientists. And then all citizens (and maybe we are all "citizen scientists" now) need to have a better understanding of the situations we face as a global society, living on a planet we are biologically damaging every day. What should we do? How can we deploy this amazingly powerful method we have invented, that we call science, to make ourselves and our descendants and our biosphere, which is to say our extended body, safer and happier? Bioethics, ecology, social planning, political economy, daily life—this book speaks to all these realms. This is perhaps the greatest virtue of Brown's project: he has gone right at one of the central problems of our time and faced it creatively and productively. In offering us a structure for comprehending our big mess better, he has performed an act of cognitive mapping that we can all put to use.

—Kim Stanley Robinson

PREFACE AND ACKNOWLEDGMENTS

In late 2017 the American Association for the Advancement of Science (AAAS) adopted a "Statement on Scientific Freedom & Responsibility": "Scientific freedom and scientific responsibility are essential to the advancement of human knowledge for the benefit of all. Scientific freedom is the freedom to engage in scientific inquiry, pursue and apply knowledge, and communicate openly. This freedom is inextricably linked to and must be exercised in accordance with scientific responsibility. Scientific responsibility is the duty to conduct and apply science with integrity, in the interest of humanity, in a spirit of stewardship for the environment, and with respect for human rights."[1] This statement is remarkable in that it links the freedom and integrity of science to larger responsibilities to humanity and beyond. Through this statement, a central organization not only in the national but in the global scientific community takes a stand that the practice of science is an *ethical* practice, one that is not aloof from, but must serve the interests of society, the environment, and human rights. As such, I take it as

1. "AAAS Statement on Scientific Freedom and Responsibility," *Science* 358, no. 6362 (2017), http://science.sciencemag.org/content/358/6362/462.2. As of fall 2018 I am currently serving as a member of the AAAS Committee on Scientific Freedom & Responsibility, which wrote the statement and won the support of the AAAS Board of Directors. The statement was adopted before my involvement with the committee.

a strong stance against the myth that science is value-free, that its only duty is to objectivity and truth. Human, ethical, and social values must be a part of science.

But how far do the responsibilities of science to society extend? And how can scientists, who are experts in technical matters but not in ethics or values, fulfill their responsibilities? These are the central questions this book asks and answers. The book is informed especially by an ongoing discussion in the field of philosophy of science about the role of values in science, a discussion that has been with us since the beginning of that field, though it has waxed and waned over time. In the early twentieth-century development of the field, the philosophers arguing for a role for values in science or the need for science to serve society were pragmatists and Marxists. The topic waned briefly at mid-century, but in the last decades of the twentieth century it was forcefully revived by feminist philosophers of science. At the turn of the twenty-first century another important thread, focused on public policy and regulatory science, especially environmental and biomedical, entered the discussion. This book has benefited from the current renascence of engagement and creative activity that draws on all three of these threads.

There are many people whose contribution to the work in this book I should acknowledge. First and foremost, Sabrina Starnaman, not only my strongest supporter and closest companion, but a scholar whose sense of the need to make scholarship actively serve the cause of justice is a constant inspiration. Between us, she is the true pragmatist. Her work, her life, and her support inspire me.

There are many philosophers who have influenced my thinking, who, despite my attempt at judicious citation and discussion, no doubt had a greater influence on this book than is communicated in the manuscript. First, my ideas would not be what they are without a long intellectual engagement with Heather Douglas. I have benefited both from her excellent writings exploring these topics as well as her warm personal support and friendship. Heather is in a large part responsible for the current liveliness of discussions of values in science. Second, in many respects, the book builds on the work of Elizabeth Anderson, who is both an excellent interpreter of the moral and political philosophy of John Dewey and a foundational pragmatist-feminist philosopher of science. Much of what I try to do here is one way of working out ideas about the role of values in science and the influence of science on values that I first encountered in her work. Finally, Janet Kourany has likewise been a friend, supporter, and interlocutor from whom I have learned much and sharpened my own thinking about these topics.

Practically speaking, the bulk of the work on this manuscript was completed

due to the kind support of the University of Texas at Dallas in the form of a year's sabbatical coincident with a visiting fellowship at the Center for Philosophy of Science at the University of Pittsburgh. Many thanks to the director of the Center during my fellowship, Edouard Machery, to the many faculty whom I had the pleasure to interact with, including Sandra Mitchell, Peter Machamer, John Norton, and Nicholas Rescher, and to the other fellows who provided feedback on two of my chapters as part of the weekly reading group and from whom I constantly learned new things and enjoyed great companionship, including Kareem Khalifa, Viorel Pâslaru, Anjan Chakravartty, Sharon Crasnow, Greg Frost-Arnold, Tobias Henschen, Yann Benetreau-Dupin, Alison Fernandes, Katie Kendig, Mikael Cozic, and Daniele Muttini. I also had the pleasure of interacting with some of the fantastic graduate students from the History and Philosophy of Science and Philosophy departments, including Zina Ward, Nora Boyd, David Colaço, Siska De Baerdemaeker, Haixin Dang, Joshua Eisenthal, Kathleen Creel, and Jennifer Whyte. In particular, in Q&A after an early talk on one element of the book, followed by email correspondence, Zina Ward pushed me on elements of my argument that helped me improve them. Thanks also to the attendees at the several conferences and workshops that took place during my time at the Center.

Three people read the first complete draft of the manuscript and provided extensive and valuable feedback. Kevin Elliott especially helped me think more carefully about the structural relationship between inquiry, value judgment, and contingency that is central to the book's argument. I benefited from both face-to-face discussion with and detailed notes from Dan Hicks. His feedback allowed me to make many points clearer and more compelling. Among other things, Dan pushed me where he saw my views as insufficiently political, as tending toward the value-neutral (rather than the value-free). I suspect we will find that we disagree on some aspects of that, but I have benefited immeasurably from engaging with his comments. Last, I shared draft chapters with the members of my graduate seminar on Science in Values at the University of Texas at Dallas (UT Dallas) in the fall semester of 2017, and Natacha Guyot of her own accord provided extensive, helpful written feedback on the manuscript. The other members of the seminar, whose questions and discussion of the ideas and arguments in the manuscript were also quite valuable, were Sara Cardona, David Lyons, Rick Townsend, Alan Alanis, and Aaron Stewart.

I am deeply grateful to Heather Douglas and Justin Biddle for reading a later draft of the manuscript and providing extensive and helpful feedback, from

helping me resolve large-scale conceptual problems in the argument, all the way down to grammatical problems. I am also thankful to Abby Collier, my editor at University of Pittsburgh Press, who provided helpful feedback on the manuscript and enthusiastically shepherded my work through the publication process, making it a better book.

I am very grateful to my friend and collaborator Joyce Havstad, with whom I have worked on a variety of issues in science and values and science and policy, especially connected to climate science and climate policy. Much of my thinking has been improved thanks to discussions with her, and she has especially helped me think through different ways of understanding the argument from inductive risk. Likewise, I owe a debt to my collaborators at UT Dallas on an extended project about ethics and values in engineering and engineering education, particularly Nicholas Gans, Magdalena Grohman, Eun Ah Lee, and Marco Tacca. While engineering is not the focus of this book (though it is included in my broad definition of "science"), our project has helped me think about the role of ethics and values in the contingencies that arise in research, and how to make decisions in those contexts responsibly.

The broader community working on values in science and socially relevant philosophy of science is one of the best, most supportive parts of academia to work in, and my thanks to the many people who make that area great. I have had the honor to host the Values in Medicine, Science, and Technology (VMST) annual conference through my position as director of the Center for Values at UT Dallas. My thanks to Dennis Kratz for founding and supporting the Center and to Madga Grohman, associate director of the Center, who is the one who really makes things happen. I have also enjoyed and benefited from the opportunity to learn from the many speakers who have agreed to participate in the Center's annual lecture series. I have also had the pleasure of participating in the meetings and serve on the board of the Consortium for Socially Relevant Philosophy of/in Science and Engineering (SRPoiSE). My thanks to all of the many guests of the Center for Values, VMST Conference attendees, SRPoiSE organizers, and SRPoiSE meeting attendees, especially Sarah Wieten, Ian James Kidd, Mark Tschaepe, Sean Valles, Carla Fehr, Katie Plaisance, Roberta Millstein, Eric Martin, Catherine Womack, and several others already mentioned. My thanks to the local members who have joined the Values in Science Research Lab that I've organized in the Center for Values, including Fred Grinnell, Pam Gossin, Karen de Olivares, Richard Scotch, Luna Allen, Mitchell Owens, Ahmad Askarian, Mehri Mirzaei Rafe, Justin Bensinger, Thomas Rocha, Rebekka Michaelsen, and Elizabeth Escalante.

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Aspects of this work have been presented in front of multiple audiences. I was invited to present at the "René Descartes Lectures & Workshop on Science, Values, and Democracy" at Tilburg University, The Netherlands; the Center for Science Studies at the University of Aarhus, Denmark; the Science Studies Colloquium at the University of California, San Diego; the Philosophy Department Colloquium at Oakland University; "Philosophy of Science: The Pragmatic Alternative" at the Center for Philosophy of Science at the University of Pittsburgh; the Philosophy Lecture Series at Texas A&M University–Commerce; a seminar hosted by the Department of Science, Technology, and Society and sponsored by the Department of Philosophy at Virginia Tech; and the "Engaging with Science, Values, and Society" workshop at the University of Alberta. My thanks to the organizers who invited me, and the students and faculty who were present at those events for their interest and feedback. Aspects of this work was also accepted for presentation at the Philosophy of Science Association biennial meeting, SRPoiSE 4 at Georgia Tech, "Scientific Knowledge under Pluralism" at the Center for Philosophy of Science at the University of Pittsburgh, and the Society for Philosophy of Science in Practice. My thanks to those audiences for their feedback on this work, as well.

My thanks to Matt Silk for drawing the reference to Knorr Cetina in Chapter 2 to my attention. Matt's interests overlap with mine considerably, and I have benefited from conversations with him and from reading his dissertation. While our views developed somewhat independently, there were many lines of convergence and valuable conversations and exchanges of ideas.

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SCIENCE AND MORAL IMAGINATION

INTRODUCTION

> We are complex and intelligent creatures and we can hold multiple ideas in our heads at the same time. We can be critical of the things that we love.
>
> —**Anita Sarkeesian**

THREE CASES OF THE INTERPLAY OF VALUES AND SCIENCE

Science and values mutually influence each other. Values are implicated in scientific knowledge and practice. Science helps us to understand our values; its progress alters our values. I argue that the influence of values on science is pervasive and that science also can and should have an influence on our values. I argue further that this interplay must be guided by accounts of scientific inquiry and of value judgment that are sensitive to the complexities of their interaction in practice. Scientists and moralists, as well as philosophers of science and ethicists, have often presented distorted and even harmful pictures of science and of values for lack of nuance about their interplay.

This book is unabashedly normative, where *normative* means making claims about what *ought* to be and guiding our *evaluation* of the quality and worth of

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Epigraph: Qtd. in Collins, "Anita Sarkeesian on GamerGate."

certain things. An argument could be made that, historically, sociologically, and psychologically speaking, science has been influenced by the values held by scientists and by the society in which science is embedded.[1] Likewise, one could argue that, as a matter of fact, our beliefs about values, our norms, our mores, our culture have changed in part as a result of scientific progress. Both of these arguments could be understood as merely descriptive, leaving untouched our ideals about how science ought to work and about where moral truths come from. By contrast, this book directly challenges the views that science ought to be value-free and that values ought to be evidence-free, independent of science. Though I will challenge the very idea of a "merely descriptive" argument, and thus the fundamental nature of the descriptive/normative distinction, I do not shy away from making normative claims. This book provides normative arguments about how we ought to evaluate episodes and decisions in science as to the way they incorporate values, as well as providing guidance to scientific practitioners and institutions on how they should incorporate value judgments into their work. As such, it seeks to revise our understanding of how science ought to work.

To introduce the kind of ideas that structure this book, I will start by briefly telling the story of three cases where values have played an important role in science. The first is the long history of scientific racism, the second is a specific early example of feminist psychology, and the third concerns embryonic and adult stem cell research. In the rest of this Introduction, I will describe the book's basic presuppositions and philosophical orientation, give an overview of the argument, and explain the general structure of the book and the ways it can be read.

Scientific Racism

The history of modern ideas of "race" is intertwined with the history of scientific racism; the emergence of each of the human sciences is tied up with emergence of modern ideas about race.[2] Starting with natural historians and philosophers as early as the sixteenth century, the modern concept of race was developed to explain the superficially obvious differences between human geographical populations and to justify the racist atrocities that Europeans began to instigate

1. Such arguments have, in fact, been made many times by feminists, sociologists of scientific knowledge, and other thinkers. For example, Fausto-Sterling, *Myths of Gender*; Haraway, *Primate Visions*; Douglas, "Values in Science," §3.1.

2. The history summarized in this section can largely be found in Gould, *Mismeasure of Man*; Smedley, "Science and the Idea of Race."

throughout the world starting in the fifteenth century. While some argued that racial differences were merely superficial and environmentally caused, many others insisted that racial differences included deep differences in capacities, including mental abilities, and that the differences were biologically determined.

In the nineteenth century, concepts and theories of race were further developed by physical anthropologists and evolutionary biologists. Pre-Darwinian scientists like Samuel Morton and Louis Agassiz made extensive physiological and anthropological comparisons of members of different races in order to argue that the races were different, hierarchically ordered species. Many Darwinians and social Darwinists like Herbert Spencer used the theory of natural selection as a mechanism to justify the racist ideology of biological determinism. (Darwin himself, who certainly did not completely escape the racism of his time, does seem to have largely opposed a biological determinist view of racial differences.)

In the early twentieth century, with the emergence of the new scientific psychology, came attempts to measure the differences in mental ability between races that had been posited by earlier thinkers and defended by Morton on physiological grounds. A variety of psychophysical, behavioral, and cognitive tests were developed in the early days of psychology, the most (in)famous of which was the intelligence quotient (IQ). When IQ tests became common in the early twentieth century, they were soon added to the repertoire of ways that scientific racism attempted to establish the innate hierarchy of the races. Ironically, the creator of the IQ test, Alfred Binet, did not believe the test measured a heritable trait, or even a single property that could be called "general intelligence." But the essentialist, biological determinist reading of IQ grew in popularity as use of the test became widespread, especially in America.

By and large this history of thinking on race reinforced status quo racism and white supremacy by making it seem natural or inevitable. While some did defend racist and paternalist policies on a cultural/environmental view of racial differences, historically biological determinism has been more commonly linked to such policies. Today it is relatively easy to see the fallacies and biases behind such research, and there have been several prominent analyses. Yet the research in its time was well regarded and considered of high quality, and such research reappears regularly in the press, despite the fact that it is invariably shown to be of poor quality.

Stephen Jay Gould's *The Mismeasure of Man* provides a classic example of racist values leading to low-quality science in the case of Samuel George Morton.[3] Morton was an early physical anthropologist who is most well known for

his collection and study of human skulls. He measured the cranial capacities of the skulls from people of different racial groups, taken by Morton and his contemporaries as an indirect measure of intellectual ability. Gould shows how Morton's (run-of-the-mill nineteenth-century) racist values influenced his work, leading Morton to literally *mismeasure* the skulls in his collection in order to confirm his racist views about different racial groups.[4] While there has been some criticism of Gould in defense of Morton,[5] Gould was essentially correct in his analysis of Morton's biases, despite some errors.[6] Moreover, in his reanalysis and critique, Gould seems to have tacitly accepted a variety of problematic assumptions, without questioning them, that Morton made about there being a meaningful answer to questions about the average cranial capacities of racial groups, including major sampling and conceptual problems.[7] The whole project of finding such racial differences is problematic, not just Morton's biased implementation of the project.

Nothing about the processes of science as they exist prevents biases like racism from being reinforced. Indeed, science is a relatively conservative institution that often reinforces the status quo, not because it contains big-C "Conservative" political values (many scientists are liberal),[8] but because science works on a system of peer review in which established experts vet the work of less-established members. In addition, scientific careers are still difficult to access for those with less social privilege, and in the past they were completely closed to all but white men of means. Furthermore, as the relevant sciences were all intertwined with racist ideologies from the beginning, overcoming them is a long-term process, still incomplete.

Science need not, and does not always, problematically reinforce the status quo. Science has the capacity to self-correct, but only when scientists and society carefully foster that capacity. Antiracist and egalitarian values, used appropriately, have helped debunk bad science and led to better methods and results across a variety of fields in the human sciences. Gould made clear his values in writing *The Mismeasure of Man*, citing his personal experience in the civil rights

3. Gould, *Mismeasure of Man*.

4. Gould thinks this influence was probably unconscious, as the influence of pernicious status-quo values often is.

5. Michael, "New Look at Morton's Craniological Research"; Lewis et al., "Mismeasure of Science."

6. Weisberg, "Remeasuring Man"; Kaplan, Pigliucci, and Banta, "Gould on Morton, Redux."

7. Kaplan, Pigliucci, and Banta, "Gould on Morton, Redux."

8. Eighty-one percent of US scientists are Democrats or lean Democratic, according to a 2009 Pew poll. Pew Research Center for the People and the Press, "Scientists, Politics and Religion."

movement and arguing that "we have a much better chance of accomplishing something significant when we follow our passionate interests and work in areas of deepest personal meaning."[9]

Feminist Psychology

Patriarchy and feminism play much the same sort of roles in science as white supremacy and antiracism. Starting in the 1970s, the feminist movement had a significant impact on science, on philosophy of science, and on science studies more broadly. One interesting and much earlier episode comes from the work of three collaborators: William Moulton Marston, Elizabeth Holloway Marston, and Olive Byrne.[10] The three made important contributions to scientific psychology from 1915 to 1931, to popular psychology in the 1930s, and to pop culture in the 1940s. Holloway, Byrne, and Marston invented the systolic blood pressure lie detector (a component of the modern polygraph) and wrote widely on emotions, consciousness, and the relation of psychology and neurology. They did work that anticipated the positive psychology movement decades later. After an academic career cut short by social prejudice toward their unconventional lifestyle, Holloway, Byrne, and Marston went on to create, write, and popularize the comic book superhero Wonder Woman (who was often a mouthpiece for their psychological theories).

Holloway, Byrne, and Marston were convinced that the status quo of their time was deeply unjust *and* psycho-emotionally unhealthy. This was a judgment based on an engagement with major feminist political writers and movements, on scientific experiments and clinical observations, and on the personal experience of living a marginalized lifestyle. Near the beginning of *Emotions of Normal People*, Holloway, Byrne, and Marston make this striking claim: "I submit that the backbone of literature has been transplanted intact into psychology, where it has proved pitifully inadequate."[11] "The backbone of literature" is their colorful

9. Gould, *Mismeasure of Man*, 37.

10. The work of the Holloway, Byrne, and Marston is discussed in detail in Brown, "Love Slaves and Wonder Women." William Moulton Marston is usually assigned sole credit for most of this work, but much of it was actually collaborative, as argued by Lepore, *Secret History of Wonder Woman*. I here attempt to correct that problematic attribution by listing all three collaborators irrespective of the official "author" of the work. Olive Byrne also went by the name "Olive Richard," and some of her published writings can be found under that name.

11. Marston, *Emotions of Normal People*, 3–4.

phrase for referring to commonsense or folk categories, which they understood most contemporary psychologists to merely take for granted. This "transplant" job tended to reinforce the social status quo as natural and scientifically justified. They wrote apt criticisms of the psychoanalytic and behaviorist systems of psychology, in part based on this problem of taking social categories for granted as real mental kinds. Contemporary feminist psychologists continue to break down sexist assumptions in psychology, neuroscience, and society.[12]

Holloway, Byrne, and Marston sought to provide a radically revisionary psychological theory that dispensed with unhealthy and unjust social relations. They forwarded an account of psycho-emotional health or "emotional normalcy" based on the promotion of "normal" emotions and relations between emotional states. They had a revisionary theory of the basic (or "primary") emotions based on neuroscientific ideas, which they termed "dominance," "compliance," "inducement," and "submission." These four basic emotions and their compounds tended to fall under the categories of *appetite* (dominance, compliance) or *love* (inducement, submission). For Holloway, Byrne, and Marston, the love emotions were primary, and relationships of "love leadership" would govern a healthy society. Women, due to their innate superiority with respect to love emotions, were better fit to be love leaders. On this ground, they defended more and less radical feminist social reforms, from equal rights, education, and economic independence of women to eventual gynocentric matriarchy. Contemporary feminist psychologists tend to reject and criticize essentialist ideas about gender difference, including emotional differences, instead forwarding accounts where gender differences are culturally conditioned and socially constructed. Holloway, Byrne, and Marston are, however, part of a long if minority feminist view that emphasizes essential differences.[13]

One potential concern is that the sociopolitical motivations behind their work were generally not presented in a straightforward way. They did not argue, for example, that Freud's work was problematic because it was sexist, nor did they make clear their values in their scientific work. Radical value judgments are presented, if at all, as conclusions, not assumptions, of the scientific research. In one way, this was a good thing: in many cases, they were able to provide compelling arguments on value-neutral grounds, in much the same way that Gould criticized scientific racists not merely for being racist, but on the basis of methodological, empirical, and technical errors in their work. For rhetorical purposes this approach is common

12. Eliot, *Pink Brain, Blue Brain*; Fine, *Delusions of Gender.*
13. Gilligan, *In a Different Voice*; Ruddick, *Maternal Thinking.*

and often more effective, but the lack of transparency is somewhat problematic.[14] One wonders what decisions lay behind the empirical results they presented.

The academic argument later became an activist project. This, too, was problematic. Interventions as diverse as legal advice, self-help writings, clinical psychology, and creative fiction in popular media are all based on scientific views far from widely accepted in their scientific community, as well as on values that were quite rare in their time. Their psychological views are presented as expert knowledge but were often quite idiosyncratic. Of Wonder Woman, William Moulton Marston once wrote, "Frankly, Wonder Woman is psychological propaganda for the new type of woman who should, I believe, rule the world."[15] One can respect Holloway, Byrne, and Marston for attempting to use their scientific work to have a beneficial impact on society without completely admiring their propagandistic approach.

Feminist science is largely another case of values having a beneficial influence on science, but we can see here that there are better and worse ways to do it. Ideally we would like to have a world where scientists are transparent about their values and their influence over their decisions, though misconceptions about the relationship between values and science often make hiding value commitments more rhetorically effective.[16] Likewise, finding ways to use science to the benefit of society is highly desirable, but using propagandistic techniques to forward idiosyncratic and uncertified views is problematic.

Stem Cell Research

Research on human embryos has been a hot-button political and ethical issue for decades. Today, the controversy is on CRISPR gene editing of human embryos,[17]

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14. On transparency, see Douglas, "Weighing Complex Evidence in a Democratic Society"; Elliott and Resnik, "Science, Policy, and the Transparency of Values"; Elliott, *Tapestry of Values*.

15. Letter to early comics historian Colton Waugh, quoted in Walowit, "Wonder Woman," 42.

16. John, "Epistemic Trust and the Ethics of Science Communication," among others, has contested the norm of transparency, arguing that it actually undermines trust in experts, with deleterious epistemic and political consequences. Given the extreme prejudice in society at the time of their writing, Holloway, Byrne, and Marston may have been right to conceal the role of their values in their scientific work; however, they still potentially run afoul of the obligation John articulates to assert only "well-established claims." It is worth noting that John's argument focuses on "communication in contexts where speakers know that their words may be twisted and manipulated for others' political or economic ends" (75), whereas we might hope for a situation where transparency might be positive rather than detrimental.

17. Cyranoski and Reardon, "Embryo Editing Sparks Epic Debate"; Evitt, Mascharak, and Altman, "Human Germline CRISPR-Cas Modification."

but for years the central controversy concerned human embryonic stem cells. In the United States bans on using federal funds for research on human embryos go back to shortly after the legalization of abortion in 1973. Some moves were made toward lifting the ban and authorizing the use of federal funds during Bill Clinton's presidential administration, but the blocks were never fully removed. The greatest controversy over the issue came during George W. Bush's administration. Bush was ironically considered the greatest opponent of embryonic stem cell research, despite the fact that he actually authorized the first federal funding for research on nineteen embryonic stem cell lines. Nevertheless, many restrictions remained in place and more were added, and most embryonic stem cell research had to seek private funding. The second major liberalization of funding for stem cell research came with Barack Obama's executive order of March 9, 2009.[18]

The motivation for restricting research on human embryos is clearly a matter of religious and ethical values. The question concerns what is and is not permissible to do to an embryo, and support for banning such research primarily came from the right-wing Christian religious groups that command significant political power in US politics. The values in question are controversial—and some would argue inappropriate—grounds for public policy in a pluralistic, secular democracy. Whether or not you agree with the policy, there is no ground for calling it "antiscientific," as many supporters of such research have done. Ethical restrictions on research because of impact on human subjects, animal subjects, or the environment are common and today are considered unremarkable. What counts as a morally considerable subject and what is permissible to do to that subject may depend on scientific information, but are straightforwardly questions of ethics and values.

As a result of the funding environment in the United States from 1973 to 2009, there was limited funding for exploratory research on stem cells. Such funding is largely provided by the federal government, as private funders prefer to support research that is more clearly and immediately commercially viable, and charitable and state funding is in relatively shorter supply. While there was never an outright ban on embryonic stem cell research, it was no doubt slowed considerably by the funding bans.

One unanticipated result of the funding restrictions was innovation in the area of *adult* stem cell research and the development of induced pluripotent stem

18. For more on the history of stem cell research funding and politics in the United States, see Wertz, "Embryo and Stem Cell Research in the United States"; Murugan, "Embryonic Stem Cell Research."

cells. The restrictions spurred the imagination of some researchers who went on to develop techniques for deriving stem cells without involving embryos. Constraint is a spur to creativity; the values-based limitations on funding spurred scientific innovation and progress. Though adult stem cells are less versatile, they also have their own virtues. For example, transplanting tissues grown from one's own stem cells has little risk of rejection, which is not the case for tissues grown from embryos. It is doubtful that as much progress would have been made as fast in the United States on adult induced stem cells without the ban in place.[19]

Values need not only be a hindrance to science, even when they create constraints and limitations on what science can do, and even when we disagree with the values or how they were applied. The silver lining in the stem cell case shows that values can interact with the imagination to push science in beneficial new directions.

THE PHILOSOPHICAL ORIENTATION OF THE BOOK

While this book aims to give generally accessible arguments for the views it lays out and to engage closely with previous ideas about values in science, inevitably it is shaped by my own philosophical orientation and personal perspectives. I believe it is helpful and somewhat more honest to lay bare my personal commitments and assumptions. While I believe each viewpoint is defensible and well defended insofar as it has an impact on the book, none is entirely uncontroversial, and it will help you as a reader to know ahead of time where I am coming from.

Normative Pragmatism

Normative arguments are central to this book; the goal of the book is to guide scientists and to inform our evaluation of science, particularly with respect to the ethical responsibilities of science. The general philosophical viewpoint of the book is normative pragmatism, in two senses. The first is that its approach to normativity is *pragmatic*. This means that the norms are engaged with practice, and ultimately evaluated by their impact on the practice. All normative claims are ultimately claims about how we should act, and nothing prior to

19. Vogel and Holden, "Developmental Biology"; Rao and Condic, "Alternative Sources of Pluripotent Stem Cells"; Murugan, "Embryonic Stem Cell Research"; Grinnell, *Everyday Practice of Science*, 95.

actual action—no a priori arguments, no nonnatural facts, no process of value judgment—can ultimately determine the truth of such claims. Only the impact on action and practice consequent to adopting a value judgment can be the test.

The second is that *pragmatism* itself is taken as a normative framework for scientific practice and value judgment. Thus scientific inquiry is conceived as properly practical inquiry, and the theory of values is considered according to a framework of pragmatic pluralism. I do not claim that pragmatism adequately captures the folk understanding of knowledge or truth, nor that it best explains what scientists are thinking about or trying to do when they engage in scientific practice. Nor do I claim that folk conceptions of ethics, or conceptual analysis of folk beliefs about values, will deliver a pragmatic pluralist theory of values and value judgment. Rather, I claim that our practices and beliefs should be revised to be more pragmatist, because pragmatism is the best normative framework for science and ethics. In concert with the first sense of "normative pragmatism," I think this second sense is justified: (1) by the recurrent problems that arise in current scientific practice as well as in accounts of science and of values (and especially of their interaction), and (2) that the ultimate test of the claim is the improvement of scientific and ethical practice.

The normative pragmatist approach is consistent with and supportive of two growing trends in philosophy of science and ethics, respectively. In philosophy of science, it is the best framework for bringing to fruition the increasing focus on and responsiveness to scientific practice, without allowing philosophy of science to collapse into a merely descriptive enterprise. In ethics, the increasing focus on the complexities of our moral lives and frameworks of practical ethical deliberation over foundational, principle-based moral theorizing is best accommodated by a pragmatist, pluralist theory of values. Many, though not all, of the elements of the argument in this book are independent of the pragmatist theory of inquiry and the pragmatic pluralist theory of values. Nevertheless, the latter two theories are the best way to fulfill the ambitions behind these current trends and provide the most robust normative ideal for the interplay of values and science.

Moral Imagination

A central concept at the heart of the positive recommendations of this book is that of "moral imagination." Moral imagination plays a central role in the theory

of value judgment laid out in Chapter 5, and thus a central role in the ideal for values in science laid out in Chapter 6. Moral imagination means a few different things, each of which plays a role in the book. In one sense, moral imagination is about the role of imaginative and creative thinking in ethics and value judgment. Our capacities for empathy and compassion depend on our understanding of the perspectives, feelings, and values of others, and are thus acts of imagination. Likewise, integrating values through creative thinking about moral problems is an important element of ethics that is undervalued and sometimes positively undermined by the philosophical literature, especially its focus on clear-cut dilemmas. In another sense, moral imagination represents a special constraint on our decision making: we should judge our actions in part by thinking expansively about their implications and consequences beyond the here and now, beyond our inner circle, and these considerations require imagination.

The third sense of moral imagination has to do with the formation of our ends and ideals. In my view, our highest ethical and social calling is to create new ends or goals and to strive for more complex values and a more intentional life, not to live habitually, unthinkingly, or for some purpose conceived remotely from ourselves. The horizon of our ethical life should not be the way things are now; we should imagine ways the world could be better, should be better, in light of the problems we face now. Our current situation is a starting point, not a destiny.

We cannot fulfill this calling alone; our ethics must be a democratic, social ethics. As Jane Addams wrote:

> If in a democratic country nothing can be permanently achieved save through the masses of the people, it will be impossible to establish a higher political life than the people themselves crave; that it is difficult to see how the notion of a higher civic life can be fostered save through common intercourse; that the blessings which we associate with a life of refinement and cultivation can be made universal and must be made universal if they are to be permanent; that the good we secure for ourselves is precarious and uncertain, is floating in mid-air, until it is secured for all of us and incorporated into our common life.[20]

No good can be adequately chosen for us from without. As the slogan goes, "Nothing about us, without us." Though ends do not become worthy *merely* by

20. Addams, *Twenty Years at Hull-House*, chap. 6.

being chosen by us, no end can be entirely worthy of us unless we choose it freely and intelligently, rather than having it imposed upon us.

What we need is an ideal for values in science that is not concerned with merely policing a minimum boundary of acceptable conduct, nor a concessive realpolitik, but an ideal that guides us to strive for a better world. Minimal bounds must sometimes be outlined and policed when we're in real danger of violating them, but focusing on minimal criteria can also be counterproductive insofar as it leads us to think of all ethics as a negative force, a restriction rather than a higher target to aim for. Realpolitik has a role to play in the short-term assessment of means to ends; it has no place in the determination of ends. There is a strong anti-idealism in certain quarters of philosophy of science and practical ethics today, which justifies itself in a mistaken reference to being realistic and practical. But there's nothing unreal about the ability of ideals properly formed to guide us toward improving the world, and there is nothing less practical than allowing bad actors and unjust systems to limit your hopes and your aspirations.

Pervasiveness of Evaluation and the Contingency of Science

In my view, evaluation is a pervasive feature of intelligent practices generally, and scientific inquiry particularly. This word, *evaluation*, carries a lot of freight. It means both making a judgment about something and determining the worth of something. Judgments are not mechanical but, as in a "judgment call," require the careful exercise of intelligence, wisdom, and wit; still it is often the case that equally wise experts judge the same case differently. This suggests open options, a contingency to the direction of evaluations. Making a judgment call generally requires determining the relative worth of the options to the situation at hand. If we are making a decision about how to act, the worthiness of the actions (their meaning and their consequences) is what we judge. If we are deciding between theories, their worthiness to explain, predict, or control the phenomena in question is perhaps foremost.

Science is hard, requiring determination, creativity, and luck; it cannot be reduced to a set of rules. Also, there are many potential paths to success in science. Some scientists move piecemeal and conservatively; others make wild leaps and suggest radical changes. Sometimes novel discoveries depend on opportunities that arise—right place, right time; others depend on whether the right confluence of training, techniques, ideas, and technologies are available to make the leap—the right person or tool for the job. For all these reasons the direction of

science is highly contingent.[21] As such, evaluation, or judgment, is necessary at many steps along the way. Any account of science must wrangle with these features of scientific practice.

Avoiding Extreme Optimism or Pessimism

My introduction to the philosophy of science came through William James, Thomas Kuhn, and Paul Feyerabend. As a result, I am highly skeptical of Pollyanna theories of science as everywhere rational, comprehensive, cumulative, and authoritative. The authority, objectivity, and beneficence of science have always been an open question for me, and I think careful research on the history and nature of scientific practice shows that it really is a mixed bag. There are incredible successes and feats of staggering genius. There are also examples of rank bias, exploitation, skullduggery, and obvious mistakes. The negatives are not particularly more prevalent in science than in any other human endeavor, particularly those endeavors that are the traditional province of the privileged, as science is and has been.

On the other hand, I have always been fascinated by science and technology, and I acknowledge that it is easy to take skepticism about science too far. It is not plausible to hold that science is *inherently* sexist and racist (even if most of its institutions have been), that it is mere politics (power struggle and clash of opinion), that it has no epistemic authority of its own. Again, it seems to me that careful research on the history and nature of science shows that something special has happened on the historical occasions when the active, experimental methods of knowledge production and the speculative, theoretical methods of knowledge production work together. Each has a long history of separate development (as the active, experimental tradition of the artisan and technician and the speculative, theoretical tradition of the mathematician and philosopher, respectively) in many cultures. Their particular combination is more historically rare and is what makes modern science so productive.

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21. Some scientists and philosophers of science deny that science is really so contingent. They point toward things like simultaneous discoveries and argue for the inevitability of certain conclusions. They would explain this fact on the basis of the constraints provided by reality. But note that *contingency* does not mean absence of constraints on successful science. Success of course depends on external constraints, but this is a judgment made retrospectively. We're focused instead on the situation of scientific practice, where the inquirer is faced with frequent contingent decisions. See Hacking, *Social Construction of What?*; Franklin, "Is Failure an Option?"; Soler, Trizio, and Pickering, *Science as It Could Have Been*.

There is a difference between having a critical attitude toward science and a skeptical one. Skepticism about science denies wholesale the very possibility of science generating knowledge. I recommend and try to teach my students how to have a critical attitude toward science. To uncritically accept every bit of scientific information would be foolish, as is the wholesale skeptical rejection of science common in certain segments of modern society.[22] It is not as difficult as many think for the well-equipped layperson to evaluate science, to tell the difference between the novel results in a single study and something established by a large literature, to recognize potential conflicts of interest and sources of bias, and to identify failures to check potential harms to society. It takes work, but it is not beyond the grasp of most. I find providing the tools for such evaluations much more satisfying than providing a partisan defense of (or attack on) science.

The Unity of Science, Engineering, and Medical Research

For some purposes we may want to distinguish science proper (or "pure" science) from engineering and medical research (or "applied" science). For example, we may want to reserve a certain percentage of funding for "basic research" that has no obvious or immediate application to technology, medicine, or policy, based on our sense of past successes of such research or its intrinsic worth, especially in an environment where such research is undervalued by granting agencies.[23] For the purposes of this book, namely understanding the general nature of scientific inquiry, the ethical responsibilities of scientists, and the impact of science on society, there are no significant differences among the three.[24] Likewise I see no significant differences between natural and social sciences with respect to these questions. Of course the different sciences have different subject matters, different relations to society, and different values relevant to their inquiries. As such, when writing in general about "science" or "research," you should know that I have all of these things in mind. *Science* throughout the book can generally be read as shorthand for "STEM" or "natural and social science, technology,

22. There may be some few areas of science where near-wholesale skepticism is warranted. See Jacob Stegenga, *Medical Nihilism*.

23. Whether we are in such an environment at present is another question.

24. For more on the interdependence of science and technology and the history of the boundary between them, see Channell, *History of Technoscience*. To avoid jargon, I have not followed those who adopt the term *technoscience* to capture the blurring of boundaries between science and technology, but my use of *science* here is inclusive of that concept.

engineering, and biomedical research," and "scientists" for "STEM researchers" or "scientists and engineers."[25]

A Heuristic Focus on the Individual and Small Groups

I will present many of the ideas and arguments in this book, at least at first, from the point of view of the individual scientist in the midst of research, or from the small-scale research collaboration. This is not because I think science or scientific knowledge is fundamentally individualistic, nor because I think the influence of society is irrelevant or can safely be ignored. Rather, my reason for presenting things in this way serves three related, heuristic purposes.

First, I think one place where we really need guidance, where there is a large gap between the way things ought to be and the way things are, is the individual level. Individual scientists and small groups in the lab have a great degree of power over the shape of the scientific process. While the larger social processes of peer review, funding, extended controversies and their settlement in the scientific community, and the codifying of knowledge for application, textbooks, and so on, are also extremely important, many important decisions take place within the research process itself, which is governed mainly by individuals and small groups; unlike their results, those decisions are often not open to scrutiny of the scientific community. Science involves a lot of trust—we trust researchers to report their results honestly and accurately, to follow the protocols that have been approved for their use of research subjects and sensitive materials, to evaluate the work of other scientists on the merits. We trust experts to give us an accurate representation of the state of scientific knowledge. Social checks and balances themselves are not enough if the conduct of scientists is not responsible. Yet the guidance we provide to science on what it means to be responsible is woefully narrow and inadequate.

Second, I follow thinkers like Ron Giere and Nancy Nersessian in thinking that the larger social processes can be treated as cognitive processes and that there is a unified framework for describing the work of the individual thinker and for describing groups, even large groups, thinking together.[26] As such, I think it is

25. Medical practice (what doctors do) has many aspects that are distinct from the research activities covered in this book and should not be understood as covered by the arguments herein. For the use of moral imagination in guiding medical practice, see Elliott and Elliott, "From the Patient's Point of View"; Mackenzie and Scully, "Moral Imagination, Disability and Embodiment."

26. Giere and Moffatt, "Distributed Cognition"; Nersessian et al., "Research Laboratories as Evolving Distributed Cognitive Systems."

possible to read the individualistic-sounding language of *choice*, *decision making*, and *judgment* literally even when the processes in question cannot in principle be done by an individual, but are the product of the whole scientific community.

Third, there are many issues of values, ethics, and politics which appear at the larger social level that are intentionally outside the scope of this book. For instance, the commercialization of science has huge impacts on the larger workings of science today, impacts that are largely negative and have led to unreliability and fraud in whole areas of research, especially certain areas of biomedical, environmental, agricultural, and nutritional research. There are practical limits to what individuals can do here. The recommendations in this book may help individuals make better decisions in the face of the problematic incentives created by commercialization, but they are admittedly insufficient to resolving the problem. Also there are large-scale religious, conservative, and populist attacks on the authority of science that are incredibly difficult to fight, and focusing on those attacks has led to reactionary responses that distort our understanding of science. Frankly, I am not only at a loss personally to provide useful guidance on these issues, I am not optimistic that they can be addressed at all without significant social, cultural, and political-economic change. Thus I focus on the level where I think we can make some real progress in ameliorating science and its impact in the midstream of the research process.

THE ARGUMENT OF THE BOOK

Contingency and choice are ubiquitous throughout the research process. Scientists, engineers, and biomedical researchers face choices of what to investigate and how to investigate it, what methods to use, what hypothesis to test, how to model phenomena, what data to collect, when to stop data collection, and what conclusions to draw based on the evidence. Peer reviewers for funding bodies decide to fund this grant application and reject that one. Committees decide to hire or tenure this scientist but not that one. Likewise, institutions have evolved in one direction but could have evolved in another; individual researchers have certain levels of talent and skill that could have been otherwise; sometimes researchers are in the right place at the right time, but other times they are not. Many of these contingencies are out of the control of individual choices, but others are matters of explicit decisions, and many things that are decided by habit, luck, or institutional practice could be made explicit and decided differently.

On what basis are scientists to decide what to do in the face of these

contingencies and choices? Some would say that they must be decided *objectively*, by the evidence, by logic and statistics, by scientific standards (sometimes called "epistemic values") such as simplicity or Okham's razor. But right away, we can see that this answer is inadequate for many scientific questions, such as which question out of the infinity of possible questions we should study, or what methods are ethical and humane to use on animal or human subjects. In order to make these decisions, we must also consider our values, what we care about, our goals, ethics, duty, responsibility, what is right and good.

This book argues that few, if any, of the decisions scientists face can, in principle, be decided by logic and evidence alone. Nor are epistemic standards sufficient. Even if those decisions could be settled that way, it does not follow that they should. Values are relevant throughout the research process, and scientists have an ethical responsibility to weigh values and make value judgments in the course of the research process, even when dealing with data and drawing conclusions. Each contingency in science could, in principle, become an explicit choice. Any such choice could have foreseeable consequences for what we value; to find these out for any particular case, we have to think about values, exercise moral imagination to determine the consequences of each option, and exercise value judgment as part of the choice. We cannot always foresee the consequences; the choices may sometimes be irrelevant to any values, but we cannot determine that ahead of time without looking at the details of the case. Thus scientists have a responsibility to make value judgments about scientific contingencies, and thus science is value-laden through and through.

I call this general argument "the contingency argument," which I develop in detail in Chapter 2. This argument is meant to undermine the ideal of science as value-free (or "the value-free ideal" for short), according to which values (except for scientific standards) have no role to play in scientific inquiry proper. That is, in the ideal, scientists should not consider values in science, except to ensure that their work is impartial toward and neutral for our values.[27] The value-free ideal is motivated by the thought that it will minimize the bias, subjectivism, and potential for wishful thinking that values would bring into science. Science, after all, is supposed to be objective. And yet, as the contingency argument shows, scientists have an ethical obligation to bring in values. While this may appear to create a conflict between the scientists' responsibilities, I argue that the apparent conflict is based on a mistake, an implicit view about values—that they

27. Lacey, *Is Science Value Free?*

are necessarily biasing, subjective, arbitrary, or, as I will put it, that they have no cognitive status. To deny that value judgments have cognitive status is to deny them meaning, warrant, credibility, and truth. To insist, as I do, that values can have cognitive status means that they need not be biasing or subjective, that they need not lead to wishful thinking, that they are meaningful and can be warranted and credible. Indeed, we cannot make sense of human practices, human passions, heartfelt disagreement over values, or the genuine difficulty of moral quandaries, without attributing some cognitive status to our values.[28]

If values have their own cognitive status, then they need not necessarily lead us to subjectivism and wishful thinking. On the other hand, we still need to know how to manage values in science. Attributions of "cognitive status" are no panacea against wishful thinking. Nevertheless, there is no general reason to think that value-laden science is deficient or problematic.

What we need is a better theory of values, one that avoids the simplistic idea that values necessarily lead to unacceptable bias, one which allows us to acknowledge the cognitive status of values, one that can help us distinguish the legitimate roles for values in science from those that lead to rigid and wishful thinking. This theory of values should be "science friendly," neither presupposing some mysterious, supernatural realm of values, nor removing values from the realm of evidence altogether. Science allows no unmoved movers. I propose a pragmatic pluralist theory of values, according to which values are inherently connected with action; come from many sources in human life, practice, and experience; and come in many different types according to the many different roles they play in our activities. According to this view there is a crucial distinction between unreflective or habitual values and reflective value judgment, where the latter is understood as a type of empirical inquiry into questions of what to do. The cognitive status of values tracks both their success in guiding human activities and the quality of the inquiry that warrants their evaluation. This theory of values may not be the only one for the job, nor does it necessarily satisfy the deeper questions of metaethics and ethical theory, but it has many benefits as a practical theory of values.

On this account scientific inquiry and value judgment share common aims and a common structure, laid out in Chapter 1 in the case of scientific inquiries, and Chapter 5 in the case of value judgment. Both are conceived as

28. This claim is consistent with the sophisticated contemporary philosophical positions of metaethical "noncognitivism" and "antirealism," which do not necessarily support the view that values are necessarily biasing, meaningless, or unwarranted.

problem-solving inquiries occasioned by problematic situations of practice. Both involve determining the facts of the case, proposing hypotheses for resolving the problem, and experimental testing. Both are contextualized by the problematic situation they respond to. Both are judged by whether they resolve the problematic situation in practice, rather than by merely intellectual criteria.

Central to the pragmatic pluralist theory of values is the concept of moral imagination. Value judgment requires considering stakeholders and the various implications and consequences of various courses of action connected with values. As such, it requires exercising imagination via empathy, dramatic rehearsal, and creative problem solving. The exercise of moral imagination is not mere fantasy but a part of all evidence-based inquiry. The emphasis on imagination is an important feature of this theory of values, one compatible with any ultimate ethical theory.

Based on this account of values, I define a new ideal for values in science, a replacement for the value-free ideal, which has been undermined by the contingency argument. I call this "the ideal of moral imagination," defined as follows: *Scientists should recognize the contingencies in their work as unforced choices, discover morally salient aspects of the situation they are deciding, empathetically recognize and understand the legitimate stakeholders, imaginatively construct and explore possible options, and exercise fair and warranted value judgment in order to guide those decisions.* Legitimate stakeholders are those who either rightfully participate in or affect the decisions in question, or who will be affected by the decision. Moral imagination is an open-ended ideal to strive for, difficult in principle to satisfy, just as the value-free ideal was. It is not a minimal criterion for all inquiry to satisfy, but it is a genuine ideal.

To say that contingencies are "choices" is to say that there is more than one open option that reasonable inquirers could settle on. To say that the choice is "unforced" is to say that no factor decisively settles the matter and shows one of the options to be the best, all-things-considered, at least from the perspective of the scientific inquirer at the moment the choice is made. Not all contingencies are, in the moment, recognized as unforced choices by the inquirers. They may not imagine that there are other options and let force of habit or convention, or the appearance of only one option, decide for them. But ideally they would recognize those contingencies for what they are and exercise their moral imagination in order to make a responsible choice.

The ideal of moral imagination in turn allows us to recognize a second kind of irresponsibility in scientific research. Already thoroughly discussed are cases

of *misconduct*, when scientists violate clear minimal constraints on responsible research (for example, fabricating data, plagiarism, experimenting on human subjects without consent). The ideal of moral imagination allows us to recognize a distinctive form of irresponsibility in *failures of moral imagination*, where scientists fail to live up to the ideal by, for example, failing to consider a reasonable range of options (including the superior option) or by not considering the impact on legitimate stakeholders. The second is the new form of evaluation that the book defines and advocates. It is generally a matter of degree, where misconduct is usually an all-or-nothing question.

While the ideal of moral imagination allows us to identify a distinctive failure of responsibility, its emphasis is on the positive, on what values and value judgment can contribute to scientific inquiry. The ideal of moral imagination gives scientists something to strive for and tools for responsibly making the choices that pervade the research process. It can guide decisions about research agenda, methodology, and framing hypotheses; it provides guidance on the questions that arise in the conduct of inquiry, of gathering data, of testing and refining hypotheses; it can improve the way that scientific results are presented and applied.

THE STRUCTURE OF THE BOOK

Before concluding this Introduction, I will explain the way the book is written, both the unusual structure of each chapter, the grouping of chapters, and the nature of the argument. There are different ways to read the book, depending on your interests and backgrounds.

The Structure of Each Chapter

If the audience for this book was only philosophers of science, each chapter would probably be structured in a familiar way: First, review previous work on the topic, arranged according to the structure of the dialectic or debate. Then identify the need for intervention through arguments showing the limits of what has come before. Provide a general argument for an alternative view. Then examine a case study that exemplifies or illustrates the alternative. (Alternatively, case studies can come before the general argument.) Finally, pose and respond to potential objections.

This book is different because it is written and structured with multiple

audiences in mind, with each chapter organized so as to highlight the main argument without presupposing specialist knowledge. Each chapter (except this introduction) is structured in four main sections: First, the "introduction" provides a brief characterization of the problem or question the chapter is meant to address. The "argument" gives the positive account or argument that addresses the problem or answers the question. The "analysis" section deals with further complications, including tying the argument to historical sources and the contemporary academic debates, and defends the positive view in greater technical detail, responding to objections and exploring further related issues. "Next steps" briefly reviews open issues and questions and sets up the transition to the next chapter. Through this structure, I hope to provide multiple pathways through the book for audiences with different interests and backgrounds.

Pathways through the Book

Anyone simply wanting to understand the unique positive arguments and theory I'm proposing, including scientists who want motivation and advice for improving their practice, can focus on sections 1, 2, and 4 of each chapter (that is, introduction, argument, and next steps), and read the last chapter in its entirety.

Chapters 1–6 give the general account of scientific inquiry, the need for values therein, the nature of values and value judgments, and the ideal of moral imagination. The conclusion ends with a discussion of the application of the ideal of moral imagination to specific cases, its use in training scientists, and future directions concerning the credibility, dissemination, and application of science.

If you want motivation for thinking that values really do matter to science, that scientific knowledge is significantly value-laden, that scientists need to exercise value judgments, chapter 2 is key. The full argument for the need for the kind of ideal I provide proceeds primarily in chapters 2–4. The argument for the ideal itself is the business of chapters 5–6 and the conclusion.

If you want to use the book primarily for practical training purposes in the responsible conduct of research, then you can focus on the entirety of the introduction and conclusion and sections 1, 2, and 4 of chapters 5–6.

Sections that focus on specialized philosophical discussions will be marked as such, occurring primarily in the "analysis" section of each chapter; these can be safely skipped by other readers without losing the thread of the book.

Additional Apparatus

At the end of the book you will find a glossary, which contains definitions of key terms that appear throughout the text. You will also find as an appendix a page which you can photocopy that provides a helpful tool for applying the ideal of moral imagination in practice. Its use is explained in the Conclusion. A digital copy of this tool, along with other useful materials, can be found on the book website at https://valuesinscience.com.

THE PROOF OF THE PUDDING

The proof of the pudding is in the eating, and the proof of a philosophical argument is in the insight it provides when put to use. In my view the appearance of definitive argument in philosophy on foundational grounds is typically an illusion. Of course, each chapter has plenty of arguments, but as far as I am concerned, the real value of the ideas is seen in their usefulness in making practice more intelligent and responsible. The best philosophical arguments proceed from the careful analysis of a genuine problem, provide arguments that justify betting on a certain way of solving the problem, and then point the way to how that solution will alter our practices and activities and how we can tell if they have been improved thereby. This is an atypical mode of argument in many philosophical traditions, but quite common to pragmatists, among others.

The entire structure of the book is geared toward this style of argument. Chapters 1–3 provide background and set up a problem, chapters 4–6 provide an alternative account and reasons to think it is plausible, while the conclusion provides details on how to apply the account to various types of decision. Each chapter to some extent also recapitulates this structure (1 for problems, 2 for the theory or account, 3 to showing how the account can handle various complexities).

My hope is that the cogency with which my account handles specific cases discussed in the conclusion will convince you of the plausibility of my account, and give you reason to try it out in your own practices, whether you're a working scientist or someone who has to be a critical consumer of scientific results. I will not be satisfied, however (and neither should you be), until the ideas here defended are put to use and make some improvement in science and in society. All I can do here is convince you to give them a try.

CHAPTER 1

EMPIRICAL SCIENCE AS PRACTICAL INQUIRY

To say that something is to be learned, is to be found out, is to be ascertained or proved or believed, is to say that something is to be done.

—**John Dewey, "The Logic of Judgments of Practice"**

INTRODUCTION: HOW SHOULD WE THINK ABOUT SCIENCE?

How we think about the interplay of science and values depends very much on how we think about science—what it aims to do, how it works, what it produces. There are several different images of science that can be found in popular culture, in science pedagogy, and in the philosophy of science that emphasize different aspects of what goes on in the sciences and depict them more or less accurately. These different images of science are in the background of the ways we think about science. We can think about science as a body of theory or knowledge, an image that emphasizes the products of science, its content. We can also think about science as a social process, a practice engaged in by a certain group of people in our society. Or we can think of science as a method, that is, an idealized logic of inquiry that emphasizes the objective and rational nature of science.

Epigraph: Dewey, "Logic of Judgments of Practice," 65.

We think about science differently if we emphasize hypothesis testing around more specific empirical hypotheses versus the large-scale dynamics of major theory change, if we emphasize laboratory practice versus the logical structure of fundamental theories like general relativity, or if we emphasize highly applicable work in biomedical science versus basic research in particle physics. A lot of confusion arises from focusing too narrowly on one particular image. When the image of science in primary education derives from simple experimental practices in classical physics (such as Galileo's simple experiments with balls, towers, planes, and so on), the public may be confused or suspicious when they learn how, say, climate science works. When pop culture portrays scientists as cold, aloof, and calculating, we may distrust scientists who are passionate about their work. When philosophy of science looks exclusively at the published results of research, they may misunderstand the process that led to those results and even what the results ultimately mean. While different images of science are better and worse for different purposes, some are more inclusive than others.[1]

For the purposes of this book, the best image of science to think with is one that emphasizes scientific inquiry. Thinking about scientific inquiry emphasizes the practice of science or the scientific process in a way that makes room for both understanding how science is actually practiced and providing a normative account of the process, that is, of scientific method. It also contextualizes the products of science, explaining the role of theory and evidence. The theory of inquiry laid out in this chapter is general without being too simplistic. It is normative, that is, it tells us something about how science *should* proceed, but it is not rationalistic, based in philosophical ideas of what is logical or rational prior to investigating how science actually works, when it works well.

The goal for our thinking about science should be that it accurately describes much of scientific practice, that it gets at what is distinctively valuable about science, that it provides guidance for practicing scientists and for others evaluating what science has done. Finally, it should provide a picture that helps us with our goal of understanding the interplay of science and values. The image of science as inquiry provided by this chapter best meets those goals.

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1. For instance, images of science that emphasize practice can be more inclusive than those that emphasize theory alone, because theorizing can be analyzed as one (part of) scientific practice.

ARGUMENT: EMPIRICAL SCIENCE AS PRACTICAL INQUIRY

In this section I provide an image of empirical science as practical inquiry[2] and show that this image is the best way to think about science, given the goals outlined in the previous section. In "Analysis: Developments of and Challenges to Science as Practical Inquiry" (p. 41), I delve into the history of related views, look at some of the limitations of this image, and address some objections.[3]

Science as a Practice

Science is, of course, a human practice. Any image of science that fails to acknowledge this is inadequate on its face, but nearly every serious philosophy of science at least pays lip service to that fact. Even philosophers who have resolutely insisted that we need to pay attention only to the logical structure of theories and the logic of evidential support have acknowledged that these are products of a process of "discovery" and have provided arguments for why the details of that process can largely be abstracted away. It has become harder and harder for philosophers of science to see that abstraction as credible or adequate for dealing with the problems they seek to address today. First, starting around 1960 philosophers of science insisted that the complex details of the history of science were relevant to understanding how science works,[4] and today many philosophers have shown that detailed attention to science as practice problematizes many of our common assumptions about how science works.[5] The image of science that I will defend thus needs to take the details of scientific practice head-on.

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2. Much of this image originates in the ideas of Charles Sanders Peirce and John Dewey. See "Pragmatism and Practical Inquiry," p. 41.

3. Aspects of this section were originally developed in Brown, "John Dewey's Logic of Science"; and Brown, "The Functional Complexity of Scientific Evidence."

4. Ludwig Fleck was significantly earlier, but was not widely read until well after Kuhn. Fleck, *Genesis and Development of a Scientific Fact*; Hanson, *Patterns of Discovery*; Kuhn, *Structure of Scientific Revolutions*; Hesse, *Models and Analogies in Science*; Lakatos, "Falsification and the Methodology of Scientific Research Programmes"; Feyerabend, *Against Method*; Laudan, *Progress and Its Problems*.

5. Cartwright, *How the Laws of Physics Lie*; Franklin, *Neglect of Experiment*; Hull, *Science as a Process*; Dupré, *The Disorder of Things*; Rouse, *Engaging Science*; Chang, *Inventing Temperature*; Soler et al., *Science after the Practice Turn*; Waters, "Shifting Attention from Theory." Many of these philosophers were strongly influenced by engagements with social studies of science—for example, Gooding, Pinch, and Schaffer, *Uses of Experiment*; Pickering, *Science as Practice and Culture*—or by close engagement with scientists, especially philosophers of biology engaging biologists.

What is a practice, and what do practices involve?[6] In the relevant sense, a practice is an activity or set of activities undertaken by a community of practitioners. The community is constituted not just as a collection of people, but involves norms or expectations, shared objectives, as well as a division of labor. A practice has a history, and that shared history is also partly constitutive of the community of practitioners. The activities have objects or ends, and are composed of actions, operations, tools, and rules or standards.

The core activity of scientific practice is *problem-solving inquiry*. Science primarily consists of inquiries into the gaps and inadequacies of previously accumulated knowledge and the perplexities that arise from the use and development of prior knowledge. This is a broad and schematic claim. Characterizing the objects or ends of particular scientific inquiries is much more difficult, in part because of the great variety of subject matters and activities that science includes. There is no principled demarcation criterion between scientific inquiries and inquiries that we typically do not call scientific.[7] Scientific inquiries commonly feature prediction, explanation, and control as central foci, at least instrumentally if not as the main aim. This does not differentiate science from other inquiries we are less likely to consider scientific; car mechanics must engage in prediction, explanation, and control in the course of their work. Scientific inquiries often aim at systematicity beyond the narrow context where perplexities arise,[8] though that systematicity is always a partial achievement rather than a universal guarantee. This does not distinguish science, either; theology and metaphysics are highly systematic disciplines. Finally, scientists are proactive in searching out gaps and perplexities in our current knowledge, rather than being only reactive to failures; then again, so are gadfly philosophers.

Inquiry is not the only activity that constitutes the practice of science, though it is the most central one. Beyond inquiry proper, the practice of science involves general science education, training of future scientists, expert advising, and grant writing. What's more, inquiries in particular fields of science fulfill many goals, including goals that do not arise primarily within science itself. Subsidiary activities that support and extend the practice of science include contributing to

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6. My analysis of practices and activities draws on cultural-historical activity theory as exemplified by Cole, *Cultural Psychology*; Engeström, "Activity Theory and Individual and Social Transformation."

7. Feyerabend, *Against Method*; Feyerabend, "How to Defend Society against Science"; Laudan, "Demise of the Demarcation Problem."

8. Hoyningen-Huene, *Systematicity*.

public education, devising and informing specific groups and the public at large, and fund-raising. A full account of scientific practice would address each of these as well, and I will touch on them as they become relevant throughout the book. For now, though, it is important to center on scientific inquiry.

Science as a Method of Inquiry

Much of our understanding of science comes from treating science, especially scientific theory, as a subject matter to be learned and applied. This product-oriented view of science is good for certain projects, but it is of limited value, and it can become distorted if it is not responsive to other ways of thinking about science. We also think of science as a method, and in many respects this is a more inclusive image of science, one that thus has a significant influence on early science education. But "method" is an ambiguous concept, and different accounts of method can be more and less helpful.

One way to think of method is as a recipe or algorithm. In popular discussions of "The Scientific Method," this is almost certainly what people have in mind: a step-by-step recipe for solving problems or producing knowledge. When elementary school students learn "the five [or six or seven] steps of the scientific method," this is what is meant by *method*.[9] Studies of scientific practice have shown this sense of *method* to be a myth. Science does not proceed linearly according to such a recipe. It is rather a messy process, with very different techniques, standards, tools, and procedures used by different scientists and across different fields. Attempts to enforce uniformity of method in this sense would destroy science.[10]

In another sense, *method* means an inference structure. This is the primary sense of *method* in most of the history of philosophy of science. There have been clashes between confirmationist, falsificationist, holist, and similar inference structures under discussions of scientific method. Confirmationist accounts hold that there is a logical inference according to which successful predictions based on a theory or hypothesis provide support for that hypothesis. Falsificationists hold instead that the key inference structure in science is falsification of a generalization through a refuting instance. Holists maintain instead that it is the best fit between general theories and the empirical basis that forms the core

9. See Blachowicz, "How Science Textbooks Treat Scientific Method."

10. The danger posed to scientific progress by simplistic theories of the scientific method is one of the key arguments of Feyerabend, *Against Method*. This is why that text is of such enduring significance.

of scientific inquiry, where both theory and data can be revised. This is one sense of *method* that Paul Feyerabend was *against*—the idea that there was one rational inference structure for all of science. That type of uniformity would hamper science, in Feyerabend's view.[11]

Another sense of *method* is a "method of inquiry." *Inquiry* means something a bit different from *inference*. *Inference* suggests a final judgment. *Inquiry* suggests a searching, an ongoing process. *Inquiry* is a little less abstract, a little closer to practice. Nevertheless, inquiry is deliberate, methodical, and there are norms and standards that make some inquiries better than others. Inquiry is a deliberate process of resolving a problem through investigation, testing, and judgment. Inquiry begins in doubt or perplexity, an inchoate sense that something is wrong—there is some problem, but we don't know what it is yet. It concludes when a clear sense of the problem and a solution grounded in evidence are brought together in judgment. A process of inquiry is neither a recipe nor an abstract or rigid inference structure; *method* in the sense of inquiry is impervious to critiques of *method* in those senses. When John Dewey referred to "science as method," it was this sense of *method* that he meant.[12]

If science is a type of inquiry, what distinguishes it from other types of inquiries? There are, for example, legal inquiries, police inquiries. There are everyday attempts to figure out what to do that barely seem to deserve the name *inquiry*, though they fit the definition. Indeed, any human practice or activity requires inquiry when it runs into problems that need to be solved. As I have said before, there is no principled demarcation of scientific inquiry from other types of inquiry, no bright line separating science from other kinds of practices. However, it may be useful to distinguish different types of inquiry in some contexts; we can give a rough-and-ready distinction according to the subject matters of the inquiries, as well as the particular way a practice values inquiry.

First, the subject matter of the inquiry, the practice in which the inquiry arises and is meant to resolve, distinguishes different types of inquiry. In a (proper) police inquiry, a crime has been committed, and the public order problematized. The inquiry seeks to solve the problems of whodunit, establishing their means, motive, and opportunity, and bringing them to justice, in order to uphold and maintain the rule of law. Likewise, scientific inquiry in chemistry is problem solving in response

11. Feyerabend, *Against Method*. The line between method as recipe and method as inference structure has not always been drawn very clearly by defenders or opponents of universal method.
12. Dewey, "Science as Subject-Matter and as Method."

to gaps in our knowledge of chemicals and chemical change (or however we best characterize the subject matter of chemistry), or perplexities that arise in our attempt to extend that knowledge, or failures in activities of prediction, explanation, and control related to chemistry, as such or for specific purposes. This type of inquiry differs from the habitual application of chemical knowledge. It differs from other fields of inquiry as well in its relationship to its specific subject matter.

A second distinguishing mark of scientific inquiry has to do with the value of inquiry itself in scientific practice at large. In our everyday lives and many of our practices, inquiry is an unfortunate thing, the result of a failure or problem, to be conducted quickly so that a valued practice can continue on its way. Scientists have almost the opposite attitude: the inquiry itself is the part of science that matters most; the knowledge it produces, and the powers of prediction, explanation, and control it enables, are almost a by-product or afterthought. Unlike many other areas of inquiry, scientific inquiry is proactive rather than reactive, seeking out problems rather than waiting for them to arise naturally. Scientists should always be plumbing the depths and limits of our knowledge, rather than resting securely in it. Part of the distinctive value of science arises from this peculiar attitude.

Science as Practical Inquiry

What is distinctive about scientific inquiry? Some would answer the question very differently. They would say that unlike other types of inquiry, scientific inquiry is interested only in the truth, in being faithful to the facts, in discovering fundamental or foundational theories and rigorously testing them. What distinguishes science, in other words, is its purity, its pure objectivity, its remove from the everyday, and the slow, steady revelation of the truth about nature.

I think, for the most part, this is an unhelpful myth about science. Science is not distinctive because it is pure, theoretical inquiry. Science includes "applied science" as well as biomedical science and engineering. Rather, scientific inquiry is inquiry into perplexities that arise in scientific practices and activities with a variety of aims. To say that science is "practical inquiry" is not to downplay its theoretical nature, but to emphasize its relationship to practices. The good sense behind claims of "purity" has less to do with the unpractical nature of scientific inquiry as it does the *systematic* ambitions of the activities of prediction, explanation, and control that play such important roles in science. Basic technology is happy to develop in an ad hoc or organic fashion, and the long history of technology in many areas (for example, agricultural technology prior to the

late nineteenth century) largely consists of such unsystematic inquiry and development. But scientific agronomy, agrotechnology, and agricultural engineering seek to systematically understand and control farming. They are not therefore more "pure" or less practical; they are no less directed at so-called non-epistemic goals. The same goes for particle physics; though more distant from directly "useful" applications than agronomy, it is nevertheless practical, intervening as it does on practices that we care about, practices concerning prediction and control of basic forces and constituents of matter.

Science is not distinguished from other modes of inquiry by being practical in this sense; in this degree, all genuine inquiry is practical inquiry. Science is the necessary response to an unfortunate situation, elevated to an art: science is the art of problem solving. While elsewhere in human life, problems, and thus inquiry, are a cause of distress; a good problem is as much a matter of delight for the scientist as a good solution. This art is practical in two senses: (1) the problems that it seeks to find and solve are problems that arise in specific human practices; (2) the art is practical in that it is very useful to anticipate and resolve problems in advance to prevent them from becoming immediately threatening.

As a practical art, there is an affective-aesthetic dimension often ignored by philosophers of science, though occasionally adverted to by philosophically inclined scientists. Problems are not always obvious, especially the precise nature of the problem. Nor are problems merely intellectual; they must be genuinely perplexing in order to be serious problems, even in science. Genuine scientific problems generally begin as felt perplexities, found in part intuitively, understood intellectually only when inquiry is well under way. Throughout inquiry, feeling or a qualitative sense of the problem continues, and the successful solution is as much a culmination of feeling and aesthetic experience as any artwork.

Inquiry as Transformative

The aim and final product of inquiry is a judgment of how to proceed, how to resolve the perplexity that initiated inquiry. What does it take to resolve a practical problem? We must be able to transform the problematic practice so as to remove the perplexity, provide clarity about how to proceed, and restore a degree of order to the practice so that it may operate relatively smoothly and successfully. In the case of scientific inquiry, one frequent result is that the activities of prediction, explanation, and control are transformed in some way. This is not just a change of mind, a matter of some item of knowledge missing that has been discovered.

Of course linguistic and intellectual habits will change as a result of the transformation, but so will a variety of social interactions, technological projects, and manipulation of the actual objects the inquiry is concerned with. Prediction, explanation, and control are not, ultimately, purely intellectual activities; they essentially involve interaction with the world.

We might describe the collective of actors, activities, and objects in a practice as a *situation*, which captures the fact that the human activities involve more than just our minds, and take place on the background of a world of objects. Changing the perplexing situation is crucial to the resolution of problems. Changing our minds is only one extreme of possible changes to the situation, and not the most general case. In general, our operative ideas, our practices, and the elements of the world that contribute to that situation will all potentially be transformed by inquiry. Of course sometimes the problem is mainly in our heads, and the type of inquiry needed is primarily therapeutic (and not less genuine, necessary, or worthwhile because of it). But this is an extreme case where only one side of a relationship needs to change. Scientific inquiry addresses a discoordinated, situated practice. The resolution of the discoordination involves changing the relationship between the constituents of the practice, physical and ideal, and often transforming the constituents themselves.

Phases of Scientific Inquiry

Scientific inquiry as it is practiced is a messy, nonlinear affair, very distant from "the scientific method" (as recipe) that is taught in school. Nevertheless, there is a kernel of truth in that oversimplified, step-by-step picture of science proceeding from problem to observation, to hypothesis, to experiment, to conclusion.[13] The temporal ordering of a scientific inquiry is simpler than this, but the functional structure is much more complex. In terms of stages, the precondition of inquiry is a *perplexity*, or what we might call "an indeterminate situation," where the practices and activities in question have become disordered or incoherent, even though recognition of that may be inchoate. Recognition of a perplexity as a problem for inquiry, and the decision to treat it as such, is where *inquiry* begins. When a perplexity or indeterminate situation becomes the subject of inquiry, we call it a "problematic situation." Inquiry has a complex, iterative or recursive

13. The origins of the version taught in school are probably an oversimplication or misunderstanding of Dewey. See Blachowicz, "How Science Textbooks Treat Scientific Method."

structure of functionally differentiated phases, which concludes with an act of *judgment*, which puts a solution to the problem into place. We call the inquiry successful if practice is rendered determinate enough to proceed.

There are some important distinctions to be made between the elements of inquiry, not as a series of steps or stages, but as what we might call "moments" or "phases." These nonlinear phases are distinguished from each other not by their order in time, but by their different functional roles in a scientific inquiry. Each phase is a process or action that produces and refines the materials of inquiry—facts, data, evidence, hypotheses, models, problem statements, chains of reasoning, and so on.

The phases are as follows.[14]

Observation

Gathering data about the problematic situation in order to understand how and why it has become problematic, to discriminate between the factual and conceptual contributions to the current situation, and to determine the facts of the case, which represent what is present and fixed about the situation. These "facts" are not given states of affairs but represent decisions about how to represent the fixed features of the situation. They are open to revision through the course of the inquiry.

Problem framing

The process of creating a statement of the problem that represents what is problematic, perplexing, discoordinated, or indeterminate about the situation, in light of the facts of the case.

Suggestion

The generation of hypotheses that would solve the problem. These hypotheses represent the possible developments of the situation in directions that could overcome the perplexity or indeterminacy represented by the problem statement.

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14. The categorization of phases is an interpretive process. There are ways of drawing the distinctions with fewer or more categories, which may be better or worse for various purposes, but there are no neat cuts in human nature. I find these five to be a perspicuous picture in general.

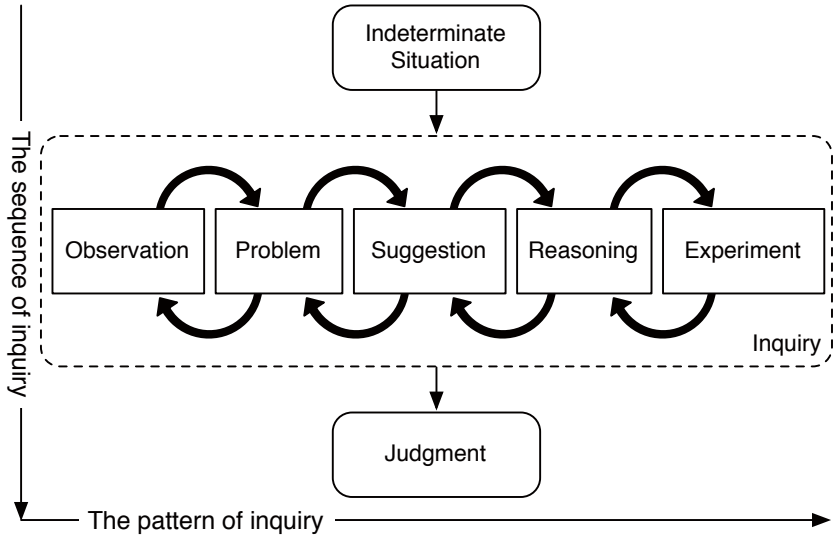

FIGURE 1.1. The Pattern of Inquiry. There are two dimensions to this account of inquiry. The first dimension shows that inquiry proceeds linearly from an initial perplexity (or indeterminate situation) to a final judgment. The second consists of the functionally defined phases. The phases of inquiry are functionally interrelated, but do not proceed in a linear fashion. The connections between the phases are simplified for presentation; in principle, they are all mutually connected.

Reasoning

The systematic refinement and coordination of the problem statement, facts, and hypotheses in order to make them function together in a way that might resolve the problem, as well as connecting them with conceptual resources that might bear on and aid the inquiry.

Experimental testing

A limited or controlled application of the hypothesis to the situation to gauge its ability to solve the problem in practice. Rather than explore the fixed features of the situation, as observation does, experiment tests whether the future developments of the situation proposed by the hypothesis are really implementable, and whether their implementation might actually resolve the problem at hand.

These phases do not proceed in a linear order. Each is iteratively refined in light of the others, until a judgment can be confidently asserted.

Judgment and the Appearance of Order

If inquiry begins in perplexity, it ends in a final judgment. *Judgment* names both the process and the product at the conclusion of inquiry. That is, when we make a final judgment, we produce something new, a judgment. Judgment is not a private mental act, but a public *assertion*. Judgment does not leave things as they were, but transforms the situation that occasioned inquiry. In the case of scientific inquiry, the judgment modifies the knowledge and the activities that had become indeterminate and perplexed, including the activities of prediction, explanation, and control, and institutes new or modified activities and knowledge.

The process of judgment is the result of the evaluation of functional fitness of the phases of inquiry in light of each other. Functional fitness means both the coherence of the activities and materials of inquiry with one another, and their fitness as a functional whole to resolve the problematic situation. Once the mutual coordination of the components of inquiry has reached the point where things are coherent enough to warrant the adoption of a solution to the problem of inquiry, or more carefully, a resolution of the perplexed and problematic situation that began the inquiry, then a judgment is rendered. The coherence in question is a pragmatic coherence, the successful working together of processes and materials of inquiry to transform the situation and practice in such a way that the problem is eliminated or ameliorated. It is functional fitness that determines the suitability of the inquiry, and not some criteria imposed outside of the problematic situation.

Scientific inquiry is generally a messy process, and the materials that inquiry works with—data sets, instruments, inscriptions, hypotheses, derivations, calculations, and so on—can be quite disorderly in the midst of inquiry. By contrast, by the point of judgment these materials are reorganized for orderly presentation. This means that data sets have been cleaned up; equipment has been (relatively) standardized; charts and graphs have been produced and made presentable; derivations, calculations, and other reasoning have been rendered into a carefully worded argument. These orderly materials are then presented (often in highly formalized and stereotyped fashion) at conferences and published in journal articles, preprint archives, and databases. This ordering serves a variety of important purposes: it makes the justification of the results easier to evaluate, and it packages data and theory in a way that makes them more portable into future research where they might serve as useful tools. A long process may then proceed from the judgment of the inquirers to the certification of their results by the relevant scientific community, and the gradual adoption thereby of new knowledge, new activities, and new modes of prediction, explanation, and control.

This ordering and packaging also involves reordering the process of science for linear presentation. This in particular has sometimes misled those who looked primarily at the published record for their understanding of scientific practice (including science educators and philosophers of science). Again, the highly stylized format in which the process of inquiry is presented in the published record serves a particular communicative and rhetorical function and is not confused by practicing scientists as a literal report of the history of the research that produced the judgment. Rather, it serves to communicate the *results* of specific aspects of the inquiry process. In particular, as inquiry moves toward judgment, experimental procedures and processes are purposefully regularized and repeated within the laboratory, and the description of "methods" often provides a (highly schematic) report of the final outcome of this process. Likewise, other parts which superficially appear to describe the research process in fact serve to explain the pragmatic coherence between the phases of inquiry. Both in reordering the materials and the process of inquiry, the ultimate aim is communication and potential use for future inquiry.

Inquiry as Situational

This image of scientific inquiry implies a strong form of contextualism. According to this contextualism, the materials of inquiry are tools evaluated for their instrumental value in resolving the perplexity that occasioned inquiry. These evaluations are tied to *specific situations* of inquiry; there is no way to guarantee, prior to further inquiry, that they will be adequate there. Of course scientists are always aiming to systematize and extend their practices, and this is one of the best ways to find new problems and occasion new inquiries. There is no algorithmic way to determine relevance of results across situations, no "shortcut" to actually engaging in scientific inquiry. We should expect and generally we find that when scientific inquiry adopts external and fixed criteria in place of the resolution of situated problems, it becomes highly dysfunctional.

This inappropriate reliance on externally set criteria seems to me to be part of what is going on in the current "crises" of replicability in a variety of sciences.[15] Each of the sciences in question depends on statistical hypothesis testing, according to which a certain kind of statistical test over the results of a randomized

15. Open Science Collaboration, "Estimating the Reproducibility of Psychological Science"; Ioannidis, "Why Most Published Research Findings Are False"; Ioannidis, "Why Most Clinical Research Is Not Useful."

controlled trial is regarded as the main criterion for a successful experiment and the main gateway to publication and all of the academic benefits that follow from that. Typically this is a so-called null hypothesis statistical test, where a statistical significance level is set ahead of time, usually as a convention of the field. This means that the scientists assume for the purposes of the analysis that there is no effect, determine how probable the results would be if that were the case, and if it meets a predetermined standard called the "significance level" (typically 5% or 1%), that is sufficient. This kind of research takes a reasonably useful statistical description of the results and turns it into the criteria of success. On the situationist approach, this is not genuine inquiry, but busywork pretending to be inquiry, and it is no surprise that crises in such science would ensue.

This situational picture also implies that the core distinctions of phases of inquiry and their materials are functional distinctions, valid within a situation. In other situations, they likely do not apply. Facts of the case in one inquiry may function as hypotheses in another, or may be rejected entirely in another. Acceptance of a hypothesis in one situation does not imply its validity in another situation. Though the diversity of situations should not be exaggerated—there is continuity between inquiries—where continuity and difference will fall cannot be assumed in advance.

This also means that there is no algorithmic way to amalgamate facts across inquiries into different problems. This raises all manner of problems for various philosophical-epistemological projects that assume, to the contrary, that we can get cross-situational generality for free. Epistemologists often speak of "all the evidence" or the "total evidence condition," the assumption being that our knowledge has to be compatible with (or stronger, confirmed by) all the evidence available at a particular time. This presumes that there are a set of things, "*the* evidence," that are evidence *in their essence* and across all contexts. To the contrary, determination of what counts as the evidence in each particular case is a highly selective and context-sensitive matter, a difficult thing to figure out. To treat everything that has ever been considered a fact in some inquiry as a constraint on *every* inquiry would stifle scientific progress completely.

Inquiry, Credibility, and Certification

Fred Grinnell's *Everyday Practice of Science*, which is also broadly speaking pragmatist in nature, draws a central distinction between *discovery* and

credibility.[16] According to Grinnell, the credibility process is the "process through which discovery claims put forth by individual researchers and research groups become transformed into the research community's credible discoveries."[17] The link between the discovery process and the credibility process is the research paper, which is the final product of the discovery process and the starting point of credibility assessment and which starts with the initial peer review of the paper, continues through the discussion and citation of the paper in the literature, and ends with the most significant and credible discoveries becoming "the textbook facts of science education."[18] Not only does credibility accrue to discovery claims, but researchers, particularly principal investigators of research groups, gain in personal credibility or "credit-ability."[19] Both the publication process and the research grant awarding process are connected with the accrual of personal credit-ability. A related account of the process of the "context of certification" is given by Philip Kitcher, focusing on the later stages of this credibility process.[20]

My account of inquiry thus far deals mostly with what Grinnell calls "discovery." Why not instead focus more on credibility? One might argue that the latter is more relevant for the questions the book ultimately poses about values in science and the responsibilities of scientists. I do believe that questions about the social structure of credibility are important to these topics, and I will discuss one example in the Conclusion. There are several reasons, however, that the topic of credibility remains on the margin, while discovery (or, I prefer to say, "inquiry") remains at the center: (1) because a discussion of credibility alone is insufficient for responsible science—an account of responsible inquiry is also needed; (2) because there are already many good accounts of the credibility process and the role of values therein in the literature;[21] and (3) because the primary focus of the book is to provide guidance to scientists in the course of inquiry and to citizens who want to evaluate specific scientific results.

16. Grinnell, *Everyday Practice of Science*.
17. Grinnell, *Everyday Practice of Science*, 64.
18. Grinnell, *Everyday Practice of Science*, 65.
19. Grinnell, *Everyday Practice of Science*, 78.
20. Kitcher, *Science in a Democratic Society*.
21. For example, Longino, *Science as Social Knowledge*.

First, it is not enough to have an adequate theory of science, much less an adequate account of the responsibilities of scientists, to focus on the large-scale social processes of scientific credibility. A significant amount of the work that goes on in science happens "in the laboratory" and "at the chalkboard," so to speak. These activities all take place in the discovery process, and what happens here is not washed out by what happens at the credibility phase. As we will see in Chapter 2, many of the contingencies faced in these processes have a central impact on the structure of scientific knowledge. Of course there is a sense in which the activities of the laboratory are social rather than individual, but this is not the sense of sociality relevant to the discovery/credibility distinction (see "A Heuristic Focus on the Individual and Small Groups," p. 17, and "The Sociality and Collectivity of Science," p. 49).

Second, while it is important to understand the larger social processes of science to understand science as such and to understand the role of values in science, accounts that center the social process of credibility or social input into the direction of science can be misleading and unhelpful for the purposes of guiding and evaluating specific scientific projects. I will make this point in detail in Chapters 3 and 6 in response particularly to the views of Helen Longino and Philip Kitcher. At the same time, once an adequate image of science at the inquiry level is established, accounts at the credibility level like Longino's or Kitcher's seem to be moving in the right direction. It is not that these accounts are no good, just that they are insufficient without an account at the inquiry level. Generally speaking, we require individual guidance for scientists and those evaluating and using science, in addition to whatever account of social structures and processes we have.

However, it is important to keep in mind that credibility and certification are crucial parts of the scientific process, even as we focus on inquiry. It keeps our attention on the fact that, as mentioned before, the product of scientific inquiry is *public judgment*, not *private belief* or mental assent. Scientists do accept certain claims, and they assert them, but these are public acts done for a purpose. Science does not traffic in mental states, but in public claims, which are initially warranted by inquiry and over time gain credibility through a public and social process like the one described by Longino[22] or Grinnell.[23]

22. Longino, *The Fate of Knowledge*.
23. Grinnell, *Everyday Practice of Science*.

ANALYSIS: DEVELOPMENTS OF AND CHALLENGES TO SCIENCE AS PRACTICAL INQUIRY

Pragmatism and Practical Inquiry

The core components of this account of inquiry can be found in Charles Saunders Peirce's series of articles, "Illustrations of the Logic of Science" (published in *Popular Science Monthly* from 1877 to 1878), and in the writings of John Dewey, particularly his *Essays in Experimental Logic* and *Logic: The Theory of Inquiry*.[24] In 1916 Dewey published his second of three major works on logic, *Essays in Experimental Logic*. The significance of the final essay in that work, "The Logic of Judgments of Practice," has often been overlooked.[25] Therein are stated Dewey's views on science as a practice, the relation of scientific inquiry and value judgment, his account of truth, and indeed Dewey's fundamental definition of his pragmatism.[26] The rhetorical structure of the chapter is somewhat difficult, beginning innocently enough by positing a form of judgment—practical judgment—that has hitherto been ignored or inadequately treated by logicians: "Propositions exist relating to agenda—to things to do or be done, judgments of a situation demanding action. There are, for example, propositions of the form: M. N. should do thus and so; it is better, wiser, more prudent, right, advisable, opportune, expedient, and so on, to act thus and so. And this is the type of judgment I denote practical."[27] As an example of practical judgment, Dewey considers the question of buying a suit. The situation calls for making a practical judgment for example, "I should buy that gray suit," or "I should buy this pinstripe suit," or "I should not buy anything today." Facts and value judgments about the different suits—for example, price, durability, style, comfort, seasonal appropriateness—play a significant role in coming to that judgment.[28]

Judgments of practice have a variety of features that Dewey enumerates

24. Peirce, "Fixation of Belief"; Peirce, "How to Make Our Ideas Clear"; Peirce, "Deduction, Induction, and Hypothesis"; Dewey, *Essays in Experimental Logic*; Dewey, *Logic*.

25. Dewey, "Logic of Judgments of Practice."

26. Elements of this section and the next were originally developed in Brown, "John Dewey's Pragmatist Alternative to the Belief-Acceptance Dichotomy"; and Brown, "The Functional Complexity of Scientific Evidence."

27. Dewey, "Logic of Judgments of Practice," 14.

28. Dewey, "Logic of Judgments of Practice," 31.

throughout the chapter.[29] They involve an open, incomplete future situation (a problematic situation, as described above); without such a situation, the judgments would be otiose. Judgments of practice modify their subject matter, because they require the subject matter be acted upon. They make a difference for better or worse by way of those modifications. Judgments of practice carry an assertion of both the rationality and acceptability of the end pursued and the possibility and efficacy of the means to reach it. They require (tentative) factual propositions that are accurate, relevant, and adequate. They propose a course of action, rather than (merely) describing a state of affairs. Judgments of practice have modal qualities referring to, for example, possibility, necessity, permissibility, futurity, betterness, and so on.

Dewey points out that judgments of practice have peculiar truth conditions: "Their truth or falsity is constituted by the issue. The determination of end-means . . . is hypothetical until the course of action indicated has been tried. The event or issue of such action is the truth or falsity of the judgment . . . In this case, at least, verification and truth completely coincide."[30] If my judgment was "I should buy *this* suit," then that judgment was *true* if doing so worked out.[31] If the consequences of that judgment are satisfying, they fulfill the needs that prompted buying the suit, they do not have unintended negative consequences, and if I do not feel regret for my decision, then it was right to say that I should buy it. What else could the truth of a judgment of practice involve? Indeed, there is a straightforward way in which the truth of the judgment is due to correspondence—the judgment corresponded with the future consequences intended by the judgment.

Here is where Dewey makes the clever rhetorical shift that has often been missed or misunderstood. Having established judgments of practice as a particular kind of judgment, with interesting features and truth conditions different from "ordinary" judgment, Dewey proposes the following hypothesis: "We may frame at least a hypothesis that all judgments of fact have reference to a determination of courses of action to be tried and to the discovery of means for their realization. In the sense already explained all propositions which state discoveries or ascertainments, all categorical propositions, would be hypothetical, and their truth would coincide with their tested consequences effected by

29. See Welchman, "Logic and Judgments of Practice," for a discussion of these features.

30. Dewey, "Logic of Judgments of Practice," 14.

31. Dewey rejects the sort of noncognitivism about practical judgment that would argue that such judgments are not candidates for truth or falsity, though admittedly the significance of this particular judgment (about suits) is minor.

intelligent action."[32] This is Dewey's definition of *pragmatism*: pragmatism is the hypothesis that all judgments are judgments of practice. What he originally forwarded as a special form of judgment (practical) with a logic different from ordinary (descriptive, theoretical) judgment, he ends up arguing that the form of practical judgment is in fact fully general, and thus that the traditional ideas about the form and logic of judgments are empty. Dewey's claim here is underappreciated, and it is a striking, clear, and compelling claim. It has far-reaching consequences for the tradition of philosophy, which has tended to neglect action, making it central to all forms of inquiry.

Based on this point, the connection to science should be clear. "To say that something is to be learned, is to be found out, is to be ascertained or proved or believed, is to say that something is to be done. Every such proposition in the concrete is a practical proposition. Every such proposition of inquiry, discovery and testing will have then the traits assigned to the class of practical propositions. They imply an incomplete situation going forward to completion, and the proposition as a specific organ of carrying on the movement."[33] Science is a type of inquiry, inquiry ends in judgment, and all judgments are judgments of practice. As Dewey puts it in one of the later sections of "The Logic of Judgments of Practice," science is a "practical art." Namely, science is the art of systematized problem solving.

From a pragmatist point of view, science is a practice, and scientific inquiry, like all inquiry, is an attempt to resolve a problematic situation. The form of the final judgment that resolves an inquiry is what Dewey has called a "judgment of practice." Like all practical judgments, scientific judgments are true or false according to their consequences. This is not the vulgar pragmatism that would measure the truth of a claim according to whether the consequences of believing it are congenial. Rather, the consequences in question are tied to the consequences *intended* by the judgment. As all judgments involve a solution to a particular problem and a transformation of a situation, then the truth of that judgment is determined by whether the transformation of the situation, carried out, resolves the problem and eliminates the specific indeterminacy in question.[34]

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32. Dewey, "Logic of Judgments of Practice," 22.

33. Dewey, "Logic of Judgments of Practice," 64.

34. Of course such resolutions are in a sense temporary; as situations change, causing new problems to arise, the matter will eventually need to be revisited. If there is any pragmatist sense to be made of William James's talk of "temporary truths" (*Pragmatism*), it must be in terms of the contextual nature of judgment in a moderately Heraclitean world.

The Phases of Inquiry in Detail

Here I describe in further detail the phases of inquiry and their interrelation.

Observation

Operations of observation must take place in order to take stock of the perplexed situation that evokes inquiry, the failures of prediction, explanation, and control that motivate the inquiry. We need to gather data on the situation that helps us begin to understand the problem at hand and the conflicting tendencies in our response to it. Prior to the discoordination that begins the inquiry, the distinction between theoretical and observational elements of description is vague. In habitual activity, we tend to run together the facts and our ideas about them, and we behave as if there is no difference between the model of a thing and the thing modeled. This is a reasonable and necessary way to go on, so long as no problems arise. But inquiry requires that we discriminate, as far as possible, (1) the factual versus conceptual contribution to the materials we have to work with, and (2) features of the subject matter in question. These constitute the relevant features of the situation which has become perplexed and are required to determine the nature of the problem and our response.

The products of observation are facts of the case, and they represented what is present and fixed in the problematic situation. They are not givens, but they are an attempt to represent the fixed conditions of the situation that must be reckoned with by inquirers. At any point during the inquiry, they are tentative, possibly incomplete, defeasible, and revisable. We can expect that, at any point in the inquiry, they might be revised.

Problem framing

The situation must be assessed in order attempt to formulate a statement of the problem that adequately captures the given perplexity, the discoordination or indeterminacy that defines the problematic situation. Scientific inquiry does not begin with a set problem or question at which science is directed. The agenda of inquiry cannot be set by fiat. Where no genuine perplexity exists, there is no room for scientific inquiry. Where it does, the problem cannot be accurately or adequately stated ahead of time; the framing of the problem is a phase of the inquiry itself, and it evolves as the inquiry is pursued, more adequate and sophisticated

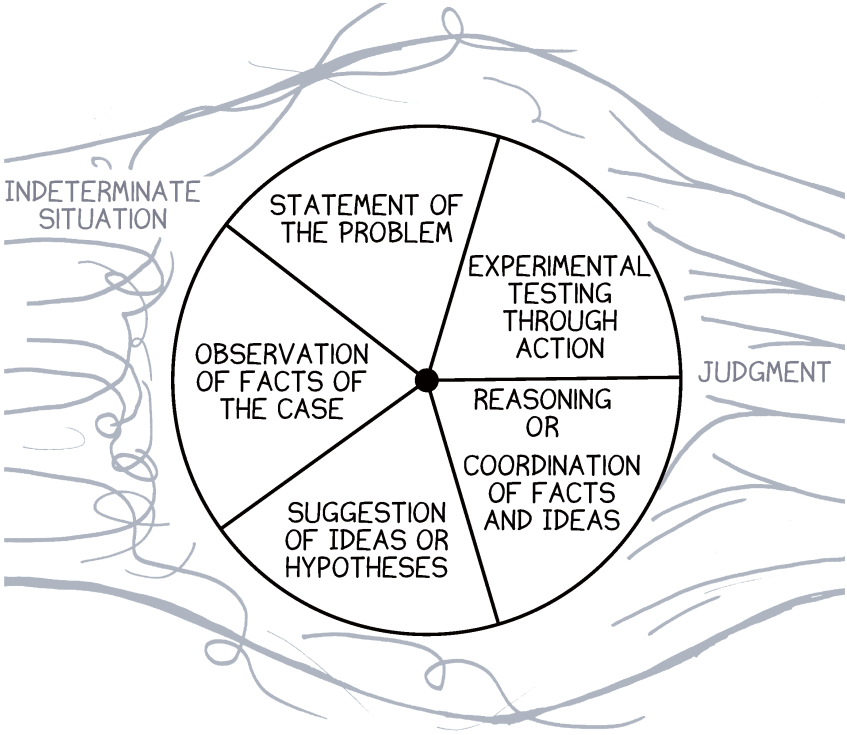

Figure 1.2. The Wheel of Inquiry. Again, the phases of inquiry do not proceed linearly, but are each interlocking parts of the whole process, which may be revisited iteratively as each phase is revisited and refined.

observations are made, and the facts of the case are made clearer. Sometimes I will call the "statement of the problem" simply "the problem" for short.

Suggestion of hypotheses

The first pass at determining the factual conditions of the situation, the conceptual possibilities in our theories, and the terms of the problem suggests hypotheses for solving the problem. Forming a problem statement and suggesting a hypothesis are coordinate activities. The former connects to the settled features of the situation in which a tension arises, while the latter connects to some possibility for further action that resolves the tension. If the factual side of inquiry represents what has been determined as a fixed feature of the problematic

situation, then the hypothetical (conceptual, theoretical) side of inquiry represents the possibilities inherent in the situation that make a resolution possible.

Systematic reasoning

Reasoning is a process of refinement and mutual coordination of the problem statement, observed facts, and hypothetical ideas produced so far by inquiry. There are several aspects of this process which depend on each other and need not proceed linearly. Background theoretical materials, well-tested models, and other conceptual resources are brought to bear on the problem at hand. None of these can be taken for granted, but all can be treated as potential tools for crafting a solution. Hypotheses are developed by processes of reasoning to be more specific and relevant to the case at hand, to be in greater concert with more general theoretical materials, to suggest further operations of observation, and to take into account the evolving body of data and statement of the problem. New observations are made in response to the evolving series of hypotheses and theoretical ideas, to answer questions posed by them and fill in information needed to specify the relevant features of the ideas. From the set of putative evidence constructed so far, certain are selected or amplified as relevant, while others are rejected as irrelevant, imprecise, poorly executed, or explained away as effects of interfering phenomena that must be controlled. The statement of the problem is refined to reflect the changing understanding of the situation and the evolving series of hypotheses.

In addition to a refined hypothesis, the process of reasoning produces a *series of deductions* that lend support to the hypothesis on the basis of broader theoretical considerations. (This process may be less than strictly deductive, and may start with less than first principles.)

The facts of the case and experimental results are refined into *data sets*, *models of data*, and a body of evidence that support the hypothesis.

Experimental testing

A series of controlled, limited, or tentative experimental applications of the hypotheses are made in order to evaluate their probable efficacy in solving the problem. Earlier experiments can suggest more refined experiments, or the necessity of further articulating data and hypothesis, or the need to "go back to the drawing board." Experimental tests are importantly different from observations.

While the evolving hypothesis may guide observation to gather more data for further specifying the nature of the problem and the conditions that need to be dealt with, experimentation puts the hypothesis to the test as a tentative problem solution. For instance, if the hypothesis involves a new technique for making predictions, experiment tests out that technique across a range of circumstances.

The body of experimental results produced is most relevant to warranting the results of inquiry.

This "pattern" represents one way of dividing up the phases of a well-conducted inquiry. As such, it represents an ideal image of the process of inquiry. Each element feeds into and depends on the others.

One of the trickiest aspects of this description of the phases of inquiry is the distinction drawn between *observation* and *experimental testing*. It is, however, crucial to the pragmatic theory of inquiry as opposed to traditional ways of thinking about the relationship of evidence and hypothesis/theory, so it deserves further explanation. The key is to understand that the two processes serve different functions with respect to the problematic situation and its resolution. They produce two different, though related, types of evidence. The goal of observation is to better understand that part of the situation that is fixed, or can be taken as fixed for the purposes of the inquiry. "Fixed" here does not mean static as opposed to dynamic, but settled as opposed to changeable. The goal of experimentation, on the other hand, concerns precisely what is *not* fixed; it is a testing out of potential interventions to resolve the problematic aspect of the situation.

Part of the awkwardness of expression here is a result of the pragmatist attempt to understand how inquiry works without presuming, from the get-go, the dichotomies of mind/world, conceptual/real, subjective/objective, et cetera. We retain the idea that the facts capture what is fixed, without the metaphysical add-ons that they are fixed because they are objective features of the real world, as opposed to changeable features of our minds. In addition, inquiry in fact will typically involve interventions in the "real world," not just a change of ideas.

Experimentation in the sense here described need not mean controlled, laboratory experimentation. The key feature is intervention on the basis of the hypothesis, as an application of the hypothesis prior to full implementation. Observation, on the other hand, might be a highly controlled process in a laboratory, even one that involves careful manipulation, but it serves a different *purpose* in inquiry than experimentation, that of attempting to represent (in an increasingly careful way) the fixed features of the situation that inquirers must deal with.

Observation of facts is functional for the definition of a problem. Experimentation is functional for testing potential solutions to the problem. Observation is often guided by a hypothesis but does not yet seek to test it.

A variety of cases of what we might call "degenerate experiments" can still play the functional role of experimental testing. For instance, *natural experiments* involve no active interventions on the part of the inquirer but consist of naturally occurring phenomena that can suitably play the role of experimental testing because they are constituted *as if* someone had set them up to test the hypothesis. *Novel observations* similarly do not involve intervening on the system itself, but they do involve changing our activities in certain ways, guided by the hypothesis—whether that means designing a new instrument or merely pointing a telescope in a certain place at a certain time—and observing results unexpected but for the hypothesis. *Thought experiments* and *simulations* push the boundaries of what can reasonably be called an experiment, as the influence of the world upon them is only through the experience of the experimenter or what they program into the simulation. Nevertheless, in certain limited cases these play the role of experimental tests as well. We might be tempted to say that degenerate experiments are not as good as "real" experiments, but we should evaluate their suitability in a situationally specific way (see "Inquiry as Situational," p. 37). Given the needs of and values relevant to a specific problematic situation, natural experiments or simulations, for example, might be the best way to test our hypothesis.

It is worth highlighting that the observational evidence or facts of the case and the experimental results represent two very different (functional) types of evidence. Facts play a complex set of roles related to observation, problem framing, suggestion, and reasoning. They define fixed features of the problematic situation, which helps to define the problem as well as to suggest hypotheses for its resolution. Through reasoning, more refined observations and statements of the facts are made, guided by the hypothesis, and in turn are used to revise the hypothesis. This reasoning process also suggests what form experimental tests will take. Experimental results arise from tentative, limited application of the hypothesis to the situation, guiding the decision to proceed to a final judgment or to further observation, a problem statement, and suggestion of new or revised hypotheses.

The distinction here may seem too idiosyncratic, as it cuts against certain elements of scientific practice as well as the vocabulary most often employed in the philosophy of scientific practice. But it marks an important functional

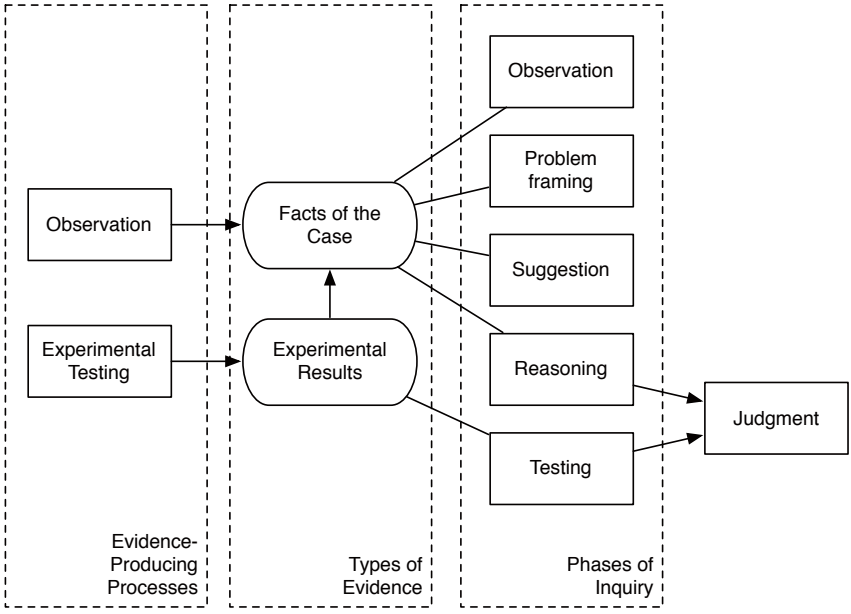

Figure 1.3. The functional roles of two types of evidence.

distinction between two phases of inquiry and two resulting products that is often obscured by our current ways of speaking about these things. It is not surprising that we should have to be a bit revisionary as we try to distinguish between functional definitions and ones that treat superficial features as essential, given how commonly the two elements are confused. Using the terms in this way captures one common use of the distinction between observing and experimenting. If someone else wants to draw the distinction using different terms, the disagreement is merely terminological.

The Sociality and Collectivity of Science

The account of inquiry I've mentioned here doesn't emphasize the social nature of science (see "Inquiry, Credibility, and Certification," p. 38). I have briefly discussed the central importance of the credibility and certification processes to the way that science works, and particularly in the way that some scientific results become public knowledge and have an influence over practices like education and public policy. Nevertheless I have dwelled primarily on particular inquiries,

rather than these larger social processes; throughout the rest of the book, I will mostly focus on responsibilities and values in the process of inquiry, which is largely the sphere of individuals and small groups of researchers. As I said in the Introduction, I think this is the area that needs a lot of attention, where scientists and the public need significant guidance. Focusing on larger social processes is not enough, but it has received a lot of attention in discussion of values in science. There are many decisions that are made in the course of inquiry that influence the results that are published, but that themselves are not made explicit in the published literature, and so are not open to inspection, criticism, and evaluation in the social process of credibility assessment.

There are a few ideas about the social side of science that can flesh out the pictures of inquiry and credibility that I have mentioned previously. This involves making a distinction between two distinct meanings of the claim "science is social," and it requires relying on the basic outlines of distributed cognition theory.[35] In terms of the former, the claim that science is social can mean two different things, which can be conflated but that I think is useful to distinguish. The first is a claim that science is a collective social process, engaged in by groups of scientists rather than individuals working in isolation. I will call this "collectivity" and translate the associated claim as "science is a collective enterprise." The second possible meaning of "science is social" is the claim that science is highly dependent on or connected to the surrounding society and culture in which it takes place. I will call this "sociality" and translate the associated claim as "science is socially situated."

In a sense the seemingly individualistic perspective I have adopted here can also account for the role of value judgment in collective scientific processes, thanks to the resources provided by distributed cognition theory (d-cog). Both the teamwork of the research group in a science laboratory, which I will refer to as "primary collectivity," and the larger-scale collective process of the field or discipline engaging in credibility assessment, which I will call "secondary collectivity," involve groups of people working together in a shared cognitive task (problem-solving inquiry or assessing credibility). D-cog allows us to analyze

35. Hutchins, "Social Organization of Distributed Cognition," 283–307; Hutchins, *Cognition in the Wild*; Nersessian et al., "Research Laboratories as Evolving Distributed Cognitive Systems"; Giere, "Scientific Cognition as Distributed Cognition," 285–99; Giere and Moffatt, "Distributed Cognition"; Magnus, "Distributed Cognition and the Task of Science"; Brown, "Science as Socially Distributed Cognition."

Table 1.1. Different ways that "science is social."

COLLECTIVITY	SOCIALITY
Primary	Upstream
Secondary	Midstream
	Downstream

the cognitive activity of that group analogously to the way we would analyze the activity of an individual agent. Whether the decision making (and the value judgments) are the work of an individual or, more likely, a small group, the basic nature of the task remains the same, at a certain level of abstraction. Likewise, I would argue, the responsibilities of the collective remain analogous to those of the individuals. D-cog allows us to abstract away from the details of the implementation in some respects.[36] Of course in other ways the implementation details matter enormously. For instance, organizations have incentive structures that have enormous impact on how individuals behave, including the value judgments they make. Those kinds of issues, despite their importance, are not directly addressed here.[37] But the *organization itself*, as an agent, has the same sort of responsibility to use well-founded value judgments, in appropriate ways, as I will argue the individual does later in this book.

On the side of sociality, I will use "upstream sociality" to refer to the connections to a particular society that inform the sociocultural background of individual scientists. Upstream sociality tends to be important in terms of the cultural values and vocational goals that the particular scientist brings to scientific practice. Insofar as certain social-institutional arrangements are also relatively fixed in the past from the point of view of a particular inquiry, we can regard those arrangements as part of the upstream sociality of science as well. I will use "downstream sociality" to refer to the interactions between science and society that come as a result of scientific inquiry around the moments of certification of

36. To be a little more precise, d-cog treats all cognitive processes as the use and transformation of representations across representational media, and so treating groups as cognitive processes is not an analogy, but a literal case of cognition, even a paradigmatic one.

37. One valuable approach might be Justin Biddle's "nonideal systems design"; Biddle, "Can Patents Prohibit Research?"

knowledge, dissemination, and application. Some have also argued that there is significant, or their ought to be greater, interaction between science and society during the inquiry process, what I will call "midstream sociality." There is already significant midstream sociality in the form of institutional review boards (IRBs) and institutional animal care and use committees (IACUCs), at least when these are constituted properly to involve nonscientists and community members, as well as in so-called citizen science initiatives. Finally, despite the terminology of *upstream*, *midstream*, and *downstream*, these should not be understood as merely linear stages; the relationships they involve may happen on much more complicated timelines and may interact with each other.

Radical Pluralism

Some may balk at the one-size-fits-all picture of science I have provided. After all, didn't Kuhn show us that different scientific paradigms function in different, incomparable ways?[38] Didn't Feyerabend show us that there is no single "scientific method" guiding all scientific inquiries, but rather a variety of different local practices?[39] Modern-day pluralists as well have shown us that different approaches, different styles of reasoning, disagreements about theory and concepts, and many other kinds of plurality and disunity are rampant in the sciences.[40] In the face of that, my picture of *the method* of scientific inquiry, despite all of the situational, practice-oriented aspects of the account, may strike you as too naive.

Diversity, dissent, and disunity are real and crucial aspects of science. Nevertheless there is something valuable about insisting on a core image of inquiry. The account I have given is quite schematic; there may be a great diversity of ways to satisfy the functional roles connected with the five phases of inquiry between different fields, time periods, and groups. Many different local techniques and methodologies might be used in observation and experimentation; hypotheses may take the form of causal claims, models, mathematical equations, or narratives, and they may be more or less tightly connected with background theories of various sorts. This account of inquiry doesn't require the kind of substantive assumptions about methods or theories that are worrisome from the pluralist standpoint.

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38. Kuhn, *Structure of Scientific Revolutions*.

39. Feyerabend, *Against Method*.

40. Dupré, *Disorder of Things*; Galison and Stump, "Disunity of Science"; Kellert, Longino, and Waters, *Scientific Pluralism*; Chang, *Is Water H_2O?*

The Large-Scale Dynamics of Theory Change

Thomas Kuhn, Imre Lakatos, Paul Feyerabend, Larry Laudan, and others are well known for their dynamic accounts of science. They differ from the account of inquiry that I've provided in virtue of their scale and scope. These sorts of accounts of science focus on the largest scale of scientific disciplines, the most central or fundamental theories shared by a large number of scientists, and the dynamics at such a scale. They tend to elide the processes of inquiry and credibility. That is, large-scale accounts of the dynamics of theory change do discuss particularly central experiments, conceptual innovations, and arguments in science, but only in the context of their influence over the large-scale social processes within the field. This is not a strike against such images of science; for the most part these accounts have different scale and purpose from the one we're currently considering.

The Autonomy of Experiment

An important turn in philosophy of science, sometimes called "the new experimentalism," can be summed up by Ian Hacking's memorable phrase, "Experimentation has a life of its own."[41] The philosophers of science in this tradition insist on the autonomy of experiment from its role in hypothesis and theory testing that had been assigned to it by most philosophers of science. They point to a variety of experimental practices with purposes independent of the testing of theory. This seems to pull against the role for experimental testing identified in my account of inquiry. Have I neglected their lessons? How can I reckon with the new experimentalists' insistence on the autonomy of experiment?

The disagreement is partly verbal. The new experimentalists call any controlled manipulation in the lab (and other kinds of controlled intervention processes, perhaps) an "experiment." This fits just fine with the usage of the term within science. But this account of experiment is *essentialist* rather than *functionalist*, that is, it regards some activity or happening as an experiment in virtue of inherent features of the activity (such as taking place in a laboratory, being controlled, or being a manipulation/intervention). On the other hand, the phase of inquiry that I have called "experimental testing" has a mainly functional

41. Hacking, *Representing and Intervening*.

definition: it is focused on the tentative application of the hypothesis as problem solution. While I agree with the new experimentalists to a point, that *usually* and *ideally* this role will be filled by an actual manipulation or intervention, my above discussion of "degenerate" experiments shows the functional nature of this distinction.

What the new experimentalists mean by *experiment* serves several distinct functions in scientific practice: the problem-finding attempts to push the limits of prediction, explanation, and control that precede inquiry proper, the phase of inquiry I've called "observation," and experimental testing as such. These stages have been discussed in detail above. We might add training and education to this list, as well as testing and calibration of equipment. While for some purposes linking them all together under the heading of "experimentation" may usefully distinguish them from other kinds of activities, for the purposes of distinguishing different aspects of inquiry, or the problem-finding activity that often precedes scientific inquiry, it is important to keep them distinct. I know of no better name for the third role than *experimental testing*, which is why I reserve that name for that role. The key, for me, is accurately distinguishing the different functions within inquiry, not legislating terminology.

The last potential substantive argument with the new experimentalists may be the centrality of hypotheses and theories in inquiry. I concede to the experimentalists that much of scientific inquiry does *not* involve the testing of major or fundamental theories. However, I insist that guiding hypotheses are central to problem-solving inquiry. Without a guiding hypothesis, the experimentalist is merely noodling around in the lab. There is no hypothesis (that is, problem solution) because there is no genuine problem (yet). The new experimentalist argument should rather be taken as a reminder that we should be open-minded about the kind of hypotheses that play a role in different kinds of scientific inquiries.

Reflexivity of This Philosophy of Science

The model of inquiry I have described in this chapter is a hypothesis, in the sense of the model itself. This hypothesis is meant to contribute to the resolution of the perplexities denoted and characterized in the Introduction: namely, how we should understand the nature of science such that the various interactions of science and values can be reckoned with, and adequate guidance be provided

to scientists so that they can be responsible in the face of those interactions, as well as guidance for the rest of us in evaluating the way that scientists discharge those responsibilities.

The model of inquiry provided here, like many background theoretical resources in other inquiries, was developed for other purposes and builds upon a prior tradition of inquiry. As mentioned above, the original thinking behind this image of science derives from the ideas of Peirce and Dewey. In prior publications I have developed their work further in order to address contemporary concerns about the nature of evidence, the use of models in science, and the evaluation of the significance of various scientific research projects.[42] These prior uses lend only tentative plausibility to the use of the model for new purposes. In the context of this book the model of inquiry is justified not only or primarily by the facts of the case (facts about prior inquiries, successful and unsuccessful) or systematic reasoning about the nature of science or knowledge, but first and foremost by its ability to resolve the perplexities of values in science. This does not need to be the best account of inquiry for other, arbitrary purposes, though such systematicity has its value.

Moreover, this account of inquiry is fallible and revisable. Though I have based this work on the ideas of competent scientists and philosophers of science whose aims are in some ways close to mine, as well as on my own experiences in science and knowledge of a wide variety of cases in the history, sociology, and philosophy of science, I have far from a synoptic view of the workings of science. The model is itself normative, stating in certain ways an ideal of scientific practice, but (as we shall see later on) this is no barrier to its revisability in the face of new evidence. Though normative, it seems to encode norms discovered in the course of a long history of scientific practice, though these lessons are not always uniformly appreciated by the practitioners. (Culture is difficult to see from the inside.) The failure of this model of inquiry to function as the background of an adequate account of science and values, as well as strong evidence against the applicability of the model to a variety of scientific inquiries, would both speak heavily in need of its revision.

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42. Brown, "Science and Experience"; Brown, "Models and Perspectives on Stage"; Brown, "Genuine Problems and the Significance of Science"; Brown, "John Dewey's Pragmatist Alternative to the Belief-Acceptance Dichotomy."

NEXT STEPS: VALUES IN SCIENTIFIC INQUIRY

The account of scientific inquiry I have provided in this chapter may seem fairly independent of the kinds of questions about values in science that have motivated philosophers of science to explore the issue in recent decades. It may strike you as a strange place to start. The reason I have started here is that so much confusion in philosophy of science arises from taking for granted certain fundamental ideas about the nature of inquiry, but these so often begin from a narrow image of science whose emphasis is ill-suited to the problem at hand. Science as practical inquiry is an inclusive image that allows us to understand the nuances of scientific practice and the role of values in science.

In the next chapter I turn to attempting to refine the perplexities of the relation of values and science identified here into a clear statement of the problem. That is, I provide a general argument that science cannot and should not be value-free, and that scientists have a responsibility to weigh values in making scientific judgments.

CHAPTER 2

THE NEED FOR VALUES IN SCIENCE

The Contingency Argument

> Since choices exist throughout the process of experimentation, there is no research core which, even in principle, is left unaffected by the circumstances of production.
>
> —**Karin Knorr-Cetina**, *The Manufacture of Knowledge*

> In the doing of science, whether for use or for pure curiosity, scientists must make choices. . . . It is precisely in these choices that values, both epistemic and, more controversially, nonepistemic, play a crucial role.
>
> —**Heather Douglas**, "**Rejecting the Ideal of Value-Free Science**"

INTRODUCTION: THE UBIQUITY OF CONTINGENCY AND CHOICE IN SCIENCE

Scientists are constantly faced with decisions in the course of their practice, unforced choices about how to proceed. What should I investigate? How should I do it? What methods to use, what data to collect, what hypotheses to test? For many such questions there are multiple options, and no factor decisively settles the matter from the perspective of the scientific inquirer at the moment the choice is

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Epigraphs: Knorr-Cetina, *Manufacture of Knowledge*, 40; Douglas, "Rejecting the Ideal of Value-Free Science," 122–23.

made. When we are dealing with science, it is natural to think of the things that can force the decision in terms of "epistemic factors," that is, evidence, logic, and standards for what constitutes a good theory, method, or high-quality evidence as such. Epistemic factors alone fail to fully determine many of the choices that scientists make.

Other moments in the scientific process do not consist of explicit choices, but they are nonetheless contingent moments—there is more than one way inquirers could reasonably go. Many of the race scientists mentioned in the Introduction likely never questioned the assumptions about racial hierarchy imported from society; nevertheless, they reasonably *could have* questioned them. In fact, they *should have* questioned them, and so the continuation of these racist assumptions is contingent. From an epistemic point of view, reasonable inquirers could have gone a different way. These too can be thought of as choices potentially, or in principle, or normatively speaking. All genuine, actual choices are contingencies, but all contingencies are potentially choices, even if in practice they are or must be settled by community-wide conventions.

Using the account of scientific inquiry developed in the previous chapter, we can delineate more clearly the kinds of choices scientists face in terms of the decision points that arise in each phase of scientific inquiry:

Problem selection and framing

What perplexities are worth inquiring into in the first place? For example, should I study treatments for infectious diseases plaguing sub-Saharan Africa or treatments for erectile dysfunction?

How should we identify and frame the problem of inquiry? For example, are we studying the link between *race* and *intelligence*, or are we studying the influence of the complex of socioeconomic, cultural, institutional, and political factors contingently associated with race on educational outcomes?

Suggestion of hypotheses and concepts

What concepts and categories should our analysis rely on? For example, should our study use *sex* or *gender*? Should our categories be binary, more than binary, or open-ended?

What hypothesis should we pose for solving the problem? For example, should we

hypothesize that primate groups are structured by male-dominance relations, or by more complex relationships involving males *and* females?

Observation

How should we gather data? Using what methods? For example, should we use animal models or human subjects? Should we do laboratory studies or field studies?

How should we characterize the data? For example, does this sample contain a tumor or not? Should we model the data linearly?

Reasoning

How should we connect this question to larger theories and conceptual frameworks? Do we need to supplement the experimental results with an account of the underlying mechanism?

Experiment and testing

What is the bearing of this evidence on the hypothesis? How strongly does the evidence support/challenge the hypothesis? Is the evidence sufficient to accept or reject the hypothesis? Should we use significance testing or Bayesian methods? Should we aim for a p-value of 5 percent or 1 percent? How certain are we in our assignment of evidential weights or probabilities to the hypothesis?

Many of the choices so delineated are unforced. While there may be various epistemic factors in favor of one way or the other of making a choice, at least at the point the decision is originally made in inquiry, there is often no all-things-considered best option, based on epistemic factors alone.

A potential problem with this way of talking about contingency and choice in science is that it does not always accurately reflect the lived experience of scientists; scientists do not always experience contingencies as decision points. Rather, they experience themselves as doing things the natural or usual way, as following external constraints, or searching for the right way to do things. Erik Fisher and his collaborators, in their Socio-Technical Integration Research (STIR) program, have found that researchers do not always see themselves as decision makers. However, through repeated engagements about what the

researchers are doing, why, and what their options are, they have shown that scientists can learn to recognize the often implicit decision points in their research, to see themselves as choice makers, and to reflect on the consequences and stakeholder interests that might be at play in those decisions.[1] Even when they do explicitly make choices in the process of inquiry, they often do not report them *as* choices, merely describing what they actually did without acknowledging alternative options.[2]

It is through contingency and actual or possible choices about them that the social and ethical responsibilities of scientists come to the fore. Scientists share the same responsibilities we all have to consider the implications and consequences of the choices that we make, who might be affected and how.[3] When our actions and decisions affect other people, their welfare, rights, or interests, or if they affect things of value, we have a responsibility to exercise a certain amount of care and good judgment when making those decisions or taking those actions. If we make a choice, we have a certain degree of responsibility for that choice.[4] The responsible thing to do is to carefully consider our decision and make our best judgment about the best course of action—this is a value judgment. It is here that the need for value judgments in the scientific process arises. Value judgments play a crucial role in settling contingencies in science, where the upshot of how the contingencies are settled is significant. Informally, this is *the contingency argument* that I will describe in more detail shortly.

This claim, that scientists need to make value judgments, that values are a part of the scientific process, might strike you as powerfully counterintuitive. Does science not seek to go beyond subjective opinion, to seek an objective, evidence-based understanding of the world, perhaps even, if we're lucky, getting us closer to the truth? Should we not, then, try our best to keep human values out of the equation? If you share these concerns, you are in good company. Philosophers of science and scientists over the past century at least have worried about

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1. Fisher and Schuurbiers, "Socio-Technical Integration Research," 97–110.

2. Douglas, "Rejecting the Ideal of Value-Free Science," 123.

3. Scientists have special responsibilities as scientists to their colleagues, their students, their research subjects, and to the facts. None of these responsibilities that are special to their role as scientists interferes with their general responsibility to consider the consequences of their decision making. Douglas, *Science, Policy, and the Value-Free Ideal.*

4. Some of the things that affect that degree of responsibility of a choice include whether the consequences are foreseeable, whether the implications are scrutable, and how free one is to actually make a choice.

the influence of values over science as a destructive, biasing factor. Many have sought to defend the "ideal of value-free science," according to which scientists ought to strive to eliminate the influence of values over science. Of course, scientists are human, and thus imperfect, but the scientific process includes checks and balances that limit the impact of their biases.

These concerns, while understandable, are ultimately mistaken. For one, they are based on a misunderstanding of the nature of values and value judgment, though I will save that argument for the following three chapters. For another, the need for value judgment is an inescapable feature of the scientific process, as this chapter will demonstrate. The burden of the rest of the book is to elaborate a new ideal of values in science according to which the pervasive influence of values on science is neither destructive nor biasing but a positive influence.

ARGUMENT: THE ROLE OF VALUE JUDGMENTS IN SCIENCE

In recent years the view of philosophers of science working on these problems has shifted against the value-free ideal in favor of the view that science must incorporate values and value judgments. These arguments have by and large left our understanding of values (at least, non-epistemic values) unchanged. In this section, after briefly reviewing the value-free ideal, I distill the core of the strongest arguments against the value-free ideal into what I will call "the contingency argument." I then defend the contingency argument against a host of motivations for thinking that science is or ought to strive to be value-free. In the following section, I compare the contingency argument to other arguments for values in science in the literature.

The Value-Free Ideal

While aspects of the notion that science should be value-free are older,[5] the current formulation of the value-free ideal for science can be traced to two distinctions made in the middle of the twentieth century. The first is between the so-called "logic of discovery" or "context of discovery" and "logic" or "context of justification." Everything involved with the messy, human processes by which inquiry actually proceeds was lumped with the former. The logic of justification, by contrast, concerned only the relations between the evidence and the theories

5. Proctor, *Value-Free Science?*

that inquiry produced, which it was thought could be evaluated independent of that messy process. In other words, it concerned only the moment of inference. It was thought that values were inevitable in discovery, but that values would play a corrupting role in inference.[6]

The second key distinction is between everyday sorts of values (social, ethical, political, religious, etc.) and so-called epistemic values. These are epistemic factors that are important standards for evaluating scientific theories, such as simplicity, precision, or fruitfulness for future research, or to evaluating the fit of theory and evidence, such as accuracy and scope.[7] They are understood as values because they are not explicit rules or criteria, but standards that are applied somewhat more loosely, requiring evaluation and judgment calls, weighted differently by different scientists. Within the context of justification, it was thought that these epistemic values would be fine, while the rest, non-epistemic values, would be corrupting. Since what we've called the "value-free ideal" really says that only epistemic values are allowed in the context of justification, we might instead want to call this "the ideal of epistemic purity."[8] I will, however, stick with the conventional phrase.

What motivates the idea that so-called non-epistemic values, those things that we typically call values, have a corrupting influence on science, and thus that science in the ideal should be value-free? I think there are two background assumptions here. The first is the stereotype that science is true, certain, reliable, unequivocal, or decisive knowledge. Beyond that stereotype is the idea that science should not *be* contingent; where science is uncertain, it should withhold judgment or state probabilities, rather than pick sides. Where there are multiple options, it should follow all or none. But very little of science is or could be like that. Contingency is endemic and unavoidable in science, as I will argue below. The other assumption is that values are themselves subjective, necessarily a matter of personal preferences, that is, biases. Their influence in science, therefore, can lead only to wishful thinking. But again, we cannot avoid values in science, and more importantly, we *should not* avoid them. In later chapters, I will argue that the basic assumption that values are subjective in this sense is a mistake.

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6. Douglas, *Science, Policy, and the Value-Free Ideal*, chap. 3; Douglas, "Values in Science."
7. Kuhn, "Objectivity, Value Judgment, and Theory Choice," 320–39; McMullin, "Values in Science," 3–28; Douglas, "Value of Cognitive Values."
8. Biddle, "State of the Field."

The Contingency Argument

The argument I will articulate for the pervasive value-ladenness of science is the contingency argument. This is a normative argument against the ideal of value-free science; the value-free ideal is shown not merely to be untenable in practice, because, for example, humans are limited and unable to completely avoid biased or motivated thinking. Rather, it is shown to be unworthy and undesirable as an ideal in principle. Values are pervasive, unavoidable, and necessary in science. Value-free science is not even desirable, if this argument is right.

The contingency argument synthesizes decades of work on science and values, including various arguments that have been made since at least the 1940s for the necessity of values in science.[9] This argument emphasizes the role of contingent moments in science, conceived as potential decision points. That is, it focuses on the many points in scientific inquiry where scientists have many reasonable options, and the consequences of choosing among those options. The steps of the argument are as follows:

1. Scientific inquiry has many contingent moments, with reasonable alternative possible options.
2. Each contingent moment is a decision point; that is, it is potentially an unforced choice.
3. The different options in these contingent moments may have implications and consequences for things that we care about, including ethical and social, as well as political, cognitive, and aesthetic values.
4. Value judgments should be part of making choices that may have ethical and social implications and consequences.
5. Thus, value judgments should be made to settle scientific contingencies; that is, scientists have a responsibility to make value judgments where there are scientific contingencies.

The ubiquity of contingencies in science tells us there are, in principle, decisions to be made. In general there is the possibility that the contingent options will differentially impact things we value through the implications of those options or their consequences. How inquirers choose to settle those contingencies thus

9. These arguments will be discussed in detail below in "Analysis: Comparison with Other Arguments for Values in Science," p. 78.

implicates values. Whether or not a scientific contingency in fact has implications and consequences for our values is not, in general, something we can know ahead of time, based on the form of the question or problem at hand. Part of value judgment is determining whether and which values are relevant to a particular decision. There is a general moral responsibility to consider the ethical and social implications and consequences of our decisions, if they can be foreseen. If what you are doing affects other people or what they care about, you ought to take that into consideration. Therefore scientists have a responsibility to make value judgments about scientific contingencies, and everywhere science is genuinely contingent, it is in a sense value-laden.

As described above ("Introduction: The Ubiquity of Contingency and Choice in Science," p. 57), contingencies are any moves or moments in inquiry that are genuinely open, where reasonable inquirers could disagree about the way to proceed. While there may be various considerations that bear for and against the options, there is no epistemic factor available to the inquirer at the time the choice must be made that decisively settles the question. Of course in practice they are settled, and often without any consideration or realization that they are open. They may be settled by habit, by widely adopted conventions of the scientific community, or by scientists immediately latching onto the first option that occurs to them.

Yet every genuine contingency is in principle a decision point in that it *could* potentially be taken up as an explicit decision, whether that decision would have to be made by individuals, groups, or the entire scientific community. Though it may be conventional practice in the lab to use one measurement technique, if there are other reasonable techniques that could legitimately be used, the use of the one technique is in a certain sense a choice, even if it is not explicit, even if it is not optional for an individual given their institutional context.[10] Insofar as values are relevant to the contingency, and affected differently by the different options in a foreseeable way, that contingency is (normatively speaking) *value-laden*, even if no explicit consideration of values was made in settling the contingency, even if there was no explicit decision at all.[11] Scientists should be more sensitive than they are to these contingencies and the options that exist for their practices,

10. This does not make the notion of individual choice prior to the notion of contingency. Rather, it helps to illuminate the normative relation between contingencies in human practices and value judgment. The importance of recognizing that these claims are normative ones is made clear by Steel, "Climate Change and Second-Order Uncertainty."

11. Again, see Steel, "Climate Change and Second-Order Uncertainty."

seeing them where possible as decision points; this sensitivity should be a central aspect of training in "research ethics" or "responsible conduct of research" (see the Conclusion).

Once these decision points are recognized, it follows from our ordinary responsibilities to consider the implications and consequences of our actions and decisions that scientists must make value judgments in the course of scientific inquiry.[12] Nothing about the practice of science or the profession of scientist absolves or screens the scientist from these ordinary responsibilities.

Practical Reasons and the Activities of Inquiry

According to the image of science described in the previous chapter, the practice of science consists first and foremost of problem-solving inquiry. The distinctive value of science is twofold: first, its tools and techniques, empirical and conceptual, are particularly adept at resolving problems and inadequacies that arise in our store of knowledge and our attempts to predict, explain, and control the world around us; second, science helps us anticipate such problems and inadequacies through its attempt at systematicity. Though science also involves more foundational or synoptic aspects—such as the attempt to provide a theory-of-everything or to outline a complete scientific worldview—those are relatively peripheral aspects of scientific practice, dependent on the success of the central practices of pragmatic, problem-solving inquiry.

The practice of scientific inquiry, as a practice, consists of distinctive types of actions, for example, the action of choosing concepts, of proposing hypotheses, of collecting evidence, of accepting, rejecting, inferring, asserting, or endorsing hypotheses. The decision points in each of these activities are decisions about how to act. As such, these decisions require *practical reasons*—and practical reasons are typically values. But note that what many philosophers of science call "epistemic values" are not action-motivating reasons in this sense. They record features of theories, evidence, or theory-evidence relations, but they do not by themselves motivate action, even the action of making claims or assertions. The kinds of values we need are reasons for action, not just reasons for claims.

If I pursue a certain hypothesis, I need to know not only the epistemic virtues

12. One of the important virtues of Heather Douglas's work on values in science is that she frequently emphasizes that much of the role that values play in science flows from the ordinary responsibilities of scientists as people, not from their special duties as scientists.

of the hypothesis, or the information that makes it plausible, but a reason or motivation to do so—perhaps I think that the hypothesis, if true, will help some good to be achieved; perhaps I deem it most likely to find support, and I have reason to play it safe in hopes of getting results for sure; perhaps it occurred to me first, and I feel any hypothesis will do. Or, if I am trying to decide whether to publish my results, the fact that the hypothesis has a certain amount of strength of evidence in its favor does not, by itself, compel me to assert it, *no matter how strong the evidence*. I need a further reason to take the affirmative step of asserting it, whether that be an ethical value, or the desire for credit, or mere whimsy.[13] Strength of evidence, by itself, is not the right kind of reason to motivate a public action like assertion or publication. As discussed in Chapter 1, to accept or assert a scientific claim, or to make a scientific judgment, is always done *for a purpose*, in a particular problematic situation. It is a public act, not a private, mental response.

The contingency argument moves from the potential impact of decisions made in science to the need for careful value judgment. We have responsibilities

13. Consider the broadly Aristotelian objection pointed out to me by Dan Hicks. Suppose one needs to choose a knife to chop onions. When assessing a knife, among the properties one might consider is its sharpness. A sharp knife performs its function better than a dull knife. That a particular knife is sharp, then, ought to count as a practical reason in favor of choosing it; it motivates the decision. Similarly, epistemic values are properties of knowledge claims that allow them to perform their function. They should thus be considered practical reasons in favor of making the knowledge claim.

Note, however, a crucial feature of the point about the knife. The argument assumes a purpose for the knife where sharpness is a virtue: chopping onions. But in other contexts, sharpness is not particularly a virtue. One does not want a knife to be sharp in certain contexts. Sharpness is unnecessary in a letter opener, and potentially hazardous. Dullness is a virtue for a knife being used in certain cosplay scenarios, where sharpened blades are not permitted. The Aristotelian must assume a canonical purpose for the knife. Likewise, the Aristotelian objection to my point about epistemic values must assume a canonical purpose for scientific inquiry, for example, to represent accurately, to predict, or to explain. The pragmatism and contextualism described in Chapter 1 assumes no such canonical purpose, and thus epistemic values, by themselves, cannot be taken as practical reasons in favor of asserting a knowledge claim. They do so only in concert with other practical reasons.

A similar point is made by Sindhuja Bhakthavatsalam and (the Aristotelian philosopher of science) Nancy Cartwright:

> If we need a theory to do a job that can be done well even by theories that are false or empirically inadequate, why restrict our choice to those that are empirically adequate? Consider an analogy. We need a knife to cut bread. Why buy a multitasking Swiss Army knife that is not only more expensive than a bread knife but also cuts bread considerably less well? Similarly, when we want a theory that's simple but need not be true to do a job in view, why take on the dual burden of finding a theory that is both empirically adequate and simple? (Bhakthavatsalam and Cartwright, "What's So Special about Empirical Adequacy?," 448)

because our choices have implications and consequences for things we care about, and so we must choose carefully. But recognizing empirical science as a form of practice, of practical inquiry, provides a complementary argument that moves in the other direction, which we might call *the practical reason argument*. Because each contingent moment involves settling on one option for what to *do*, it requires or implies a value that motivates or justifies that course of action, a practical reason. Both the contingency argument and the practical reason argument build from the ubiquity of contingency and choice in science. Wherever decision points exist in a practice, practical reasons are needed as a factor in the decision. All decisions to act, explicit or implicit, require consideration of practical reasons, that is, of values. Those reasons may be obscure to the nonspecialist in highly technical inquiries, but they exist all the same.

There is a potential problem in the view sketched in this section and the last. As I have defined decision points, it may seem as if there is an endless series of such points, and the demand for their explicit recognition and reflective value judgment about each will quickly bring inquiry to a standstill. Habit is as important to the functioning of inquiry as reflection; the smooth functioning of inquiry, as with any practice, requires that some potentially open questions remain tacit, intuitive, implicit. The recognition of decision points is an open-ended matter, but open-endedness need not become endlessness. What is required is that inquirers not only be sensitive to any decision points, but that they be sensitive to *significant* decision points, points rendered significant by their meaning and impact on our values.[14] But there is already a kind of built-in check on this issue, due to reflexively applying the argument to itself. The decision to continue identifying and explicitly reflecting on contingencies itself has consequences for things that we care about, especially if it slows inquiry to a halt. As such, there will be times where the decision to stop reflecting and settle the contingency will be the right decision, according to the contingency argument. Since reflecting on contingencies is itself a decision, there must be a sufficient, practical reason to continue it, according to the practical reason argument. Either way, there is a reflexive self-limitation built into the argument.

In the following sections, I will focus on explicating and defending the contingency argument, as I believe it is the less controversial of the two arguments here. Where relevant, I will also bring in further considerations suggested by the practical reason argument.

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14. Compare Kitcher, *Science, Truth, and Democracy*, on "significant questions."

The Contingencies Are Epistemically Significant

The defender of value-free science might acknowledge the role of contingency presupposed in these arguments but attempt to confine the role of values in such contingencies to a mere feature of the process of scientific discovery without any impact on the *content* of science. We might acknowledge that values play a significant role in every step of science, up to and including the decision to assert some result by publishing it in a scientific journal. But these are all just part of the process of discovery; the significant questions have to do with the content, not the process.

What matters, according to this view, are the products of inquiry—evidence, analysis, argument, hypothesis, theory—and the logical relationships between them. Values have no role to play here. The guardian of the epistemic purity of science will point out that values do not appear in scientific reports and publications; whatever the role of values in the process, the results are intended to stand on their own. The strength of evidence for the hypothesis, the quality of the analysis, the soundness of the argument are what matter to the credibility of the science. Whatever idiosyncratic role the scientist's values play drops out, according to the defender of value-free science.

This argument amounts to a revival of the distinction between the "context of discovery" and "context of justification." Many have come to reject the distinction on grounds independent from our discussion of values in science.[15] While the distinction was used to limit philosophy of science to the logical analysis of the content of science,[16] many scholars have exhibited the philosophical richness in the history and practice of science. So already we have independent reason to be wary of the distinction. As an objection to the thesis that science is value-laden, there are at least two problems with the context distinction.

First, the products of inquiry are clearly contingent on the decisions made during the process of inquiry. We can assess only the evidential support for the hypotheses and theories that are actually proposed. We can assess only that support relative to the base of evidence that is actually gathered. If we grant that the process of theory generation is value-laden, even if the comparative assessment of two theories were totally value-free, rational, and done in light of a large base of evidence, the chosen theory will be value-laden. Even if the decision procedure

15. Kuhn, *Structure of Scientific Revolutions*.
16. Schickore, "Scientific Discovery."

in the context of justification is value-free, in this case it only tells us which is the epistemically better among the available alternatives, each of which is value-laden.[17] Values in, values out. A series of such choices will result in a value-laden pattern of knowledge. And values further pattern our knowledge in terms of what problems we do and do not attempt to research, what concepts we choose to use, a variety of decisions that produce the evidence, and so on.

Second, we should not concede the point that the judgments of credibility in the context of justification are in fact value-free. The evaluation of the products of inquiry is just as much a matter of unforced choice as any decision in the process of inquiry. The decision to accept or reject a hypothesis on the basis of the evidence is an unforced choice, because such decisions are always (in nontrivial cases) ampliative or inductive, thus uncertain, thus unforced. Even if you hold, as Richard Jeffrey did, that it is not the job of a scientist to accept or reject hypotheses, but only to assign probabilities to a hypothesis (and its negation) in light of the evidence,[18] the choice is still value-laden. First, there is second-order uncertainty, that is, uncertainty about the assignment of a probability to the hypothesis; such uncertainty implies unforced choice, which in turn implies value-ladenness.[19] Second, there are risks associated with the pragmatics of probability assignment, and the choice to make a probability assignment, rather than to accept or reject it, can definitely impact how results are communicated and understood by various audiences. If one attempts to replace a precise probability assignment with a range over a confidence interval or credibility interval, then there is the problem of third-order uncertainty—that is, uncertainty in the determination of the boundaries of the interval—and even greater risks in the pragmatics of communicating probabilities. Moreover, there is the meta-level choice about whether to assign probabilities as Bayesian, frequentist, likelihoodist, and so on, which, given that they are all live options in the philosophical and statistical literature, clearly seems like an unforced choice. These meta-level decisions are increasingly remote from the specific issues at hand, and so less clear and harder to make responsibly. Attempting to move the considerations of risk to these meta-levels thus increases rather than decreases the burden of value judgment on scientists, and arguably leads to a greater likelihood of bad decisions.

17. Okruhlik, "Gender and the Biological Sciences," works this argument out in detail with reference to the role of values related to gender in the biological sciences.

18. Jeffrey, "Valuation and Acceptance of Scientific Hypotheses."

19. Douglas, *Science, Policy, and the Value-Free Ideal*, 53–54; Steel, "Climate Change and Second-Order Uncertainty."

Another way of denying the significance of contingency is to deny that it happens much. One version of this denial is to point out that in the long run, contingencies are often settled unequivocally. As Justin Biddle has shown, this is an ineffective argument.[20] While contingency may wash out in the long run, the consequences and implications that require us to consider value judgments also take place in the short- and medium-term. Even if contingency is merely transient, and that's a big *if*,[21] the bulk of active science remains value-laden. Another version of the point is to argue that even short-term contingencies in science are rare. This claim is implausible on its face, given the large number of apparently contingent decisions facing science. Here is a short list: whether to do science at all, how much to fund science in general, what topics to research, specific research agenda, how to make funding decisions and priorities, choice of methods and techniques, design of protocols, human and animal subject protections via IRB/IACUC processes, conceptual choice and innovation, how to apply value-laden concepts, how to operationalize or quantify concepts, how to frame research questions, which hypotheses to test, which theories to pursue or accept, background assumptions, how to characterize data, decisions about data relevance, decisions about data reliability, assessing weight of evidence, stopping rules for data collection, standards of acceptance, whether and where to publish, peer review assessments, journal rules and standards, critical evaluation of published work, metaanalytical decision, what to include in textbooks and reference works, what knowledge to use for the purposes of technology and policy, and so on. The contingencies are legion, they are ubiquitous, and they cannot be eliminated by fiat.

These Decisions Cannot Be Deferred

Another way to oppose the contingency argument for the value-ladenness of science, and to recapture some central element of the value-free ideal, is the deferred decision response.[22] The deferred decision response acknowledges that value judgments are necessary to many decision points in science. What it hopes to show, however, is that the value-laden decisions can be deferred, held open during the course of inquiry, and settled only after the fact, once inquiry has

20. Biddle, "State of the Field."

21. See Soler, Trizio, and Pickering, *Science as It Could Have Been*.

22. The concept of the "deferred decision response" was first worked out with my coauthor Joyce Havstad. See Brown and Havstad, "Inductive Risk, Deferred Decisions, and Climate Science Advising."

concluded, by the relevant parties who are applying the results. The argument of Richard Jeffrey mentioned previously, that it is not the job of scientists to accept hypotheses but instead to provide the probabilities of hypotheses, can be interpreted as a very basic form of this strategy, as it argues that the decision to accept or reject a hypothesis be deferred to whoever seeks to *apply* scientific knowledge, not to the scientists themselves.

One serious concern that motivates some version of the deferred decision response is what we might call "the democratic objection" to value-laden science.[23] The worry comes from the special role that science is accorded in our societies, its unique epistemic authority in matters of public policy, education, technology, and culture. If science is value free, that means it is impartial between the many competing value commitments that our pluralistic, democratic society contains, and thus its authority poses no problem for democratic legitimacy. If we allow science to be value-laden, and we allow scientists to apply their own idiosyncratic value judgments to the various decision points, then the authority of science becomes problematic, as science itself becomes partisan and loses its special democratic legitimacy. We stand between the dangers of technocratic tyranny or losing the valuable tools that science provides.

More sophisticated versions of the deferred decision response have been proposed than the Jeffrey version. For instance, science policy scholar Roger Pielke Jr. has proposed a model of science advising for policy that he calls *the honest broker of policy alternatives*.[24] On the honest broker model, the appropriate role for scientists is not to settle questions but to multiply plausible policy options, where the range of alternatives provides scientifically justifiable means to a range of policy ends, with the ends to be filled in by democratically accountable policy makers.[25] A related but even more sophisticated deferred decision approach can be found in Ottmar Edenhofer and Martin Kowarsch's *pragmatic-enlightened model* of scientific policy assessment.[26] Edenhofer and Kowarsch acknowledge more clearly than Pielke the value-ladenness of science, and they use a cartographic metaphor for the multiple paths through the scientific decision points that must be made to resolve a scientific question. Ordinary scientific inquiry,

23. Betz, "In Defence of the Value Free Ideal"; Bright, "Du Bois' Democratic Defence of the Value Free Ideal."

24. Pielke, *The Honest Broker.*

25. For critique of the honest broker model, see Brown and Havstad, "Neutrality, Relevance, Prescription, and the IPCC."

26. Edenhofer and Kowarsch, "Cartography of Pathways."

with all the decisions settled, represents a single path through the landscape of possible choices. The role of the democratically responsible science advisor, however, is to identify multiple paths through the landscape, each representing different objectives or values that policy makers might choose.[27] Despite the good intentions and sophisticated nature of these approaches, however, the deferred decision response in all its forms is unworkable.

The first problem with this response is that the ubiquity of decision points in inquiry makes deferral impractical. An implicit assumption of each version of the deferred decision response is that the relevant decisions are few enough that a manageable number of options can be presented to policy makers, school boards, members of the public, or whoever is making decisions based on the information scientists provide. But there are many decisions, large and small, throughout the scientific process, and so just as many potential places where value judgment enters. It cannot be decided in advance whether any particular decision point is socially relevant, and there are generally many such potential moments.

In addition, there is no reason to think that a small number of objectives or values can be used to chart pathways through these decisions. For example, what research questions to focus on depends on value judgments about which type of knowledge it is useful to have. Do we want more pharmaceuticals or more knowledge about the benefits of diet and exercise? Decisions about what is permissible with animal research subjects depend on values related to animal rights and welfare. Decisions about whether to publish certain results depends on assessments of, among other things, the consequences of error. There is no reason to think that one's views regarding what is useful to know, on animal rights, and evaluation of the consequences of a specific error are closely correlated. The pathways through the landscape multiply and multiply.

The technical nature of many of the decision points prevents us from eliminating the role of expert judgment. In order to replace expert judgment with the judgment of a policy maker or other layperson requires not only that they fill in their own values, but that they understand what is at stake well enough in order to do so. In order to understand either, they must become technically sophisticated near the level of the scientist, which is impractical, or the issue must be sufficiently explained or simplified so that they can make a judgment,

27. For a sympathetic critique of the pragmatic-enlightened model, see Brown and Havstad, "Inductive Risk, Deferred Decisions, and Climate Science Advising." The criticisms below are based on ideas worked out in that paper.

which risks oversimplification and distortion. For example, when it comes to the complex decisions concerning modeling assumptions in climate science, the idea of deferring the decisions, and of nonexperts understanding precisely what is at stake in each decision, is a dubious proposition.[28]

The democratic objection raises an important issue; we want our policy making to be democratically legitimate, accountable to the public, and representative of the range of our values. This legitimate concern, unfortunately, cannot be addressed through the deferred decision response; matters are not that easy. There are too many decisions, and technical expertise is needed for making judgments about most of them, in practice if not in principle. Part of the difficulty comes from asking an epistemic ideal to do an ethical-political job. What will make science advising democratically legitimate has to do with the influence of public values on science (discussed in Chapter 4), as well as the role of values in the social structure of science and the way science is applied through technology and policy.

In *Science, Policy, and the Value-Free Ideal*, Heather Douglas discusses the epistemic authority of science and the potential problems it poses:

> On the basis of the value-free nature of science, one could argue for the general authoritativeness of its claims. But an autonomous *and* authoritative science is intolerable. For if the values that drive inquiry, either in the selection and framing of research or in the setting of burdens of proof, are inimical to the society in which the science exists, the surrounding society is forced to accept the science and its claims, with no recourse. A fully autonomous and authoritative science is too powerful, with no attendant responsibility. . . . Critiques of science's general authority in the face of its obvious importance seem absurd. The issue that requires serious examination and reevaluation is not the authority of science, but its autonomy. Simply assuming that science should be autonomous, because that is the supposed source of authority, generates many of the difficulties in understanding the relationship between science and society.[29]

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28. See Biddle and Winsberg, "Value Judgements and the Estimation of Uncertainty in Climate Modeling"; Winsberg, "Values and Uncertainties in the Predictions of Global Climate Models"; and Intemann, "Distinguishing between Legitimate and Illegitimate Values in Climate Modeling," for explanations of the value-ladenness of climate modeling assumptions. Betz, "In Defence of the Value Free Ideal"; and Parker, "Values and Uncertainties in Climate Prediction, Revisited," dispute these claims, but I think Steel, "Climate Change and Second-Order Uncertainty," clearly shows that, taken as a *normative* argument rather than a merely descriptive one, climate modeling involves values.
29. Douglas, *Science, Policy, and the Value-Free Ideal*, 7–8.

The value-free ideal could manage to combine the authority and autonomy of science in a democratically legitimate fashion. Given that the ideal is unattainable and undesirable for the reasons already laid out here (as well as the arguments provided by Douglas), insisting on the social autonomy of science, that is, insisting that it be unaccountable to social and ethical values, is to risk at best its haphazard impact on our society, if not its outright abuse. And we see that abuse often when science is brought into the public sphere.

In Douglas's view, the acknowledgment that science is not and should not be value-free is a step *toward* improving the democratic legitimacy of science, especially science advising and policy-relevant science. Douglas devotes the last two chapters of her book to carefully considering the ways that scientific integrity and democratic legitimacy can be maintained when value-laden science plays a role in the policy process.[30] It will be an important matter to keep in mind as we consider the source and role of value judgments in science in later chapters.

The Responsibilities of Scientists qua Scientists

Another strategy for responding to the contingency argument is to question its third premise by denying that scientists have a responsibility to consider the full implications and consequences of their actions when doing scientific inquiry proper. According to this strategy, something about the responsibilities associated with the scientists' special social role, or the special norms of scientific practice, exempts scientists from their ordinary, general moral responsibilities. This moral exemption response to the contingency argument usually draws a distinction between "pure" or "basic" science and "applied" science, or between scientific inquiry aimed at belief and scientific inquiry aimed at acceptance (for a purpose). When it comes to creating scientific knowledge, the only responsibilities scientists have are the ones distinctive to scientific practice, mainly epistemic concerns.

According to this account scientists may have to make value judgments when they are interacting with the public (as in science advising, science communication, education, application), but when they are engaged in scientific practice as such, their responsibilities are to the practice itself. Real science is pure science, focused only on creating knowledge. The main responsibility of scientists is to the evidence, and ultimately to the truth. They also have special responsibilities

30. These chapters are often missed or misread by those who raise the democratic objection to Douglas's view, for example, Pielke, "Myth of Objective Scientists."

to their colleagues, their students, and their research subjects. But they do not have larger social responsibilities in the main part of scientific practice. Values come in only in the context of application.

There are several problems with this approach. First, the distinctions between types of science or scientific inquiry that the approach presupposes are untenable. There are not two types of scientific inquiry or method, one for pure science and one for applied science. There are of course differences between every field and every specific inquiry, but the differences do not support such a weighty distinction. Second, the linear model, according to which pure science feeds into applied science, which feeds into application and decision making, is untenable. According to this model, pure science produces scientific knowledge, and applied science works out its consequences for particular contexts of application, in a form that can be used by technologists, policy makers, or the public.[31] Several decades of research on the nature of engineering science, technological innovation, and the role of science in policy have undermined the linear model.[32] It turns outs that the workings of applied science and engineering are a lot more complicated and interesting than the linear model suggests; in many cases, so-called applied science independently generates new knowledge in which basic science plays a minor or nonexistent role. Applied science even drives developments in basic science.[33]

There is an implicit and problematic value hierarchy in the way the moral exemption response uses the distinction between basic and applied science. The retort to the contingency argument's claim that science is value-laden is something like, "Well, only applied science." Pure or basic science is implicitly treated as the only "real" science. Not only is this hierarchy increasingly difficult to maintain, given the more realistic pictures that are emerging of the relation between the areas we pick out as "applied science" and "pure science," but the valuation actually seems topsy-turvy. It is success in application, in growth of prediction and control of the world, that seems the clearest marker of progress in science. It is much more difficult to assess progress for pure science, and some have argued that there is no adequate measure of progress for pure science.[34] It is

31. Some would add another step of "translational science" between applied science and application proper.

32. Stern and Fineberg, *Understanding Risk*; Pielke, *Honest Broker*; Douglas, *Science, Policy, and the Value-Free Ideal*; Brown, *Science in Democracy*; Beck, "Moving beyond the Linear Model of Expertise?"

33. Lelas, "Science as Technology"; Stokes, *Pasteur's Quadrant*; Hansson, *The Role of Technology in Science*.

at least tendentious to treat "pure science" as if it is the whole of science, or even the central case; "applied science" involves a lot of science, perhaps even what is most central and valuable in science as a whole, certainly what receives the most funding, and such science is indisputably value-laden.

Second, even science for its own sake has external impacts on things that we value. For instance, consider the impact of Darwin's evolutionary theory on society. As Philip Kitcher shows, public awareness of the theory was highly disruptive; many figures who were absolutely convinced by Darwin's arguments became demoralized and melancholy at how they understood the view to refute their religious worldview.[35] Furthermore, there was cultural uptake of the theory of evolution by social Darwinists and the eugenics movement. The public reception of quantum theory has also created some significant social impacts; some are quite comforted by the return of mystery or agency they think it brings to the world, while others are quite despondent at the way they believe the theory robs the world of order and sense. We need not endorse the accuracy of popular interpretations of these basic theories in order to acknowledge them *as* impacts of the theory, some of them anticipatable (some of them actually were anticipated by Darwin and by physicists). Nor should we conclude from the fact that there are values that should be taken into account, that therefore there is something wrong about what Darwin or Heisenberg did in publishing their theories. Generally the public reads basic science, the media reports on it, and it has an impact; the open decisions made throughout the scientific process should therefore factor into that impact.

The moral exemptionist may reply that this begs the question. It may be true that science for its own sake has broader impacts, but those impacts should not be a consideration for scientists, whose role is to seek evidence and truth. The side effects of that search are not their concern. We should be very careful here; there are very few roles in society that allow people to ignore the effects of their actions on others. Lawyers, for example, are protected by attorney-client privilege, even when keeping that information secret has a harmful effect on society. Likewise with doctors and therapists concerning their patients. Their role involves a duty of confidentiality that prevents them from disclosing information that in other circumstances they might be required to divulge.[36]

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34. Douglas, "Pure Science and the Problem of Progress"; Sarewitz, "Saving Science."

35. Kitcher, *Science, Truth, and Democracy*, 147–51.

36. Note, however, that in neither case is this privilege unlimited.

But scientists are not like lawyers and should not want to be. What makes attorney-client privilege work is that lawyers are part of an adversarial system, where the defense and the prosecution argue opposing sides of a question and their arguments are judged by impartial third parties. If attorneys could be required to testify about everything they know about their client, it could easily undermine this process.[37] Doctors owe confidentially to their patients because of the special autonomy and rights to privacy patients have concerning their own bodies. Scientists do not have such roles or responsibilities. What begs the question is the assumption that the role of values in science *necessarily* interferes with the search for truth. Though it is the case that *some* uses of values do interfere, proper normative guidance for the use of values in science aims to prevent such a conflict, even to show how value judgment can promote the search for truth, as I will show in later chapters. There are no special aspects of the jobs of scientists that exempt their ordinary moral responsibilities. As science is largely a publicly supported enterprise, and scientists have a special role as trustees of our social store of knowledge, one could argue that they are *more* responsible than the average private citizen to consider the social and ethical impact of their actions.[38]

What would be necessary to insulate basic science and scientific practitioners from the responsibility to consider values would be, in fact, a radical change to the institutions of science and the role of science in society. What would be necessary is something like the complete seclusion of science from society, except in approved forums with extra levels of oversight from representatives of the public. Basic science would have to be developed in secret, kept hidden from the public, so that its impact on society could be minimized. This could successfully screen scientists from the responsibility to make value judgments. To continue to screen scientists from this responsibility as science would be applied or made public, separate boards of overseers would have to examine the kinds of questions the contingency argument raises and make the relevant value judgments on behalf of the public, so that scientists could avoid them. It seems to me that the downsides of such a radical change are obvious and decisive.[39]

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37. Compare Douglas, *Science, Policy, and the Value-Free Ideal*, 73ff, for a more detailed discussion of and response to the legal analogy.

38. For more on the idea of science as a public trust, see Brown, *Science in Democracy*; Brown, "Democratic Control of the Scientific Control of Democracy"; Brown and Havstad, "Disconnect Problem, Scientific Authority, and Climate Policy."

39. Douglas makes a similar argument in her forthcoming *Science, Values, and Democracy*.

ANALYSIS: COMPARISON WITH OTHER ARGUMENTS FOR VALUES IN SCIENCE

As I have explained, the contingency argument attempts to distill work from a variety of directions that challenges the value-free ideal. In order to better understand the argument, then, I will discuss a variety of other approaches to the value-ladenness of science and compare them to the contingency argument.

The Conceptual Argument

One classic argument for the value-ladenness of science is *the conceptual argument*, which proceeds as follows:

1. Scientists must choose the concepts with which to frame and analyze their subject matter, as well as definitions of and assumptions about those concepts.
2. Often these concepts have evaluative content or assumptions built into them, implicitly or explicitly.
3. Everyone, scientists included, has a responsibility to consider the meaning and consequences of their use of evaluative language.
4. Insofar as such concepts are in use, scientists have a responsibility to make value judgments about them in order to guide conceptual choice.

A variety of concepts with evaluative content or assumptions plays a role in scientific inquiry, especially in the biological, psychological, and social sciences. Concepts like race, sex, gender, wealth, well-being, health, disease, intelligence, family, divorce, abuse, trauma, learning, and many others cannot be eliminated from science and involve inextricable combinations of descriptive and evaluative meanings.

Hilary Putnam follows Bernard Williams in calling these "thick ethical concepts."[40] For example, Putnam considers the case of the concept "cruel" as a counterexample to the fact/value dichotomy. Putnam argues that ascriptions of cruelty involve both a value judgment (in this case, a negative evaluation of the person judged cruel) as well as a description of behaviors or dispositions. "What is characteristic of 'negative' descriptions like 'cruel,' as well as positive

40. Putnam, *Collapse of the Fact/Value Dichotomy*; Williams, *Ethics and the Limits of Philosophy*. Though Williams coined the term, he did not originate the idea. Williams himself claims to have picked it up from Philippa Foot and Iris Murdoch in the 1950s. See Putnam, *Collapse of the Fact/Value Dichotomy*, 159n19; and Väyrynen, "Thick Ethical Concepts," §1, for discussion of potential historical antecedents.

descriptions like 'brave,' 'temperate,' and 'just' . . . is that to use them with any discrimination one has to be able to identify imaginatively with an *evaluative point of view*."[41] Competence in the descriptive use of terms like "cruel" requires familiarity and facility with their evaluative use. Putnam regards Amartya Sen's work in economics as a paradigm example of scientists meeting their responsibilities when working with concepts that defy the fact/value dichotomy.[42]

John Dupré considers the case of "violence."[43] Sociologists and psychologists may come up with operational criteria for attributing or quantifying the violence of groups or individuals. And yet such claims as "The United States is a violent country" or "Sam is a violent child" also express evaluations of the character of that nation or person. While Dupré acknowledges that it may be true that we could replace *violent* with a technical term with the same operational criteria but devoid of the evaluative meaning, it is nonetheless undesirable because the evaluative meaning is crucial to the *significance* of the science in question, and especially its bearing on potential actions. Dupré argues, "Once we move away from the rarified environments of cosmology or particle physics, we are interested in scientific investigations that have consequences for action. And this undoubtedly is why, while often paying lip service to operationalized or technical concepts, scientific language often gets expressed in everyday evaluative language. . . . Evaluative language expresses our interests, which, unsurprisingly, are things we are interested in expressing. When we describe things, it is often, perhaps usually, in terms that relate to the relevance of things for satisfying our interests."[44] And indeed, it is this relevance for our interests that determines what counts as successful operationalization or technical clarification of our everyday language. Thus a sharp distinction between fact and value for most of our scientific conceptual repertoire is both untenable and undesirable.[45] Dupré pursues more detailed examples in evolutionary psychology and economics to demonstrate the point. Anna Alexandrova provides a detailed analysis of the concept of "well-being" and the "mixed claims" or "mixed hypotheses" in which the concept plays a role.[46]

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41. Putnam, *Collapse of the Fact/Value Dichotomy*, 39.
42. Putnam, *Collapse of the Fact/Value Dichotomy*, chap. 3.
43. Dupré, "Fact and Value."
44. Dupré, "Fact and Value," 30.
45. Dupré, "Fact and Value," 31.
46. Alexandrova, *A Philosophy for the Science of Well-Being*; Alexandrova, "Can the Science of Well-Being Be Objective?" Alexandrova argues that we should distinguished "mixed claims" from "thick concepts," as the latter present a variety of foundational problems in metaethics and philosophy of language, while the role of value judgments in the former is vexed no matter how we answer those questions.

Clearly, the conceptual choice argument is an instance of the contingency argument. Conceptual choice is one particular decision point in scientific inquiry, one of particular consequence for how problems and hypotheses are framed and for how evidence is characterized and analyzed. The evaluative content of thick concepts is one way in which the meaning and consequences of conceptual choice impact values and require value judgments. It may be possible for purely descriptive terms to also have consequences for values, though that does not seem generally true in the way it is for thick concepts.

The Underdetermination Argument

Another classic source of arguments for the value-ladenness of science is the problem referred to as "the underdetermination of theory by data." Underdetermination is actually a number of different problems about the relation of theory or hypothesis and data, observation, or evidence, but each version identifies some kind of *gap* between the two, a gap that cannot be filled by traditional logic. Hence, the use of underdetermination in arguments for the value-ladenness of science are sometimes called "the gap argument."[47] The gap may consist of merely the uncertainty of any ampliative inference, sometimes called "Humean underdetermination." The gap may be what Helen Longino calls the "semantic gap" between hypotheses and data caused by the different languages of theory and evidence, or by the lack of "formal relations of derivability," or the fact that data do not come with their "evidential relevance" specified in advance.[48] Or the gap may be a result of the multiple rival theories (explicit or unconceived) that are equally well supported by the data.[49]

There are thus many types of underdetermination or gap arguments for the value-ladenness of science. In general they proceed as follows:

1. A gap exists between scientific theories or hypotheses and the possible or available evidence—because of the need of auxiliary hypotheses linking the two, or because there are alternatives compatible with the evidence, and so on.

47. Intemann, "Feminism, Underdetermination, and Values in Science"; Elliott, *Is a Little Pollution Good for You?*; Brown, "Values in Science beyond Underdetermination and Inductive Risk."
48. Longino, "How Values Can Be Good for Science," 132; Longino, "Values, Heuristics, and the Politics of Knowledge," 70.
49. Stanford, "Underdetermination of Scientific Theory."

2. Scientists thus must make choices about how to fill the gap in order to decide whether a hypothesis or theory is supported (or falsified) by the evidence, or to choose among competing alternatives, and so on.
3. The different ways of filling in the gap often have implications and consequences for things that we care about, including ethical, social, political, cognitive, and aesthetic values.
4. Everyone, scientists included, has a responsibility to consider the implications and consequences of their choices and actions.
5. Insofar as such implications and consequences can reasonably be anticipated, scientists have a responsibility to make value judgments about them in order to guide decisions about how to fill in the gap.

In this schematic form, the argument is agnostic between different types of gap, and different notions of gap filling. So, for example, Longino claims that the gap is filled in the first instance by a variety of background assumptions about the nature of the instruments—about the ontology of the subject matter and about proper scientific method and technique, which are to some extent arbitrary—and their choice can legitimately be mediated by cognitive and social values. Others have broader, fuzzier notions of what the gap filling consists of.

The underdetermination argument can be interpreted as a normative or descriptive argument.[50] In its normative form, the underdetermination argument for values in science is clearly an instance of the contingency argument. The decision points consist of the various options for filling in the gap between hypothesis and data. These choices are unforced because the background assumptions, instrumental choices, and other elements are themselves usually tested only indirectly. On the other hand, the metaphor of *the gap* suggests the possibility of narrowing or closing it. As the total evidence base increases, as clever tests between rivals are devised, as linking background assumptions themselves accumulate direct and indirect evidence in their favor, the gap narrows and the relevance of the underdetermination argument for values in science closes.[51] To

50. Intemann, "Feminism, Underdetermination, and Values in Science"; Douglas, "Values in Science."
51. Although this is typically an accepted point, it actually is not true in cases where there are difficult judgments to be made about the interpretation and relevance of evidence. In such cases underdetermination is not decreased by gathering more evidence, nor is the role of values diminished. See Hicks, "Inductive Risk and Regulatory Toxicology."

rely exclusively on this argument for an account of values in science is to adopt what I have called "the lexical priority of evidence," a problematic principle that I will discuss in the next chapter.[52]

The Argument from Inductive Risk

The argument from inductive risk derives from William James's observation that "Believe truth! Shun error!" represent two different epistemic commandments, and that the two are generally in tension with one another.[53] The argument from inductive risk is one of the most influential and important arguments against the value-free ideal of science in the contemporary discussion. This is due almost entirely to the work of Heather Douglas,[54] who has drawn from earlier presentations of the argument by C. West Churchman, Carl Hempel, and especially Richard Rudner. Rudner argues that it follows from the fact that when scientists accept or reject hypotheses, they make value judgments: "For, since no scientific hypothesis is ever completely verified, in accepting a hypothesis the scientist must make the decision that the evidence is *sufficiently* strong or that the probability is *sufficiently* high to warrant the acceptance of the hypothesis. Obviously our decision regarding the evidence and respecting how strong is 'strong enough,' is going to be a function of the *importance*, in the typically ethical sense, of making a mistake in accepting or rejecting the hypothesis."[55] There are different ways to elaborate Rudner's argument, which as Douglas[56] has shown applies not only to acceptance and rejection of hypotheses but to any of the ampliative inferences in science. In particular, there are two main versions of the argument, depending on whether you focus on the role of *error* or the role of *decisions to accept* in the argument.[57]

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52. See also Brown, "Values in Science beyond Underdetermination and Inductive Risk"; Hicks, "New Direction for Science and Values."

53. James, "Will to Believe"; Magnus, "What Scientists Know Is Not a Function of What Scientists Know." Magnus thus refers to the argument from inductive risk as the "James-Rudner-Douglas Thesis."

54. Douglas, "Inductive Risk and Values in Science"; Douglas, *Science, Policy, and the Value-Free Ideal*.

55. Rudner, "Scientist qua Scientist Makes Value Judgments," 2.

56. Douglas, "Inductive Risk and Values in Science."

57. Some question remains about the relationship between underdetermination arguments and inductive risk arguments. Inductive risk may be a special case of underdetermination. See Biddle, "State of the Field"; ChoGlueck, "Error's in the Gap."

Version 1: The Error Argument

Here is perhaps the most common way to understand Rudner's argument, the way that informs Douglas's earlier presentations of it:[58]

1. Scientists make judgments about whether to accept or reject hypotheses.
2. These choices are uncertain (that is, they involve inductive or ampliative inferences).
3. Because the choice is uncertain, we must make an unforced choice about whether there is sufficient evidence to accept or reject the hypothesis.
4. The choice of standards of sufficient evidence often creates a nonnegligible risk of error (for example, false negative or false positive error).
5. These errors often have implications and consequences for things that we care about, including ethical, social, political, cognitive, and aesthetic values.
6. Insofar as such implications and consequences can reasonably be anticipated, scientists have a responsibility to make value judgments about them in order to guide decisions about standards of evidence.

This is clearly an elaboration of a specific form of the contingency argument. We can rephrase the argument slightly to bring out the shared structure between the two arguments:

1. Scientists are faced with unforced choices about whether to accept or reject hypotheses through their choice of standards for sufficient evidence because the choice is uncertain (inductive).
2. Accepting or rejecting a hypothesis has a nonnegligible chance of error, and those errors often have implications and consequences for things that we care about, including ethical, social, political, cognitive, and aesthetic values.
3. Everyone, scientists included, has a responsibility to consider the implications and consequences of their choices and actions.
4. Insofar as such implications and consequences of error can reasonably be anticipated, scientists have a responsibility to use value judgments about them in order to guide decisions about standards of evidence.

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58. Douglas, "Inductive Risk and Values in Science"; Douglas, *Science, Policy, and the Value-Free Ideal*.

Note also that, like the underdetermination argument, the error argument has a mechanism through which values become increasingly less relevant to science. Insofar as uncertainties can be reduced by the collection of more or better evidence, the applicability of the argument decreases.[59] Likewise, the argument is inapplicable in cases where the hypothesis has no significant social and ethical implications, or when they cannot be anticipated. It seems that this form of the argument from inductive risk, if relied on exclusively, again commits us to a version of *the lexical priority of evidence*. I will argue in the next chapter that we should thus be wary of relying too much on this argument as a complete account of values in science.

Version 2: The Pragmatic Argument

There is another way to elaborate this argument, one which I see, for example, in Heather Douglas's later presentations of the argument (for example, in her forthcoming *Science, Values, and Democracy*):

1. Scientists make choices about whether to accept or reject hypotheses.
2. Evidence, logic, and epistemic values tell us the strength of evidential support for a hypothesis, but that strength is always limited for nontrivial inductive hypotheses.
3. The decision to accept, infer, assert, or endorse a (nontrivial, ampliative/inductive) hypothesis is an action taken under uncertainty.
4. No amount or strength of support necessarily compels us to assert, infer, and so on.
5. Instead, we require some sort of practical reason (that is, values) concerning sufficiency conditions for asserting, inferring, and so on.
6. Where there are foreseeable consequences of error, these are among the relevant practical reasons.

This is not only a version of the contingency argument, but it fits with the strong practical reason argument discussed above ("Practical Reasons and the Activities of Inquiry," p. 65). In this version of the argument, the need for values is ubiquitous. Even when analyzing cases from particle physics, such as the identification of the Higgs boson, the argument encourages us to think

59. This is not always possible to do by merely collecting more evidence. See Hicks, "Inductive Risk and Regulatory Toxicology."

about the inductive risks, and to search for the practical reasons for accepting a certain sufficient evidence level, 5-sigma or 6-sigma, say.[60] Rather than commit to the lexical priority of evidence, this version of the argument sees the role of values as ubiquitous in science, but playing a systematically different functional role than evidence plays. There is a cost to this ubiquity claim.[61] Version 1 of the argument from inductive risk draws our attention to cases where the social and ethical consequences of science are most significant, and the need for value judgments most pressing. Version 2, the pragmatic argument, has us attend to them in a more diffuse way. On the other hand, significant issues are less likely to slip through the cracks, decision points throughout the process become more salient, and less obvious social and ethical consequences and implications may be found. The pragmatic argument places a higher burden and diffuses our efforts, but it may be a burden worth meeting, and it may be worth focusing more of our efforts on it.

The Geography of Epistemic Risk

An attempt to generalize arguments from values in science similar to my contingency argument is found in Justin Biddle and Quill R. Kukla's discussion of "epistemic risk."[62] Biddle and Kukla are particularly interested in the developments in the literature beginning from Douglas's reinvigoration of the argument from inductive risk. They argue that inductive risk is one member of broader categories of risk. Inductive risk, which they argue we should restrict to the risk of wrongly accepting or rejecting a hypothesis on the basis of evidence, is a type of phronetic risk. "Phronetic risks" are defined as the risks of any kind of errors in the course of empirical reasoning (inquiry). Phronetic risk is only one kind of epistemic risk, which they define as the risk of any kind of mistake or error arising in any kind of knowledge practice. For example, currently holding a settled false belief would not be a phronetic risk, but it would be an epistemic risk. Typical cases of inductive risks, however, would be phronetic risks, and so also epistemic risks.

There is a significant similarity between what I call a "contingency" and what they call an "epistemic risk." I will note only two differences. First, the notion of a "contingency" is broader than an epistemic risk. Epistemic risk involves contingency, but it also involves the possibility of error or mistakes. But sometimes

60. Staley, "Decisions, Decisions."

61. Thanks to Joyce Havstad for pointing this out to me.

62. Biddle and Kukla, "Geography of Epistemic Risk."

there is no right or best answer among contingencies. To pick a banal example, it is contingent which flavor of ice cream you choose for dessert, but there is no wrong choice, and so no risk of error.[63]

Second, Biddle and Kukla's project is largely complementary to mine here. They are primarily focused on distinguishing varieties of epistemic risk and showing how they should typically be managed differently. They are splitters. The contingency argument shows that there is a common structure to the reason that epistemic risks and other contingencies must be managed by using value judgments, and the ideal of moral imagination that will be articulated and argued for in the rest of the book is a single ideal covering all forms of contingency. In this respect, I am a lumper rather than a splitter. These are complementary rather than competing approaches: the differences that they discover really do matter for more fine-grained critique and decision making. They are just not my focus here.

NEXT STEPS: WHY WE NEED FURTHER GUIDANCE

Having established the value-ladenness of science, the impossibility, undesirability, and irresponsibility of holding science to an ideal of value freedom and epistemic purity, have we achieved an adequate understanding of values in science? No. The fact that science requires value judgments does not settle the issue of *how* values should be used and, more importantly, how they should *not* be used.[64] There are obvious worries here: about the ways that values can lead to bias and wishful thinking and about the preservation of scientific integrity and objectivity. We need new normative guidance for values in science, now that we have overcome the value-free ideal. However, many previous attempts to provide alternatives to the value-free ideal have failed for lack of an adequate theory of values and value judgments. In the next chapter, I discuss those failings. In chapters 4–5, I provide an account of values and value judgments. In chapter 6, I lay out an alternative ideal that provides the normative guidance we need, and in the rest of the book I show how to apply that ideal in a variety of decision points in science and in philosophy of science.

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63. Unless you choose pistachio.

64. This point is already made explicit by Elizabeth Anderson ("Uses of Value Judgments in Science"), and discussed in greater detail by Heather Douglas in terms of finding a "replacement" for the value-free ideal (*Science, Policy, and the Value-Free Ideal*, 18). I attempted to draw this out in my critique of Kourany's *Philosophy of Science after Feminism* (Brown, "Source and Status of Values in Socially Responsible Science"). That this is the central question for discussion of values in science is argued cogently by Dan Hicks ("New Direction for Science and Values").

CHAPTER 3

THE NEED FOR A BETTER THEORY OF VALUES

A skeptically inclined person viewing the present state of the discussion of valuing and values might find reason for concluding that a great ado is being made about very little, possibly about nothing at all.

—John Dewey, ***Theory of Valuation***

INTRODUCTION: WHAT DO WE MEAN BY *VALUES*?

In the last chapter, I argued that values are a necessary component of science, a result of the intersection of science's contingencies with science's significant social influence. If science is and ought to be value-laden, what does this mean for our understanding of science and its status in society? Will values make science biased, subjective, subject to wishful thinking, and hostage to politics? Will values further the ongoing erosion of science in this era of "alternative facts" and "fake news"? Or, to the contrary, could values have a positive impact on science, making it more responsible, more *rigorous*, more thoughtful, creative, and careful? To answer such questions, we need to know what we mean when we talk about "values."

Epigraph: Dewey, *Theory of Valuation*, 191.

To a point this is obvious: if we are going to have an account of values in science, we need to understand how science works (as I have explored in the previous two chapters), as well as what values are. Yet views about the nature of values are taken for granted and left implicit in most discussions of values in science. And in fact, many statements about science and values seem committed to some fairly implausible claims, as I will argue below. To get a basic grasp on the issue, consider how the following broad ideas about values might impact our view of values in science.

Suppose we interpret *values* to be wishes or desires (or perhaps as a kind of second-order desire to have a desire, like the desire not to desire another piece of cake). If we make decisions in science on the basis of values in that sense, especially decisions about testing and acceptance, we may rightly be accused of wishful thinking. Thus many have thought that the problem of wishful thinking is a serious objection to the type of arguments explored in the previous chapter. Wishful thinking is a problem insofar as we confuse the way we wish things to be with the way things are. To take my mere desire for gender equality as a *reason* to accept a feminist-friendly empirical conclusion—for example, about whether there are gender differences—seems to undermine objectivity and replace science with wishful thinking. If we were justified in concluding that something is true because we *wish* it were true, there would be no call to do experimental science at all. Such an account of values calls out for an ideal that blocks wishful thinking by managing the influence of values. Although this problem of wishful thinking does not reduce the force of the contingency argument, it does impact our search for a replacement for the value-free ideal.

Suppose instead that we understand *values* as existing goods to be preserved, a kind of *conservative* theory of value. Values in this sense are a feature of things, whereas the previous sort of values are attitudes of people. In this sense, values are not something we wish for, but something we already have. Concluding that we have the valued thing is thus somewhat redundant, but not biased. Unlike values-as-wishes, there is a direct link between valuing something and that thing being the case. Of course we can still be self-deluded: we may believe our society is free and fair when it is not, for instance. But we can be self-deluded about anything. The problem is not a result of the influence of values. Likewise, we will, if we are philosophical conservatives of this stripe, also *desire* the preservation of our values; this can of course lead us to wishful thinking, for the reasons already mentioned. But this is an indirect effect of holding such values, not a direct result,

and one that occurs only if we allow those desires to interfere with inquiry. The values themselves are not the source of a problem.

Suppose that values are neither present things nor mere wishes, but ultimate ends or absolute ideals. They are things that we aspire to, but in a deeper sense than mere desire. Such a view is often coupled with the idea that the truth of the ideal is secure, a divine commandment or a requirement of rationality. This is not in itself a form of wishful thinking, but this level of confidence in values can lead us to complete closed-mindedness, an unwillingness to revise our value judgments or other beliefs associated with them, which easily becomes an extreme sort of wishful thinking. Contrast the view that "values" are merely tentative objectives, "ends-in-view," sensitive to reevaluation in light of information about what it would take to achieve them and what it might be like once we have done so. Such values are not held in a closed-minded fashion, and they pose significantly less danger of pernicious influence on science.

I hope this gives a sense of the sensitivity of issues of science and values to presumptions about what values are. In my view, most of the literature on science assumes some problematic views of values, without explicitly defending them or recognizing the problems they cause. These problems will occupy the main focus of the rest of this chapter.

ARGUMENT: PROBLEMS WITH THE WAYS WE TALK ABOUT VALUES

Discussions of values, especially in the context of science, have a tendency to fall into some problematic ideas about what values are, what their role is, and what their status is. We have hastily assumed some mistaken ideas about values: that they are necessarily subjective, meaningless, and unreal; that they are absolute; that they lead to wishful thinking; or that they are less relevant than "hard facts." Here I draw out such assumptions, where they are often left implicit, and criticize them. This critique will show that we need to think more carefully about the nature of values and value judgment.

Wishful Thinking and the Cognitive Status of Values

One very common worry, both at a pre-philosophical level as well as among many philosophers of science, is that if we let values into science, it will lead to bias, subjectivism, and wishful thinking. I think this worry is based on an implicit view that values themselves have no cognitive status or somehow

systematically inferior cognitive status to other components of inquiry, such as data, experiments, hypotheses, logic, and reasoning. This broad noncognitivism[1] is not explicitly defended, but I believe it plays an important role in forming some of our intuitions about values in science.[2]

Cognitive status, as I use the term, is multidimensional: it speaks to issues of meaning, truth, warrant, and credibility. One can deny cognitive status to some claim by regarding it as meaningless, as false, as lacking truth conditions, as being unwarranted, or as being the kind of thing not subject to judgments of warrant or credibility. Likewise, one claim can have comparatively lower cognitive status than another by having less warrant, or being liable only to inferior kinds of warrant, or being less credible in some systematic sense.

It is often just presumed that values have no cognitive status, or systematically inferior cognitive status to factual claims. Values are taken to be merely subjective, to be a matter of opinion or cultural beliefs. The very framing of the problem of wishful thinking presumes that values are *mere* wishes and desires. If values have a cognitive status that is not systematically inferior to all other claims, the problem of wishful thinking loses some of its bite. That doesn't mean that assertion of "cognitive status" is a panacea against wishful thinking; even highly warranted, true value judgments could lead to wishful thinking, depending on the type of value, the way they are used, and the context or question at issue. But there is no *general* problem of wishful thinking, in the sense that the mere presence of values will not be a reason to worry.

And there is good reason to think that values can have cognitive status. We tend to think there is genuinely something at issue when we disagree about matters of value. If I assert that access to a reasonable standard of health care is a human right, and you deny this, typically we take there to be a genuine issue between us. I am not expressing a personal preference; instead, I am staking a claim about the kind of society we should live in, the world we ought to build,

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1. *Cognitivism* and *noncognitivism* name positions in metaethics, the affirmation and denial, respectively, of the idea that claims about values are straightforward assertions with ordinary truth conditions. The sophisticated versions of these positions in contemporary philosophy are beside the point here. The version of noncognitivism at work in philosophy of science is much coarser and less plausible, and while the antidote I pursue is broadly speaking cognitivist, no doubt clever noncognitivism could accomplish the same work. We don't need deep metaethics here; we need more sensible views about how values work in our practices.

2. For more on the history of noncognitivism in philosophy of science and the implicit role of those beliefs in the current debate, see "The Roots of Noncognitivism," p. 101.

and the way we ought to treat each other. While those disagreements may be more difficult to resolve than disagreements about simpler matters of fact,[3] that doesn't deflate the sense that they are genuine disagreements. Given the opportunity, if I really believe that health care is a right, I ought to try to persuade you, and you me. If it is a strongly held and highly prioritized value for me, I will try to persuade many people through campaigns or protests, and try to motivate like-minded people to work toward the goal. If values are no more than a matter of taste,[4] if it is not possible for them to be true or false, or more or less warranted, then it is impossible to make sense of a whole host of social interactions around values, as well as the role and significance of values in our lives.

We also revise our values as we gain experience and learn how our behavior turns out, how it affects others and how it makes us feel. When I act in a way that hurts those I care about, or when I come face-to-face with the way my privilege harms or disadvantages others in my community who are less privileged than I, I am forced both to check my behavior against my values and to reexamine my values. As science contributes to our understanding of nature, humans, animals,

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3. Although I actually doubt this is the case in any general way. All but the most simple matters of fact can be subject to difficult-to-resolve controversies, while there are widespread agreements about many value judgments. Although it is not necessary to my argument, I think there is no widespread difference between "facts" and "values" in terms of potential for disagreement or difficulty of resolving controversy.

4. John Dewey argues that even in matters of taste, it is possible or reasonable to dispute:

> The word "taste" has perhaps got too completely associated with arbitrary liking to express the nature of judgments of value. But if the word be used in the sense of an appreciation at once cultivated and active, one may say that the formation of taste is the chief matter wherever values enter in, whether intellectual, esthetic or moral. Relatively immediate judgments, which we call tact or to which we give the name of intuition, do not precede reflective inquiry, but are the funded products of much thoughtful experience. Expertness of taste is at once the result and the reward of constant exercise of thinking. Instead of there being no disputing about tastes, they are the one thing worth disputing about, if by "dispute" is signified discussion involving reflective inquiry. Taste, if we use the word in its best sense, is the outcome of experience brought cumulatively to bear on the intelligent appreciation of the real worth of likings and enjoyments. There is nothing in which a person so completely reveals himself as in the things which he judges enjoyable and desirable. Such judgments are the sole alternative to the domination of belief by impulse, chance, blind habit and self-interest. The formation of a cultivated and effectively operative good judgment or taste with respect to what is esthetically admirable, intellectually acceptable and morally approvable is the supreme task set to human beings by the incidents of experience. (Dewey, *Quest for Certainty*, 209)

On a Deweyan account of taste, then, I would not object to drawing a connection between value judgments and matters of taste.

and society, it also leads to changes in value outlook. For example, when it was plausible to think of animals as mere automata, or as nature as something too vast for us to harm, we thought differently about our obligations than we do today. Now we understand that animals not only feel pain but in many cases have complex cognitive abilities and social lives, and we see our ability to interfere in the complex processes of nature, harming sensitive ecologies and our own futures. In addition, there are reasons to think that some values are beneficial to science, while others are harmful, and sometimes these align with our sense of the ethical justification of those values. The (epistemically) damaging role of sexist and racist values versus the (epistemically) beneficial role of egalitarian and feminist values in the history of science should give us some confidence that the latter, but not the former, are beneficial for science as well as for society. All of these things paint a more optimistic picture of the status of values that the coarse noncognitivism often at work in discussions of values in science allows.

Absolutism and Closed-Mindedness

Another assumption about values, less common in relation to science but very common in some parts of society as well as in ethics, is the assumption that they are *absolute*. Common approaches in ethical theory assume or reinforce absolutism, insofar as they presume that the goal of ethical theory is to articulate the one fundamental ethical principle that applies without exception. Kant's categorical imperative or Bentham's principle of utility, for example, is taken to be a unitary law that covers all cases, an exceptionless and unchanging criterion for the rightness and wrongness of actions. Attitudes toward values in many Western religious traditions also tend toward absolutism, though the foundations there tend to be divine rather than the rational grounding secular ethicists appeal to.

Absolutism raises a problem related to wishful thinking, namely *closed-mindedness*. If we believe that there is one consistent set of unchanging, absolute values, and we combine this with the overconfident attitude that we know what those absolute values are, then the outcome will necessarily be holding to those values without the possibility of revision. (If both absolutism and that confidence were justified, this would be the reasonable position to adopt as well.) If we are closed-minded about values, and we allow that values influence science, then it is likely we may be driven to force science to fit our predetermined conclusions, lest science challenge our faith in those values. For example, some deeply held religious worldviews involve unshakeable allegiance to ultimate values, which

are often founded on or tied up with factual claims that are also held absolutely.[5] Such closed-mindedness can easily lead to wishful thinking.

On the other hand, if we hold that value judgment is a fallible, contextual process that gives values warrant, then closed-mindedness is less of a temptation. Any friction between our values and our evidence will be reason to reexamine our value judgments themselves, and the particular way we're trying to use them in science. If we insist that there are no unmoved movers in science, no absolute foundations, that everything that potentially moves science may be moved by it, then the threat of closed-mindedness dissipates.

Note that my argument here does not require the further anti-absolutist move of denying that there is some one, correct, fundamental, normative ethical theory. Utilitarianism or a form of the categorical imperative might, for all I know, be the right theory at the level of fundamental normative ethics. That's not the level I'm concerned with. Even if there is a correct absolute principle at that level, my point here stands because determining the right course of action in any particular case will still require a further process of contextual value judgment in applying that theory. It will require connecting the fundamental principle to facts about the specific case, possibly mediated by mid-level values or rules, and balancing moral/ethical considerations against, for example, prudential, aesthetic, and intellectual/epistemic considerations. There is no guarantee that, if an absolutist fundamental ethical theory is correct, its principles are best satisfied by absolutist moral reasoners. Absolutism at the fundamental level does not require absolutism and closed-mindedness at the level of practice; indeed, the latter may well generate immoral action by the lights of the former.

The Priority of the Epistemic

A related concern, also based on problematic views about the nature of values and their relationship to evidence, is the epistemic priority thesis or the priority of epistemic over non-epistemic values.[6] There are stronger and weaker versions of this thesis, but they all restrict the role of ethical, social, and other values to influencing science after the evidence has been considered and epistemic standards like accuracy, precision, scope, and simplicity have been satisfied. In

5. Anderson, "Uses of Value Judgments in Science," 8.

6. Elements of the critique in this section were originally developed in Brown, "Against Epistemic Priority."

addition, the various versions of this view tend to be motivated by the problem of wishful thinking as discussed above.

The strongest version of epistemic priority is the thesis of lexical priority of evidence.[7] According to this principle, evidence sets the bounds in which values can influence science, and where evidence and values conflict, evidence trumps. According to this thesis, the only relevant contingency in science where values might come in is inductive uncertainty (at least, as far as the "internal" justificatory phases of inquiry are concerned), and the role for values decreases as evidence narrows that uncertainty.

A somewhat broader view focuses on epistemic standards (sometimes called "epistemic values") rather than evidence as such. After all, some kind of standards or values are needed to link evidence with theories and hypotheses in the first place. According to this view, contingencies must be settled by epistemic standards first; whatever contingencies remain at that point may be settled by other values. If we have a contingent choice of models, for example, we should choose the one that maximizes the epistemic standards of, for example, empirical adequacy, simplicity, and precision; if at that point there remain open options, we can then consider the relevance of other values. We might introduce further qualifications at this point, making an exception for restrictions on human subjects research, say, even if it hurts our ability to satisfy epistemic values, and even replacing strict lexical priority with a weighted trade-off.[8]

Different views of the role of values in science agree in very general terms on what ideal scientific results should look like: a large body of strong evidence, unequivocally in support of an internally coherent hypothesis or theory that satisfies all epistemic standards *and* all relevant values quite well and that has been subjected to rigorous testing and been debated by a diverse and appropriately structured epistemic community. I take it as uncontroversial, once we recognize that there is some relevance of values to scientific inquiry, that the best case scenario is joint satisfaction of all epistemic and non-epistemic considerations, a complete integration.

It is only because we generally have to settle for less that the normative guidance provided by different approaches comes apart, and we thus have to worry

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7. By *lexical* priority, I mean a strict priority. One thing is lexically prior to another if all of the one thing comes before all of the second, as when all of the words starting with the letter "a" come before any words starting with "b" in an alphabetical list. I take the term *lexical priority* from Rawls, who uses it to describe the relation between his two principles of justice.

8. Steel, "Epistemic Values and the Argument from Inductive Risk"; Steel, "Qualified Epistemic Priority," 49–63.

about questions like epistemic priority. Our data might not be so strong or unequivocal, or it might be hard to come by, as when using the fossil record in paleontology.[9] The data might appear to go against deeply held values. The theory we've been using, despite some evidential support, may cease to be fruitful in solving new problems of interest, as was the case with classical physics in the early twentieth century. The epistemic priority thesis tells us how we may proceed in such situations, particularly with tensions between values and epistemic standards.

In some cases we need not settle for less, even if we find ourselves in nonideal circumstances. In some situations, rather than rush to judgment, we can gather new data, reexamine and perhaps find flaws with or recontextualize the current evidence, revise or replace theories, examine our reasons for holding various values and consider revising those, or pursue entirely new approaches. In such cases we can patiently wait until complete integration can be achieved.

So to understand why we need the epistemic priority thesis, or some alternative to it, we need to ask, Why do we settle for less when we do? We do so when two conditions are met:

1. Joint satisfaction of epistemic standards and values eludes us at present.
2. We have to make an immediate decision.

Note that the immediate decision will be made for *non-epistemic* reasons. The non-epistemic reasons that guide us to bring inquiry to a close are various: we have to act, to pass a law, to graduate, to publish or perish, to get the next grant, to get famous writing a controversial book, to move on to a more interesting problem. For example, inquiry into the efficacy and safety of an Ebola virus vaccine during the midst of an epidemic might need to come to a close much more quickly than when there are few cases of infection, and more quickly than a new treatment for a disease we already have treatments for.[10] There are no purely epistemic reasons to bring inquiry to a close before ideal integration has been achieved. When we consider the conditions that require the close of inquiry under nonideal circumstances, they problematize the general commitment to

9. Havstad, "Values in (Paleontological) Science."

10. When a few cases of Ebola infection occurred in Dallas and other cities in the United States in 2014, there was no approved vaccine, but there was some discussion of rushing them into use or at least expediting research into their safety and efficacy. In 2018 and 2019 an experimental vaccine was put into the field under so-called compassionate use rules. Mole, "As Ebola Outbreak Rages, Vaccine Is 97.5." Consider related public discussions about rushing a SARS-CoV-2 vaccine to market.

epistemic priority. If the immediate need for a decision is because of a crisis of human health or safety, for instance, it seems clear that those values might take priority over purely epistemic considerations. If, on the other hand, the urgency comes from the impending exhaustion of our grant funding, other values or even epistemic standards might hold sway instead.

The epistemic priority thesis presupposes the lack of, or systematically inferior cognitive status of, values, as compared to evidence or epistemic standards. According to the epistemic priority thesis, when values and standards conflict, values must give way. Why should this be? Because meeting epistemic standards has to do with evidence, reasons, and truth, whereas values do not. The idea is that evidence and satisfaction of epistemic standards contribute to the epistemic justification of a theory or hypothesis, whereas satisfying values is at best neutral, and at worst detrimental to the justification of scientific or factual claims. This implies that values have no standing in comparison to meeting epistemic standards, or very little, and that whatever reasons we have for our value judgments, they are systematically less reasonable than empirical reasons.[11]

The reason that those who are inclined toward the epistemic priority thesis give so little standing to values must be that values are something like mere wishes or preferences, and thus are epistemically flimsy. In such a view they should play a role only if and when epistemic standards are satisfied. Otherwise, if we rely on mere wishes or preferences to guide us, they will tend to lead us to wishful thinking. But as we've seen, values are often more than mere wishes and desires. Often we think there is something really at issue in claims of value, and these claims are sensitive to reasons and evidence. Moreover, epistemic standards, if held absolutely, can likewise lead to wishful thinking. Simplicity, logical consistency, and empirical adequacy are all common epistemic standards, but if taken to extremes they can lead us to wishful thinking when our subject matter is complex, when it defies the ordinary laws of logic, or when evidence tends to systematically mislead us about the way the world really is. Standards involve what we might call "cosmological" or "ontological assumptions," such as the idea that the world at a fundamental level is simple and consistent, and application

11. Another view is that values have cognitive status, but they derive it based on a kind of Kantian "pure practical reason," that is wholly isolated from the factual claims at issue here. A similar point could be made about how purely abstract mathematical truths derive their cognitive status from pure reason. This view of values is highly implausible in the context of epistemic priority views, as they already admit the interaction of science and values.

of the standards can reinforce the ideas about the way the world is that are built into these assumptions.[12]

If we had a proper theory of values and value judgments, we would have no need for the epistemic priority thesis. Rather than worry about the cognitive status of values in general, we would be able to judge values case by case, avoiding absolutism and facing the burden of judgment head-on. This would lead to all-things-considered better results than a wholesale strategy like the epistemic priority thesis.

Values as Evidence

So far I have argued that we should regard values as having a certain cognitive status, that we should not be closed-minded about values, and that we should not prioritize evidence or epistemic standards over values in a generalized way. Values as such inform all stages of the research process, from framing questions, to choice of methodology, to characterizing the evidence itself, such that it makes no sense to speak of evidence as "prior" to values, even when assessing hypotheses and choosing between theories. A further separation between values and science remains in Heather Douglas's claim that "Values are not evidence; wishing does not make it so."[13] But is it true that values can *never* be evidence?

I think there are some serious problems with holding to this strict separation, given the arguments of this and the previous chapter. First, once we allow that our values play an important role in science, it seems pertinent to ask, as Elizabeth Anderson does, "whether some values are more systematically fruitful than others."[14] If we look, for example, at the track record of androcentric and sexist values in science as compared to the track record of feminist and egalitarian values, we see an important difference in success favoring the latter; the former has often been responsible for inadequate and perniciously biased science, while the latter has often been necessary to uncover such bias and has generally improved the quality of science.[15] Second, in acknowledging a cognitive status for values,

12. Chang, "Ontological Principles and the Intelligibility of Epistemic Activities"; Feyerabend, *Science in a Free Society*, 34ff; Feyerabend, *Against Method*, 233ff.

13. Douglas, *Science, Policy, and the Value-Free Ideal*, 87.

14. Anderson, "Uses of Value Judgments in Science," 2.

15. Clough, *Beyond Epistemology*; Goldenberg, "How Can Feminist Theories of Evidence Assist Clinical Reasoning and Decision-Making?"

it seems reasonable to think about the empirical support values might have. If they can show their merit through their fruitfulness and through being subject to "empirical control" by evidence and value judgment,[16] then it seems reasonable to suppose in some cases that the values themselves might lend some evidential support to the hypotheses they cohere with.

One classic view regards evidence as essentially a representation of matters of fact about particulars. Whether we're talking about perceptual evidence, forensic evidence, or data produced by laboratory equipment, a piece of evidence is a singular, particular fact (or representation thereof). But this kind of view about evidence is out of step with actual practice and as such has been widely rejected by philosophers of science in favor of a view where many different kinds of things provide evidence in different contexts.

For instance, James Woodward and James Bogen argue in an influential paper that data as such (which represent particular experimental or observational happenings) do not themselves provide evidence for theories or hypotheses. Rather, they help establish the existence of *phenomena*, the stable, repeatable things that theories are about, and phenomena themselves are evidence for certain kinds of theoretical claims, despite the fact that phenomena are general rather than particular.[17] The popular Bayesian account of evidence and confirmation is in principle even more permissive: anything to which the relevant probabilities can be assigned in principle can act as supporting evidence or what the evidence supports.

Likewise, theories themselves can occasionally provide evidence for other theories. For instance, Kepler's theory of the solar system provided a much more accurate account of observed planetary motions than any prior theory. While Newton's theory did not exactly reproduce the dynamics of Kepler's theory, it could explain why Kepler's theory was as accurate as it was.[18] It is reasonable to think that this sort of subsumption allows Kepler's theory to provide evidence for Newton's theory. Likewise, well-confirmed general theories can provide evidence for or against the reliability of a detector or even the validity of a measurement. Conflict with well-established theory is also often evidence against a new experimental result. For example, in 2011 a group of scientists announced an observation of particles (neutrinos) traveling faster than the speed of light, an impossible situation

16. Hankinson Nelson, *Who Knows*, 297.

17. Bogen and Woodward, "Saving the Phenomena."

18. On such explanations, see Friedman, "Explanation and Scientific Understanding"; Kitcher, "Explanation, Conjunction, and Unification"; Kitcher, "Explanatory Unification."

according to our best theories in physics. Most physicists doubted the result, not because they are rigid and closed-minded, but because the strength of the theory gave them good reason to doubt a single new result. It turned out they were right to doubt it, as the result was an artifact of technical problems with the experiment.[19]

So too in certain cases it seems that values can provide evidence; it is not their form or essence that suits them to be evidence, but rather, as I argued in chapter 1, their ability to play the functional roles of evidence that suits them to be evidence. There are many ways in which values might be suited to play such roles. For instance, when dealing with social, psychological, or biological subject matters where the appropriate categories themselves are thick concepts—that is, concepts with both descriptive and normative content intertwined—then any ordinary evidence expressed in terms of such concepts, such as recording the gender of a participant or measuring something like violence or intelligence, will itself encode a value judgment as well as a description of what is going on. In some cases the immediately experienced value of something can provide defeasible evidence, for example, of its desirability. For example, a positive experience with some new activity may provide evidence that the activity is genuinely valuable, or the displeasure at the taste of something that might or might not be food may provide some evidence that it is not desirable to eat, though in both cases that evidence can be countered with further information.

Feminist philosophers have pointed to the role of value systems, like feminism, egalitarianism, or androcentrism, and the fact that some prove empirically fruitful across various inquires, while others seem to lead inquiry down bad roads (for example, androcentrism). The use of such guiding value systems that have proven their fruitfulness might be considered as a kind of evidence by increasing our confidence in hypotheses that fit with them. In Sharyn Clough's example, one archeological theory may obtain genuine evidential support from its fit with feminist values, especially in contrast to an androcentric theory that ignores or undervalues women's lives or experiences.[20] This is reasonable given the past record of feminist and androcentric values in science.

There is also a special case in which "wishing" *does* make it so, namely, when wishing motivates action that brings about the thing wished for or makes it possible for us to gain evidence that it is so. William James brings many such cases to light in his classic, "The Will to Believe." Any social phenomenon that requires

19. Reich, "Embattled Neutrino Project Leaders Step Down."
20. Clough, *Beyond Epistemology*, 116.

collective action is like this. But so are other kinds of circumstances: "We stand on a mountain pass in the midst of whirling snow and blinding mist, through which we get glimpses now and then of paths which may be deceptive. If we stand still we shall be frozen to death. If we take the wrong road we shall be dashed to pieces. We do not certainly know whether there is any right one. What must we do?"[21] Only by wishing that one road is the right one, and choosing to follow it, will I possibly have the fortitude to survive. If I am lucky, it is my wishing, and acting on that wish, that makes it the case that I discover it was the right road after all. Such cases are more relevant to science than it may at first appear. Science is, first and foremost, practical inquiry which sets in motion practices of prediction and control that remake the world we live in. As such, we sometimes find ourselves precisely in the predicament James discussed.

In such cases the wishes are not themselves precisely evidence, if we construe "evidence" narrowly as having the functional role of providing the facts of the case or recording experimental tests.[22] Rather, they allow us to make the "leap of faith" necessary to make judgments which, retrospectively, provide the evidence that the leap was justified. In these cases, values are not evidence, but they precede evidence, and they "make it so" in the sense of causing our judgment to be true. As such, values are sometimes direct reasons for making scientific judgments.

These remarks on values *as* evidence are, I hope, suggestive, but not ultimately dispositive. To assess whether it makes sense to think of values as (sometimes) evidence, we really need an account of the sources and status of values. Providing such an account is the business of the following two chapters.

ANALYSIS: PROBLEMATIC APPROACHES TO VALUES IN PHILOSOPHY OF SCIENCE

In the section above I have discussed some of the problems in the ways we talk about values when we talk about values in science. This problem is especially acute in philosophy of science when values are discussed, whether the philosopher in question is for or against value-free science. In a paper from 1972 (the dark times for discussions of values in science) Michael Scriven wrote: "If there is one set of arguments worse than those put forward for 'value free science,' it is

21. James, "Will to Believe," 347.

22. See "The Phases of Inquiry in Detail," p. 44.

those put forward against it. Both sets have one common characteristic, besides a high frequency of invalidity, and that is the failure to make any serious effort at a plausible analysis of the concept of 'value judgment,' one that will apply to some of the difficult cases, and not just to one paradigm."[23] While it is no longer plausible that the arguments against the value-free ideal are worse than the ones in defense of it (and it seems to me it wasn't so plausible in 1972), Scriven's main complaint remains a serious problem for the values in science literature. The generations working on science and values prior to Scriven (for example, Dewey, Rudner) recognized the need for such an account, and some attempted to provide a theory adequate to the task. Contemporary philosophers of science, with a few exceptions,[24] have not recognized that they need such accounts, and they have tended to make serious errors as a result.

The Roots of Noncognitivism

Noncognitivism has a complicated history within philosophy of science. Noncognitivism was a broadly shared commitment of the members of the Vienna Circle,[25] and the influential strain of logical empiricism that followed from it. These philosophers were keen to distinguish the meaningful parts of philosophy and science that could be based in empirical data and logical/mathematical reasoning from the nonsense of metaphysics, normative ethics, and superstition. These philosophers centered logic and philosophy of science, and while their views have largely fallen into disfavor in analytic philosophy in general, within philosophy of science they still have a certain influence. In particular, I think their commitment to noncognitivism survives in the intuitions many philosophers of science have about values.

Rudolph Carnap's thesis that value judgments are meaningless is the most well-known statement of noncognitivism among the logical empiricists, and usually it is thought to be representative. However, even for Carnap the situation

23. Scriven, "Exact Role of Value Judgments in Science."

24. I note especially the work of Sharyn Clough and Dan Hicks in this connection.

25. The Vienna Circle was a group of philosophers and scientists who gathered (originally) around Moritz Schlick in Vienna in the 1920s and 1930s to discuss issues of mutual interest, including the ideas of Ernst Mach and Ludwig Wittgenstein, the relation of science and philosophy, and the pernicious political and scientific impact of certain forms of metaphysics. The group birthed two movements with an enormous impact on the early field of philosophy of science: logical empiricism (or logical positivism) and the unity of science. See Uebel, "Vienna Circle."

is complex. In his early philosophical work, *Der logische Aufbau der Welt* (*The Logical Construction of the World*), Carnap made a place for values as meaningful, one of the objects of study for scientific philosophy. However, around 1929–1931 Carnap came to accept a strict separation of facts and values and to regard value judgments as "meaningless metaphysics" (a term of abuse applied widely by the Vienna Circle).[26] Carnap did not hold that science could be entirely value-free; in particular, in Carnap's mature view the choice of linguistic or ontological framework, undeniably a feature of science and scientific philosophy, was decided on "pragmatic grounds." They could not be decided by logic or empirical evidence alone, but must be decided by value-laden considerations about how the framework was suited to our purposes. He called these "external questions," and they are clearly decided by value judgments.[27]

Hans Reichenbach fortified Carnap's noncognitivism by drawing a sharp distinction between the context of discovery and the context of justification, where the former includes all the contingent, messy, and potentially value-laden aspects of scientific inquiry, while the latter concerned only the objective, abstract, logical relations between theory and evidence. Reichenbach likewise thought that nothing normative belonged to the context of justification, and that there could be no knowledge of normative matters. Reichenbach puts the point in no uncertain terms: "The modern analysis of knowledge [into the purely analytic, tautologous statements of logic and mathematics and the synthetic statements about matters of fact] makes a cognitive ethics impossible: knowledge does not include any normative parts and therefore does not lend itself to an interpretation of ethics . . . if it could be carried through . . . ethical rules would be deprived of their imperative character. The two-thousand-year-old plan to establish ethics on a cognitive basis results from a misunderstanding of knowledge, from the erroneous conception that knowledge contains a normative part."[28] According to Reichenbach, values have no part in science (at least in the context of justification, the part of science that delivers knowledge), and values have no cognitive status whatsoever.[29] Carnap's "external questions," properly shunted into the context of discovery, could be treated as totally separate from science proper, which is value-free.

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26. Mormann, "Carnap's Logical Empiricism, Values, and American Pragmatism."
27. McMullin, "Values in Science," 12–13.
28. Reichenbach, *Rise of Scientific Philosophy*, 277.
29. Douglas, *Science, Policy, and the Value-Free Ideal*, 48–49.

Otto Neurath is something of an exception to the rule on many of the supposed doctrines of the Vienna Circle, and this case is no different. Neurath articulates a version of the underdetermination argument (see "The Underdetermination Argument," p. 80), and a form of epistemological holism, and on that basis sees science as necessarily value-laden all the way down.[30] Yet Neurath seems to have accepted the standard noncognitivist line on values themselves, eschewing the term "values" itself in favor of "auxiliary motives," emphasizing that though one could be motivated by values, the attempt to reason about them was a kind of pseudo-rationalism.[31]

While few philosophers today subscribe to the tenets of logical empiricism, and even philosophy of science is undoubtedly in a "post-positivist" era, this does not mean that these noncognitivist views are entirely dead. Rather than being an explicit commitment grounded in a theory of meaning, as it was for Carnap, for example, today this view of values survives as part of an implicit model.[32] Implicit models tend to drive philosophical intuitions and beliefs when the subject of the model is not an explicit topic of investigation. The implicit model of values that most philosophers of science work with, whether or not they think that science ought to be value-free, is generally an emotivist or at least noncognitivist one. Noncognitivist assumptions or presuppositions pervade discussions of values in science on both sides. There are a few key exceptions to this rule (for example, Elizabeth Anderson, Sharyn Clough, Dan Hicks, Lynn Hankinson Nelson), and others explicitly deny that they hold a noncognitivist view, while continuing to defend claims that seem to me to necessarily presuppose some kind of noncognitivism.[33]

The roots of noncognitivism run deep in philosophy of science. This has had a deleterious effect on the treatment of science and values.[34] We must thus thoroughly rethink the nature of values and value judgment in order to reorient our thinking in this area along productive tracks.

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30. Howard, "Lost Wanderers in the Forest of Knowledge."

31. Neurath went as far as to try to get John Dewey to change the title of his contribution to the *International Encyclopedia of Unified Science* from *Theory of Valuation* to *Empirical Axiology*.

32. For more on implicit models in philosophy of science, see Brown, "Functional Complexity of Scientific Evidence."

33. For example, see my exchange with Dan Steel over the epistemic priority thesis in Elliott and Steel, *Current Controversies in Values and Science*.

34. Arguably, it has had a similarly deleterious effect on ethics and value theory more broadly by separating them from science.

Epistemic Priority: Underdetermination and Inductive Risk

The two most important arguments for the value-ladenness of science are the underdetermination argument and the argument from inductive risk, already discussed at length in the previous chapter. The underdetermination argument, also called "the gap argument,"[35] argues from a gap between theory and evidence, to the need to fill that gap, to the permissibility or even the necessity of values in science. Once the evidence is in, a gap remains in definitively determining how it bears on the hypothesis (holist case) or which competing hypothesis to accept (contrastive case). In this case it can be legitimate to fill the gap with social values. Indeed, one may have a responsibility to do so.[36]

The other argument, the argument from inductive risk, also known as "the error argument"[37] and the "James-Rudner-Douglas Thesis,"[38] focuses on the uncertainty endemic to the ampliative inferences in science—not just the final decision to accept or reject a hypothesis or theory, but also a variety of earlier inferences in scientific reasoning that are themselves uncertain, such as categorizing an observation as being of a certain kind, or adopting a model of a phenomenon. With such uncertain inferences, inquirers must decide whether there is enough evidence to make the relevant inference. What counts as enough should be determined by how important the question is, that is, the seriousness of making a mistake. That importance or seriousness is generally (in part) an ethical question, dependent on the ethical evaluation of the consequences of error.

These two arguments against the value freedom of science share a common premise. The gap argument holds that values can play a role in the space fixed by the evidence; if the gap narrows as more evidence comes in,[39] there are fewer ways in which values can play a role. *If* the gap could ever close, the conclusion would be value-free. The inductive risk argument allows values to play a role in decisions about how to manage uncertainty—not directly by telling us which option to pick, but indirectly in determining how much uncertainty is acceptable.

Both arguments begin from a situation where the evidence is fixed and take values to play a role in the space that is left over. The reason that values must

35. Intemann, "Feminism, Underdetermination, and Values in Science."

36. Elements of this section have been developed in Brown, "Values in Science beyond Underdetermination and Inductive Risk."

37. Elliott, *Is a Little Pollution Good for You?*

38. Magnus, "What Scientists Know Is Not a Function of What Scientists Know."

39. Which it will not always do anyhow. See Hicks, "Inductive Risk and Regulatory Toxicology."

play a role is that some sort of uncertainty or indeterminacy remains once the evidence is in. In a relatively weak version of this argument, social values fill in the space between evidence and theory because something has to, so it might as well be (and often is) social values. In more sophisticated versions, we must use social values to fill the gap because of our general moral obligation to consider the foreseeable consequences of our actions, including the action of accepting a hypothesis. All of the forms of these two arguments assume the *lexical priority of evidence*. The premise of lexical priority guarantees that even in value-laden science, values do not compete with evidence when the two conflict. This is often defended as an important guarantor of the objectivity or reliability of the science in question.

I have already criticized the epistemic priority thesis and the lexical priority of evidence (see "The Priority of the Epistemic," p. 93). The worries about wishful thinking that drive it, and the noncognitivism behind those worries, are problematic to say the least. The reduction of the distinction between values and value judgments implied by such a coarse noncognitivism is highly problematic. Valuing may be the expression of a preference, but value judgments are reflective decisions about what to value, and are better and worse on the basis of reasons.

If value judgments are really judgments—adopted for good reasons, subject to certain sorts of tests—then it is unreasonable to treat them according to any version of the epistemic priority thesis. Just as the good (partly empirical) reasons for adopting a theory, hypothesis, or background assumption can sometimes give us good reasons to reinterpret, reject, or even ignore evidence apparently in conflict with them, so too with a good value judgment. In treating values as having qualitatively lower epistemic status than evidence, lexical priority shows itself to be an unreasonable presumption. If evidence and values pull in opposite directions on a hypothesis, then we should not always be forced to follow the (putative) evidence.

The gap and error arguments, of course, do not need to be understood as being ultimately committed to epistemic priority. We can consider them to be *strategic* arguments rather than *ultimate* accounts for the value-ladenness of science. As such, these arguments assume an account of the relationship between evidence and values closer to what the defender of value-free science accepts, in order to provide an argument that an interlocutor might accept. Starting instead from the contingency argument, we do not have the same problematic assumptions about the relationship of values to science. Contingencies may or may not involve evidential uncertainties. Even when they do, evidence is not privileged.

The contingency argument assumes only that there are cases where there is more than one reasonable way to proceed, reading "reasonable" in broad terms. Evidence, logic, standards, and values are all relevant to settling contingencies.

Critical Contextual Empiricism

One positive proposal for dealing with the "gap" of underdetermination is from Helen Longino.[40] Her account of "critical contextual empiricism" or "social value management" accepts that scientists do and should use their values to guide their inquiries, and places little limitation on how they do so. Indeed, the influence of social values is necessary to setting appropriate epistemic standards for research. What guarantees the objectivity of science, according to Longino, are the norms that should govern critical discussion in the scientific community. The norms are:

1. *Public venues for criticism*—Recognized forums for sharing and criticizing research exist and are available to the community.
2. *Uptake of criticism*—The discourse of the community, and the beliefs and arguments of community members, develops over time in response to critical interaction. This does not mean that every member must revise every belief that comes under critical scrutiny, but that over time their responses take into account the criticisms made.
3. *Public standards*—The community shares some standards of evaluation and criticism. These standards need not be static or absolute, but there has to be enough of a shared core that criticism can be widely regarded as relevant and fair.
4. *Tempered equality of intellectual authority*—Everyone in the community has equal access to the public venues of publication and criticism, and everyone's voice "counts" in the debate, subject to differences in talent, ability, and experience relevant to the question at hand, and also limited by the condition of uptake. All the relevant perspectives must be included.

According to Longino, a community structured according to these norms will engage in "transformative criticism" and will be objective and produce knowledge in the sense we should care about. There is little guidance for individual

40. Longino, *Science as Social Knowledge*; Longino, *Fate of Knowledge*; Kourany, "Replacing the Ideal of Value-Free Science."

scientists, other than that they must act in accordance with the community structure above. There is no particular restriction on how values are incorporated into an individual scientist's or research group's work.

A requirement of *diversity* is a straightforward consequence of equality of intellectual authority. "What consensus exists . . . ," Longino writes, "must be the result of critical dialogue in which all relevant perspectives are represented. . . . Although requiring diversity in the community, this is not a relativist position."[41] Similarly, in *The Fate of Knowledge*, elaborating on tempered equality of epistemic authority, Longino writes, "A diversity of perspectives is necessary for vigorous and epistemically effective critical discourse"[42] According to this requirement, the scientific community should not exclude members based on their values or their social or economic position in the wider society, and in fact, where feasible, should foster the diversification of the scientific community along social-demographic and value-commitment dimensions that are currently underrepresented, so long as the new members commit to the norms of transformative critical discourse.

Longino's account, like the accounts previously discussed, seems like it may be committed to some implausible claims about values. First, many scholars have read Longino as committed to encouraging the diversification of values in the community, even when those values are ethically pernicious.[43] Of course Longino nowhere argues that we should do this, but it is hard to see how she can avoid this conclusion. In her discussions of tempered equality, she consistently argues that we should not exclude dissenting perspectives prior to the critical dialogue, that considerations like "social position" and "economic power" are not legitimate reasons for exclusion or decreased intellectual authority; on the positive side, only talent, training, experience, and (epistemic) relevance, all value-neutral considerations, are brought up as potential reasons. Only the social process of transformative criticism can provide a judgment against certain values, and that judgment is contextual. It seems like racists, sexists, eugenicists, and such cannot be permanently excluded from the discourse community.

Second, connected with this last point, Longino's account holds that the influence of values must and can be "managed" only through this critical social

41. Longino, "Subjects, Power, Knowledge," 113.

42. Longino, *Fate of Knowledge*, 131.

43. Kourany, "Philosophy of Science"; Kourany, "Replacing the Ideal of Value-Free Science"; Intemann, "Feminism, Underdetermination, and Values in Science"; Hicks, "Is Longino's Conception of Objectivity Feminist?"; Pinto, "Philosophy of Science for Globalized Privatization."

process in order to remain objective, so that idiosyncratic epistemic standards, buttressed only by controversial social values, do not go unchallenged. As the critical process continues, it washes out the idiosyncrasy to some degree. That is, while diverse value judgments may continue to influence different approaches within the community, they must be able to withstand and respond to criticism from other approaches. This approach involves a kind of denial of individual value judgment. As Sharyn Clough puts it, "the only way to address the potentially biasing role they can play is not through empirical assessment of the values themselves, but through the careful balancing of a diversity of values in our research communities." This fits well with Longino's social account of objectivity: for both science and for values, objectivity is a consequence of the right kind of social credibility process. So it is not quite right for Clough to say that, for Longino, "there is no objective way to decide between values."[44] Rather, the objective process of value judgment is a social credibility process, just the same as for scientific knowledge. The problem, from our point of view, is that this provides no guidance for individuals, and no process of empirical inquiry into values. We need an ideal that functions at that level as well.

The Role Restriction Ideal

Another account with much to recommend it is Heather Douglas's role restriction ideal, which derives from the inductive risk arguments discussed in the previous chapter.[45] On Douglas's account, as on my own, values must be used to make a variety of contingent choices in science. According to Douglas, in order to distinguish legitimate and illegitimate uses of values, we must distinguish when it is appropriate for values to play *direct* versus only *indirect* roles. A direct role is a reason to decide or to act. So when we decide to pursue one research project over another because we believe it will better serve a valued aim, then that valued aim plays a *direct* role in the decision; it decides the question on the background of what we know about the two projects and in concert with other relevant aims and values. An indirect role relative to a question means a reason for adopting a standard, criterion, or method for answering the question, but not a reason for choosing one answer over the other. So when we are deciding whether to accept

44. Clough, "Feminist Theories of Evidence and Biomedical Research Communities," 73.
45. "The Argument from Inductive Risk," p. 82; Douglas, "Inductive Risk and Values in Science"; Douglas, *Science, Policy, and the Value-Free Ideal*; Douglas, "Values in Science."

or reject a hypothesis based on the evidence we have gathered, we can use value judgments to set standards for evidence and determine the trade-off between false positive and false negative error, but we should not consider the bearing of our values on the hypothesis itself (and presumably, we should make these decisions before performing the analysis, to avoid using values in the direct role to manipulate the outcome).[46]

This account has several significant virtues. For one, it distinguishes values and evidence according to their functional roles in inquiry, a crucial pragmatist move. It recognizes that value judgments are central to both determining the aims of inquiry and constraining its direction. In addition, it provides a conceptually, strategically, and rhetorically useful entry point to thinking about values in science, as well as a way to think about when values are needed and when their role could exercise a problematic influence on science.[47]

I take two important lessons from the role restriction account. One is a particular way of characterizing the functional distinction between the roles of values and of evidence in scientific inquiry, founded on the distinction between reasons to act and reasons for claims (practical and theoretical reasons). Second, on the basis of the first lesson, we can see the relevance to discussions of values in science of understanding the *norms of assertion* and taking them into account.[48] Despite these lessons, there are significant problems with the role restriction account. First, it mistakenly ties values as ordinarily understood only to reasons to act. Second, it implies the denial that the norms of assertion are defeasible norms. Third, it is committed to epistemic priority, and thus makes too much of the distinction between "internal" and "external" parts of scientific inquiry.

When we look closely at the role restriction account, we see that it is founded on the distinction between two types of reasons: *reasons to act* (practical reasons) and *reasons for claims* (theoretical reasons).[49] Reasons to act provide motivations to do something or make a certain decision; they also justify, in the ethical or practical sense, the action taken or the decision made. Reasons for claims, on the other hand, stand in logical or evidential relationships to those claims; they justify them in the epistemic sense. What the inductive risk argument shows

46. There is one exception to this rule: what Douglas calls the minimal epistemic standards (or criteria) of empirical adequacy and internal consistency could be considered epistemic values that should play a direct role.

47. Hicks, "Inductive Risk and Regulatory Toxicology"; Douglas, *Science, Values, and Democracy.*

48. Franco, "Assertion, Nonepistemic Values, and Scientific Practice."

49. Brown, "Descriptive, the Normative, and the Entanglement of Values in Science."

is that no amount of reasons for claims compels us to jump the inferential gap from reasons *for* a claim to reasons *to* assert or infer that claim. Assertions and inferences are actions, and so require values to justify them.[50]

It should be clear that there is no *general* problem of values, ordinarily so-called, standing as reasons for claims. When we are engaged in ethical discourse, for example, values will justify other claims about values. Douglas's account implies that they will not similarly do so in science, but this seems to me to depend on the context, on the nature of the claim in question, and on the nature of the relevant values. For instance, when value-laden thick concepts appear in the claim, values might stand as reasons for such claims, even if they are not by themselves sufficient reasons.[51]

When it comes to assertion, the reasons to act become a tricky matter. As Paul Franco has recently argued, we should shift our attention from the role of values in belief or acceptance to assertion.[52] The norms of assertion are the second source of what's right in the role restriction ideal. Inductive risk is a necessary consideration in assertion because one has a moral obligation to consider the perlocutionary effects of one's assertions.[53] In terms of role restriction, it is central to the norms of assertion that one should not assert something one knows or believes to be false (the sincerity norm). This norm is of course defeasible; sometimes it is permissible or even obligatory to lie, and a lie does not cease to be an assertion.[54] But one does so at the cost of corrupting the practice of assertion and the social relations that normally depend on it. Nevertheless it seems that the norms of assertion, and likewise the role restrictions, are defeasible, if only in extreme circumstances and at significant cost. One does not fail to assert when one lies, and one does not fail to do science when one makes an assertion merely because it fits with one's values, despite evidence to the contrary; however, in both cases one does something *pro tanto* wrong.[55]

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50. And on the pragmatist view defended in Chapter 1, all scientific inquiries concern action, whereas reasons for claims are always instrumental to judgments about what to do.

51. See "Values as Evidence," p. 97, and "Facts versus Values," p. 142.

52. Franco, "Assertion, Nonepistemic Values, and Scientific Practice"; compare Douglas, *Science, Policy, and the Value-Free Ideal*, 70.

53. Franco, "Assertion, Nonepistemic Values, and Scientific Practice," 176.

54. Stokke, "Lying and Asserting."

55. Something is *pro tanto* wrong, as opposed to *absolutely* wrong, when this feature contributes negatively to the evaluation of the action, but nevertheless in some contexts it still may turn out to the be right thing to do for other reasons.

The direct/indirect roles distinction and the role restriction ideal assume overly simplistic distinctions between discovery and justification, external and internal aspects of science, as well as too simple a view of the landscape of values. We need a more complex account of the roles for values, given a richer theory of scientific practice than the context distinction provides, and the varying types and statuses of values that play a role in science.

NEXT STEPS: THE SOURCE AND STATUS OF VALUES

A proper account of values that fills the need identified by this chapter must answer two questions:

1. Where do values come from?
2. How do we judge and warrant values, and what is the status of warranted value judgments?

The first question must receive a science-safe answer, that is, one broadly compatible with naturalism. On the one hand, this means that we cannot require scientists to presuppose supernatural sources of value or an inherent purpose or telos to the universe. These presuppositions are difficult if not impossible to reconcile with science, and would no doubt cause significant dissonance for many scientists. On the other hand, the answer must not draw us into pure subjectivism and noncognitivism, lest the specters haunting this chapter return. The second question must provide a positive account of the cognitive status of value judgments, without leading into absolutism and closed-mindedness about values. Ideally, the answers to both questions will be compatible with the normative pragmatist framework as well.

We need to show, on the one hand, that values can be more than mere wishes and desires, and on the other hand, how they can be held fallibly rather than absolutely. The implicit noncognitivism that tends to crop up in our discussions of values in science must be overcome, but the tendency of ethics to seek absolute, foundational principles will not be helpful in our case, either. We need an account of fallible value judgment in practice that explains the cognitive status of values.

The next two chapters take up these two questions, respectively. I will provide answers to each of the questions in turn, in ways that fit with a broad naturalism, with the account of inquiry discussed in chapter 1, with the need for

value judgments raised in chapter 2, and with the problems raised in this chapter. These chapters develop a pragmatic pluralist answer to the first question, about the nature and sources of values, and a theory of value judgment as pragmatic-empirical inquiry in answer to the second.

CHAPTER 4

THE SOURCES AND TYPES OF VALUES IN SCIENCE

Qualitative individuality and constant relations, contingency and need, movement and arrest are common traits of all existence. This fact is source both of values and of their precariousness; both of immediate possession which is casual and of reflection which is a precondition of secure attainment and appropriation.

—John Dewey, ***Experience and Nature***

INTRODUCTION: WHAT ARE VALUES? PRAGMATIC PLURALISM DEFINED

In the previous chapter I argued that a better theory of values is necessary for an adequate account of values in science, and that other accounts of values in science have tended to focus on giving accounts of the nature of science and the role of values therein while leaving *values* as an empty placeholder, vaguely identified with ethics, political views, desires and wishes, or stakeholder interests. I have shown that this inattention to the nature of values has led theorists of values in science astray, down unproductive paths marked by incorrect assumptions

Epigraph: Dewey, *Experience and Nature*, 308.

about the nature and status of values. Even the lengthy discussions of so-called epistemic values in philosophy of science have rarely touched on what exactly makes them *values*, focusing instead on what makes them *epistemic*.

We need not engage in deep metaethical inquiry into the ultimate reality of normative facts, nor engage in fundamental normative ethical theory building, however. Such inquiries tend to be abstruse, a priori, and remote from questions of practice; they also often produce accounts of the nature of values that are not "science-safe," assuming prescientific conceptions of human nature, mysterious nonnatural facts, pure subjectivism, or absolutism.

It will be enough to develop an account of values that fits our everyday experiences of valuing and decision making, the role of valuing in our practices, in human life broadly. We are not concerned here with ultimate theories of right and wrong, with what ethicists would call "criteria of rightness" or "theories of right-making characteristics of action." In any case, such accounts are elusive and often quite abstract. It is enough for us to concern ourselves with the variety of lived values and procedures of decision making, with the cognitive status of such values rather than their ultimate metaphysical foundations. This more proximate study of the nature of values is (partly) empirical—drawing on both lived experience and scientific study. This sort of shallow metaethics and mid-level normative theorizing is better for the purposes of this work.

I propose that we adopt, for these purposes, a pragmatic pluralism about values that has the following features:

1. Values are inherently connected with action and practice.
2. There are many sources of values in human life and practice.
3. There are many different types of values in terms of their functions in life and inquiry.
4. There is a central distinction between what we unreflectively or habitually value and the results of value judgment, between what we might call valuing and evaluation, or between unreflective desires and preferences and reflective needs and interests.
5. Value judgment is a type of practical-empirical inquiry ultimately connected with questions of what to do, with the same basic structure as scientific inquiry.
6. Value judgments, in some contexts, come with evidential warrant.

In this chapter I will discuss (1–3): the proximate nature, the sources, and the types of values. Points (4–6), concerning value judgment and evidential

support, will largely remain in the background, to be taken up in the following chapter. The present chapter will establish that values can have cognitive status and evidential value, rather than being mere subjective wishes, without being mysterious or scientifically disreputable entities. We can recognize that valuing is a natural feature of human activity without positing a deflationary/reductionistic account of values along behaviorist, psychologistic, or evolutionary lines.

ARGUMENT: AN ABUNDANCE OF VALUES

This section demonstrates what can be accomplished by taking pragmatic pluralism as a guiding hypothesis in the investigation of the proximate nature of values. First, I will shed light on the connection of values and action. Second, I will show the many sources of our values, and what this tells us about how various values work. Third, I will discuss the various types of values, distinguished by their functional roles in practice and activity, as well as the differences in cognitive status associated with each.

The Connection of Values to Action

Valuing lies at the heart of acting, activity, and practice. To value something is to be disposed to act for the sake of that thing. Values figure centrally in action-explanations, often so deeply that they are included only implicitly. If I ask you, "Why do you drink diet soda?," you might offer a number of enthymatic explanations: "Because it has zero calories," "Because it tastes almost as good as regular soda," "Because I am trying to lose some weight," or "Because corn syrup isn't healthy." In the background of all of these explanations are values related to health or body image, values that can be difficult to subject to critical scrutiny when left implicit (and in this example, for many, deeply in need of being subjected to critical scrutiny).

Value claims have many forms (a point we'll focus on more below). "Ought" claims, for example, "one ought to keep promises," tend to demand (or forbid) specific courses of action. Other value claims attribute properties to things: "honesty is good," "dietary fiber is healthy," "the Mona Lisa is beautiful." These statements, in a more general way, call us to act for the sake of those attributes in certain contexts or given certain ends. Other value claims refer to virtues of people's character, virtues that we ought to admire in others and cultivate in ourselves. Still other value claims involve whole worldviews that connect multiple types of value claims with beliefs about the way the world is.

Our understanding of values thus allows us to make sense of action. That said, the relation of values both to action and to conscious desire is complicated. There is a spectrum of conscious awareness of values between totally implicit habits and explicit desires, and there is also a spectrum of relations to behavior, from directly motivating behavior to one's behaviors typically going against one's values. Values need not, in every case, be thought of as conscious desires. In some cases, we can infer deeply ingrained value attitudes from patterns of behavior that are *contrary* to explicit desires, as when an avowed antiracist still displays racial biases in day-to-day dealings with various people. Such a person has *both* racist and antiracist values, where *values* stands for different kinds of valuings. We may explicitly hold ideals that conflict with our conscious desires or with our unconscious habitual values. In that case, our ideal values are a kind of desire-to-desire, but we have not yet successfully internalized them such that they modify all of our desires, and so they may rarely predict or motivate behavior. Sometimes our values reflect what we happen to be valuing, by force of tradition or habit, and sometimes they are a result of explicit and reflective evaluation, though the effect of the latter on our day-to-day attitudes, habits, and desires may be slow. So while values are intrinsically linked to action, the links are rarely clear and direct.

The Many Sources of Values

The previous discussion of the connection of values with action outlines a general sense of the nature of value in terms of its role in our lives. Values capture our esteem and our estimation of the features of things, events, and especially actions, within a particular situation. To this general characterization, we can add two further levels of detail that will help us understand how values work. The first, to be taken up immediately, is where our values come from. The second, to be taken up in "The Functional Types of Values" (p. 135), is the different types of values according to their different functional roles in experience, decision making, and inquiry.

Many discussions of values, especially values in science, leave open the specific content and sources of values, using "non-epistemic values" or "social and ethical values" as a placeholder. By contrast, in trying to explore at length the many sources of our values, I hope to show that such values are neither arbitrary nor subjective in a troubling way; nor are they mysterious entities outside the bounds of science. Many of our values are as objective and as tractable as the

laws and posits of science. I follow Richard Rudner[1] and Abraham Kaplan[2] in thinking that the question of the objectivity of value-laden science is in part a matter of the objectivity of values.[3] This may sound mysterious, but it will be the burden of this and the next chapter to show that it need not be. While we do have some arbitrary preferences and idiosyncratic enjoyments, these are extreme cases. On the other extreme, some few values have a claim to be considered biological universals. There is a spectrum in between where many of our values lie.

In discussing the sources of value, I will be moving, in a sense, from the more broadly shared to the more particular. I will begin with biological sources of value, values that are implicated in the very activity of life. I do not mean here to propose a biologically reductionist account of value, but rather to suggest that the basics of living activity imply values or something like them. From there I move to values that are basic preconditions of sociality as such. And although we do not share these with highly isolationist species, given the constitution of humans as social animals, these are as basic for us as biologically based values. From there we move to more particular forms of value: cultural values, personal and professional values, values at the heart of science as a practice and profession, and the values that are inherent in democracy. The particularity of these later sorts of values implies a kind of pluralism at that level, but not a kind of subjectivism or crass relativism about values; rather, it is a form of contextualism.

I am not proposing here an ultimate metaethical pluralist theory, though personally I find such theories plausible. When I talk about "sources" of values, I do not mean some ultimate metaphysical theory at all. Perhaps a clever reductionist will show that all values will be reducible to evolutionary facts. Perhaps the long tradition of moral fundamentalism will pay off and develop one overarching normative theory from which all of the particular value claims can be derived. I remain agnostic on this point and stay at the level of the particular value claims and their sources in our lives, experiences, and practices. When I speak of the

1. "What is being proposed here is that objectivity for science lies at least in becoming precise about what value judgments are being and might have been made in a given inquiry—and even, to put it in its most challenging form, what value decisions ought to be made; in short that a science of ethics is a necessary requirement if science's progress toward objectivity is to be continuous"; Rudner, "Scientist qua Scientist Makes Value Judgments," 6.

2. "The objectivity of science demands its being value-free only if values are necessarily and irreducibly subjective"; Kaplan, *Conduct of Inquiry*, 387. Compare the discussion of Kaplan in Mormann, "Carnap's Logical Empiricism, Values, and American Pragmatism."

3. Kitcher is committed to a similar view in *Science in a Democratic Society*, though not as explicitly.

"sources" of value, I am focusing on tracing values back to the activities, experiences, and practices in which they arise.[4]

Biological Sources of Value

As argued above, valuing lies behind all activity, practice, action, or undertaking. Even when explicit reasoning on the basis of values is absent, implicit value attitudes are part of any activity. In a sense, it is activity—striving or acting-for-the-sake-of—that characterizes life. From the simplest amoeba to the most complex animals, living organisms interact with their environment in ways that allow them to sustain and reproduce themselves. While many organisms are far more passive or far less intelligent than ourselves, in some sense they're all active or striving in this way. In that sense then the origin of life is also the moment that values, as a necessary element in understanding activity as activity, emerge into the world.[5] The striving and aversion evident even in the activity of an amoeba implies rudimentary values.

Of course saying that there are biological *sources* of value does not mean the reverse, that biological processes or evolutionary history are themselves teleological. That organisms have values, properly understood, need not be at all mysterious, nor commit us to the idea that organisms have a final cause and inherent, ultimate value. (They may or may not. Aristotle thought they did, as do some contemporary environmental ethicists.)[6] Nor does it imply that evolution has some final goal. It also does not stake a claim about consciousness or cognition (in the way we normally think about them) in amoebae. All it means is that organisms strive for some things and avoid others in an organized way. Values can be understood to an extent behaviorally, as the aims, objects, or ends that activity is directed toward.

Biologically based values are valuings of the necessary conditions of a core feature of life, which we might characterize as organism fitness,[7] homeostasis,[8] or allostasis.[9] That is, those things that are necessary to the maintenance and

4. Throughout this discussion, I am highly indebted to Johnson, *Morality for Humans*.

5. See Evan Thompson's discussion of "norm-guided behavior" in autopoetic systems in *Mind in Life*.

6. For example, Taylor, *Respect for Nature*.

7. Flanagan, *Really Hard Problem*.

8. Damasio, *Self Comes to Mind*.

9. Jay Schulkin, *Adaptation and Well-Being*. Compare Johnson, *Morality for Humans*, chap. 2.

regulation of an organism oriented toward survival and propagation/reproduction are the biological source of values, chronologically the first source of values. For aerobic organisms, for example, breathable air is an important value.

Mark Johnson characterizes such values as "enabling conditions . . . for even the most modest human survival and well-being."[10] He provides a list of examples:

- food capable of sustaining life processes
- a moderate climate that avoids extremes. . . that would destroy life
- sufficiently clean air and water
- protection from predators or others who might do one harm
- care and nurturance necessary for an infant (and child).[11]

The list is neither exhaustive, nor perhaps the best version of such a list. But it does suggest the sort of values that have a biological basis. Note that not all biological organisms will share these biological values, but that all human beings, as members of the species, will share them.

Biological values come *first* in two respects. They are historically or chronologically the first kinds of value to come into existence with very basic organisms. (Or, if you are uncomfortable attributing values to nonhuman organisms or some subset thereof, with the very first humans.) They also come first in that they are basic preconditions for other types of value. It is difficult if not impossible to fight for justice when one lacks food to eat or sufficient resources to nurture one's own children.[12]

It would be a mistake to move from the fact that these values come first (in either sense) to the claim that they are the only or the overriding types of values, to conclude either that, as many reductionists do today, all legitimate values are systematically founded in these values, or, as the social Darwinists did, that we should strive for organismic fitness above all else. In one of his earliest publications, William James criticized the social Darwinist Herbert Spencer along just such lines. According to Spencer, the ultimate purpose served by the human mind is survival through adaptation or adjustment to the demands of the environment. But as James rightly points out, "To common sense, survival is only one out of

10. Johnson, *Morality for Humans*, 56.
11. Johnson, *Morality for Humans*, 56.
12. Nussbaum, *Women and Human Development*; Johnson, *Morality for Humans*, 56.

many interests"; one only made a worthy value through the existence of others: "The social affections, all the various forms of play, the thrilling intimations of art, the delights of philosophic contemplation, the rest of religious emotion, the joy of moral self-approbation, the charm of fancy and of wit—some or all of these are absolutely required to make the notion of mere existence tolerable; and individuals who, by their special powers, satisfy these desires are protected by their fellows and enabled to survive, though their mental constitution should in other respects be lamentably ill-'adjusted' to the outward world."[13] If anything, to us survival is a mere necessary condition for pursuing other values, more instrumentally than intrinsically valuable. So it goes for many of the biologically grounded values.

The Preconditions of Society

Humans are social animals. As basic to our species's survival and flourishing as the biologically based imperatives discussed above are the norms that make social interaction possible and functional. We can hardly have the one without the other. These basic social values include whatever is necessary for society as such to exist and function. Indeed, because society is essential to our survival and flourishing, and because sociality is key to the way we humans satisfy most of our other biological values, it is fair to say that the most basic social values are, for humans, biological values as well.

Communication, cooperation, and joint action are central to human ways of life. None of these is unique to humans among social animals, but it seems fair to say that these things are uniquely well developed, in scale if nothing else, but also probably in flexibility and quality. We work together to meet our needs, whether in small hunting or gathering parties or in transnational economic systems. Our leisure and pleasure are largely convivial. Social isolation not only makes it more difficult for us to live, but enforced isolation has been shown to cause lasting psychological damage.[14]

Plausibly, for society to even exist and for it to function well, certain values must be held. Among those values are some virtues that must be cherished by society's members. Other basic social values are norms best understood and encoded into social structures and institutions. A society without these values would be dysfunctional at best, if it could survive at all.

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13. James, "Remarks on Spencer's Definition of Mind as Correspondence," 7–8.
14. House, "Social Isolation Kills, but How and Why?"

Perhaps the most basic social values are those necessary for our kin-group social interactions. Mark Johnson picks out two such values: *empathy* and *care/nurturance*. Johnson here follows the feminist care ethicists in emphasizing the centrality of (inter)dependence to the human condition.[15] The nature of empathy and its role in our moral psychology and normative ethics is a tricky and controversial subject (see "The Value of Empathy," p. 147). Empathy narrowly construed is our capacity to feel what another feels, to share affective and emotional states. According to Franz de Waal, we share this capacity with other animals.[16] Cognitive empathy or empathetic understanding involves our capacity to understand the feelings, emotions, and values of another, to imaginatively project ourselves into their perspective, and to evaluate their reasons on their own terms.

Some form of empathy, whether it be empathetic feeling or empathetic understanding, is necessary for making the feelings of another part of your own decision making. Human society requires more than Machiavellian cooperation to function; it requires altruism, fellow feeling, bonding, and care for the other. These require an awareness of how our actions make others feel. Every minimally adequate normative ethical theory incorporates such information, whether directly (as in utilitarian moral theories concerned with maximizing pleasure and minimizing pain) or indirectly (as in Kantian moral theories concerned with respect for the humanity of others).

In order to have a working society, even at the small scale of the kin group or the tribe, we must not only be able to feel the feelings or understand the perspective of others; we must be motivated to act for the sake of others, to care for and nurture them. Traditional notions of sympathy or compassion combine empathy with concern for others, and it is this sense of *sympathy* that Hume thought foundational to morality.[17] Care begins with children, who are born absolutely dependent, but extends to mating partners, friends, elderly parents, and other cherished members of the community.

Beyond these fundamental features of our basic social interactions, other probably universal social values include those personal virtues that, when realized in a society's members, tend to support the stability and flourishing of that society to the benefit of all. *Loyalty* promotes social cohesion and our ability to

15. Gilligan, *In a Different Voice*; Noddings, *Caring*; Kittay, *Love's Labor*; Held, *Ethics of Care*.
16. De Waal, "Putting the Altruism Back in Altruism"; see Johnson, *Morality for Humans*, 60–61.
17. See discussion in Johnson, *Morality for Humans*, 61.

rely on each other to support our common causes.[18] *Truthfulness* to some degree is necessary for the trust that permits cooperation and communication.[19] *Courage* is necessary for the defense of the community from threats to its existence.[20] We could suggest others, or quibble with the examples on Johnson's list, but I think they give a fair representation of the basic social virtues. We need not settle on a definitive list, but merely indicate the sorts of things that might count as such values, and leave it up to inquiry to determine which are genuinely necessary.

There are also virtues of institutions necessary for the existence and advancement of society on larger scales. For instance, *fairness* or *justice* seems necessary for our loyalty to social institutions.[21] If we feel abused or treated arbitrarily, we doubt our institutions, and we have reason to rebel. This is why even oppressive forms of government go to great lengths to justify the justness of their rule: they have been ordained by God, or they protect us from immediate threats, and so on. Even many dictatorships today have "elections" (though the outcome is usually predetermined).

Perhaps an even more basic virtue of social institutions is relative stability. We can adapt to many different systems of social order and convention, but if the system is not stable, if the rules are constantly changing, then we cannot adapt. We cannot plan our behavior accordingly, and this creates significant social unrest. This stability need not (and should not) be absolute, but change should be at a slow pace and predictable pattern, such that members of society can live successfully within it.

In many cases, these basic social values and virtues are highly schematic, too broad and sketchy to guide action themselves. They must be given specific content by being spelled out in further detail, realized in particular social relations and institutions, spelled out in customs, mores, and explicit cultural values.

Cultural Values

The values discussed in the previous section have some call to universality, though they may be realized differently in different societies. Though I may have misidentified particular cases, the general idea that some values are essential for any (recognizable, human) society to exist, to function, and to flourish is, I

18. Royce, *Philosophy of Loyalty*; Johnson, *Morality for Humans*, 65.
19. Kant, *Lectures on Ethics*; Johnson, *Morality for Humans*, 64.
20. Johnson, *Morality for Humans*, 64–65; compare Plato, *Laches*.
21. Rawls, *Theory of Justice*.

hope, clear enough. We have evolved as a highly social species. It should be no surprise that some of the particularly human types of striving and avoidance are concerned with our social interactions and our ability to form societies, and these are the basis of a set of universal social values. But this core set of social values is insufficient, even when spelled out concretely, to account for the norms that make a particular society work. Beyond them, there are many other arrangements that can possibly create a functioning society. These norms are "cultural values."

The universal institutional norm of stability is one of the key functions that cultural values fulfill. In order to function as a group, people need protocols of communication and stable expectations about each other's behavior. Beyond the mere necessities of survival, human flourishing depends on our ability to form goals to work toward and ideals to hope for. These *cultural values* will tend to vary historically and from culture to culture. They can become too restrictive and thus oppressive, or too lax and thus unable to do their job of creating stability. Good cultural values will find a middle way between these two extremes.

Cultural values include mores and manners, but they also include what are thought of as ethical/moral values, as well as religious values. Cultural values are not merely a matter of superficial protocol; they go to the core of our shared hopes and dreams. In pluralistic modern societies, political values, shared among members of a political identity group, are also in play, as well as what we might call "family values" and "personal values," which will be discussed next.

Some examples of cultural values include the virtues of honor, fealty, charity, and piety. These are not universal values, but ones that have specific roles in particular cultural-historical contexts, defined by particular social relations, institutions, customs, and practices. Specifications of respect and ways of acknowledging authority are likewise specific cultural values. Some of these may add specific content to schematic social values like loyalty. Others may promote social stability. And yet others may arise wholly to meet the needs of a particular culture at a particular time.

The existence of cultural values *as* values does not, however, imply a crass relativism.[22] Cultural relativism is the view that value claims are true relative to cultures. This requires that we can identify which values are genuine to a culture, which in turn requires a degree of homogeneity within cultures. Relativism of

22. That is, it does not imply the kind of view that the term "relativism" usually evokes, especially when it is used pejoratively. However, more sophisticated uses of the term may be compatible with the views discussed here, such as David Wong's "pluralistic relativism" in *Natural Moralities*.

this sort means that there is no reason within a culture to question the validity of values already held, and thus denies the rationality of change of those values. It means that cultures can be distinguished and are relatively isolated from one another, and that one cannot make reasonable judgments of the values of a culture outside ones' own or make comparative judgments between cultures. None of these implications is reasonable, nor implicit in the treatment of cultural values. Cultures provide the context for making sense of some values, just as scientific paradigms or research programs provide the context for making sense of certain concepts (such as "mass" or "temperature"). This is a benign kind of contextualism.

What the notion of "cultural values" acknowledges is that there is a diversity of reasonable ways of life and that diversity is reflected in a diversity of value commitments, just as it is reflected in a diverse array of opinion on matters of fact. While we have no basis for concluding that there is one right way to live, because different social arrangements following different sets of cultural values may be equally reasonable, that does not imply that we cannot make comparative judgments. And since cultures are far from hermetically sealed, but in constant interaction, collaboration, and conflict with one another, we should not assume, as the relativist does, that there is no way to reconcile such conflicts on the level of values. Culture is fluid, as are cultural values, but they are not thus arbitrary.

Identity: Personal and Professional Values

Some values are a necessary part of life; others are universal requirements for associated living and the maintenance of society. Still other values are the result of our particular social institutions or a reflection of the particular aspirations of our family or culture. Each of these values is connected with membership of a kind: living things, social organisms, the human species, a particular society and culture, a family.

Another source of values comes from the commitments we make in the course of becoming who we are, the values tied up with our *identity*, our *personal values*. Some of these values are purely personal, a result of the particular projects we choose to pursue. Others are linked with voluntary associations in particular groups. Whereas cultural values are widely shared among members of a particular society at a particular time, the particular set of personal values (including purely personal and group membership) distinguishes individuals within a culture.

Membership in or association with a group can be more and less voluntary. At one extreme, membership in an activist group or a soccer team is a matter almost entirely of personal choice. In some cultures, religious membership is obligatory, but in many contemporary societies one may choose to be, for example, Buddhist, Christian, or Freethinker. Still, the influence of family and local subculture has a big impact on religious identity, constraining the choice for many who are formally free to decide. At the far extreme is membership within identity groups connected with, for example, race, gender, class, or sexuality that are less under the voluntary control of the individual member, but depend on real or imagined features of the individual. While movement between some of these groups is certainly possible, it is rarely easy, and it is often constrained by the way a culture interprets the meaning of ancestry, birth, and other circumstances largely outside of our control.

That said, we always have a choice whether or not to identify with and participate in the identity group society lumps us into. Identity is a complex negotiation between this voluntary identification and socially determined and assigned classification, as well as performance and self-image. Whether we do accept or resist our socially assigned identity has an impact on our personal values (and reflects them). For example, that society assumes that I belong to a particular racial category does not imply that I personally identify as a member of that race, and it certainly does not require that I adopt the values of those who *do* strongly identify. But my personal values will still be formed in part through this set of relationships.

An important type of personal values is the values one adopts as a member of a *professional* group. When becoming a doctor, a lawyer, an anthropologist, or an engineer, one commits to certain kinds of projects and to a professional code; these values become a part of one's identity, and for many of us, the most publicly recognizable part of our identity.[23] For example, if one identifies as a lawyer, this is a part of one's identity; one is entitled to identify oneself using the title "esquire," for instance. A set of professional duties and expectations, such as client-attorney privilege, some but not all of which are protected by law, is part of adopting that identity. Likewise, members of a scientific or engineering profession typically have a professional ethic, often officially encoded by the relevant professional or academic society, setting out shared professional values.

23. Davis, "Thinking Like an Engineer"; Davis, "What Can We Learn by Looking for the First Code of Professional Ethics?"

One's personal values tend to change over time, being influenced by one's family and community. Your personal values also change as you grow and mature, as you gain new experiences, as you learn, and as you join and leave various groups. It is often possible to provide reasons (or rationalizations) for the choice of personal values, but personal history plays a major role in actually determining them. So too does existential commitment. Sometimes we face choices in life as consequential as they are arbitrary, where we make irreversible choices about what kind of person we are going to be. In many cases these are our most deeply held value commitments. That they are personal, however, does not make them "merely" subjective. The vicissitudes of personal history provide a context for certain kinds of evaluation. They do not make the results of that evaluation arbitrary wishes.

The Preconditions of Science

Science is a particular culturally and historically situated practice and profession. The origins of contemporary mainstream science can be traced back to Greek philosophy, Babylonian and Arabic astronomy, Semitic religion, Indian mathematics, and various artisan traditions, but more specifically to the way these elements were combined in Europe during the Renaissance. As such, science is something that is *culturally* valued, though it is today valued across many cultures. It is also a generator of specific professional values for the scientific professions. There are several values that are preconditions of the practice of science as such. That is, there are things that we must value, insofar as we value the practice of science—though this does not imply that we necessarily achieve these things, nor that failure to meet these values disqualifies an activity as "science" in a descriptive or eulogistic sense. As with many values, these are often ideals to aim for rather than minimal criteria.

These *basic scientific values* are not, therefore, universal, nor are they absolutely valuable. To treat them as such would fall into an overreaching attitude sometimes called "scient*ism*." We must value these things *if* we value science, and we must value them *to the degree* that we value science, because they are the values that make science possible and allow it to flourish. But the scientist and the consumer of science are both human creatures, members of society, family, culture, and state. These and other contexts provide boundaries on the value of these basic scientific values. The extreme science enthusiasts who treat these values as inviolable, as trumping all other values, thus commit the error of scientism. As a result they are liable to seriously mistake value judgments.

The attempt to enumerate the basic values of science should be approached with more trepidation than it is often given. Science is a complex and adaptable set of practices, and what may seem like essential values could easily prove to be historically specific manifestations of science. That said, here are some candidates for core scientific values:

1. *Consistency*—Consistency, in some sense, is a core constraint on science. The nature of this constraint can easily be overstated—if internal consistency according to classical logics is what is meant, then it is easy to see how science might (or has, depending on your interpretation of quantum theory) violate it in a progressive way, requiring a revised logic.[24] Scientists can use logically inconsistent systems,[25] ambiguities in scientific theories and concepts can be productive, and radically ad hoc approaches can often bear fruit. Inconsistency with established theory can also be a positive driver of scientific innovation (typically by setting a problem for further inquiry). What is required of consistency in practice is that scientific inquiry aim for and sometimes generate stable results in particular contexts. Call this local, pragmatic consistency. In some contexts, stronger versions of consistency are an ideal, but in others, they are an impediment to inquiry.
2. *Empirical control*—It is difficult to see how an enterprise could be considered scientific at all if its speculations, models, theories, explanations, predictions, or narratives did not at least aim to be controlled by evidence or experiment. No particular degree of empirical adequacy, accuracy, or rigor can be considered a universal standard, but the goal of empirical control over scientific practice is a crucial guiding ideal, even if it can sometimes be outweighed by other considerations.
3. *Systematicity*—As mentioned in chapter 1, systematicity is another core aim of science, one that distinguishes science from other practices of inquiry. The sciences aim at systematic understanding of their subject matters, though this is always a work in progress. This is not the same as saying that science often achieves

24. This suggestion derives from Quine, "Two Dogmas of Empiricism," and is argued explicitly by Putnam, "Is Logic Empirical?"

25. Vickers, *Understanding Inconsistent Science*, argues that although scientists can tolerate such inconsistencies, they are not so interesting or important, and scientists employ a variety of strategies for containing or limiting the impact of the inconsistency. Frisch, "Peter Vickers, *Understanding Inconsistent Science*," disagrees with Vickers, arguing that the inconsistencies can still be interesting. Either way, we need to avoid an overstated version of "consistency" as a core value.

generality, nor that it aims at reductionism or unity. Failures of systematicity are always *pro tanto* reasons for doubt about and revisions of scientific achievements.

4. *Universalism*—This is one of the norms articulated by Robert K. Merton, the founder of the field of sociology of science.[26] According to this norm, the opportunity to participate in science, the validity of scientific results, and the merits of the scientist are determined by the same, impersonal criteria, without regard for personal or group identity, that is, race, class, gender, nationality, or culture. Helen Longino calls this value *tempered equality of intellectual authority*.[27] Of course, science has rarely if ever actually lived up to this norm; but insofar as it has failed to do so, it has been to the detriment of science. Nor should this norm be misinterpreted as requiring that we achieve a "view from nowhere."
5. *Communalism*—This is another of Merton's norms (originally called "communism"), according to which scientific results are the common property of the scientific community, communicated freely and openly.
6. *Open-mindedness* or *fallibilism*—A willingness to consider alternative perspectives, new ideas, and different problems.[28] No commitment, theory, hypothesis, putative evidence, methodology, or technique is in principle immune to doubt and revision. This does not mean scientists must constantly doubt or fail to defend such commitments, only that they do not remain completely closed-minded about them. One expression of this fallibilism is C. S. Peirce's dictum: "Do not block the way of inquiry."[29] Insofar as scientists have a fairly clear sense that some paths lead to dead ends, of course, there is motivation to limit fallibilism. This norm is the same as Merton's *organized skepticism*.
7. *Peer review*—According to this norm, scientific results and knowledge claims are subjected to critical scrutiny before they are certified by the scientific community. One manifestation of this norm is the motto of the Royal Society (the oldest extant scientific society): "Nullius et verba," roughly translated as "Take no one's word for it." This should not be understood narrowly as the institution of prepublication peer review as currently constituted, but the broader application of organized skepticism by the community to claims before their acceptance is widespread.
8. *Due credit*—The scientific enterprise is highly collaborative, both within the lab and in the larger community. A system of responsibilities is necessary to keep it

26. Merton, "Normative Structure of Science."
27. Longino, *Science as Social Knowledge*; Longino, *Fate of Knowledge*.
28. Dewey, *How We Think*, 136; Tschaepe, "Cultural Humility and Dewey's Pattern of Inquiry," 156.
29. Peirce, "First Rule of Reason," 135.

working, most important of which is the credit system, according to which those responsible for important achievements receive credit where credit is due. This norm is central in governing rules against plagiarism, responsible treatment toward students and junior colleagues, and so on.

9. *Whole-heartedness*—Full commitment to inquiry as a process and to its results, with a commitment to changing one's mind and one's behavior as a result, if necessary.[30] One can fail to be whole-hearted out of disinterest, but also out of an unwillingness to commit, as in: I will accept the results of inquiry only if I like them. Whole-heartedness requires us to value inquiry itself.

We can make a distinction here, within each of these norms, between what is necessary for minimal functioning versus what is necessary for the flourishing of science. Either way, some level of commitment to this group of scientific values, or something like it, is necessary for having functional scientific practices as such. Without some limited valuing of all or most of these values, it is hard to see how one could have *scientific* practices.

Perhaps that is too strong. Consider, for example, contemporary commercialized research, such as we see in the pharmaceutical industry or industrial agriculture. These sectors of research make heavy use of intellectual property rights, licensing agreements, trade secrets, and other mechanisms that clearly violate the norms of communalism. It is important that we be able to point to the variety of ways in which this "closed" and for-profit science is dysfunctional.[31] But one could reasonably object that it goes too far to say that such inquiries are not scientific practices as such.[32] And we know that, when it comes to the complexities of human practices, trying to identify the necessary and sufficient conditions to count them as part of the practice is a fool's errand, even for much simpler practices.

Still, while we can recognize practices that follow the preponderance of these norms, even if they violate one or two, we should recognize inquiries that violate them as suspect and dysfunctional. Healthy scientific inquiries abide by all of

30. Dewey, *How We Think*, 137; Tschaepe, "Cultural Humility and Dewey's Pattern of Inquiry," 156.
31. Brown, "Funding, Objectivity and the Socialization of Medical Research"; Brown, "The Community of Science"; Brown, "Politics, Method, and Medical Research"; Brown, "Patents and Progress"; Krimsky, *Science in the Private Interest*; Biddle, "Lessons from the Vioxx Debacle"; Mirowski, *Science-Mart*; Holman and Bruner, "Experimentation by Industrial Selection"; Holman and Elliott, "Promise and Perils of Industry-Funded Science."
32. My thanks to Justin Biddle for raising this objection.

these norms and cherish these values at least at a minimal level. That does not mean that these basic scientific values take precedence in all cases of values in science; indeed, that would be a form of the problematic *epistemic priority* approach criticized in the previous chapter.[33] But they certainly have significant weight in deliberating questions and contingencies that arise in the course of scientific inquiry.

Refined Epistemic Standards and Cognitive Values

The basic scientific values described above are meant to be those values necessary to some extent for the conduct of science, or at least a preponderance of those values. Without commitment to those values to some degree, science cannot function and flourish. This core of values is fundamental to the practice of science. We have also learned much throughout the history of science and the development of various fields over time about those practices, techniques, and standards that tend to make for better research. Thus over time we refine our scientific or epistemic values as we learn from the experience of doing science. None of these values is absolute or necessary for the practice of science, nor are they criteria as such for good science. In many cases the refinements are discipline-specific contextual achievements, helpful given a particular scientific project at a given time. Others demonstrate their usefulness across multiple contexts. The fruitfulness of these practices over time leads to their adoption as standards of evaluation.

Refined epistemic standards include *theoretical virtues*, properties of theories, models, and explanations that have proven helpful in a variety of contexts, such as simplicity, breadth of scope, precision, accuracy, and fruitfulness in generating new results. Some of these virtues are context-specific, for example, while simplicity may be desirable in models of particle physics, oversimplification may be a vice and *heterogeneity* a virtue in social science, because a model that does not leave any important factors out is more valuable than one that risks treating human beings reductively.[34]

Some have argued that egalitarian social values (antisexism, antiracism, etc.) have proven themselves to also be epistemic standards.[35] That is, a long history

33. Compare Douglas, "Moral Terrain of Science."

34. Longino, "Gender, Politics, and the Theoretical Virtues"; Longino, "Cognitive and Non-cognitive Values in Science."

35. Rooney, "Borderlands between Epistemic and Non-epistemic Values."

of, for example, success in feminist-motivated research, and a long history of problems in the status quo supporting (patriarchal- or white supremacist–motivated) research indicates that egalitarianism is a theoretical virtue and racism and androcentrism are theoretical vices. The fact that epistemic values can be refined over time makes sense of this argument.

Other sources of refined epistemic values beside the aforementioned theoretical virtues include methodological conventions, institutional arrangements, and virtues of scientists themselves. For instance, there is nothing logically compelling about a false-positive or type-I error rate of 5 percent, and yet across a variety of fields, this statistic is the common standard.[36] Likewise, neither the meticulous, rigorous type nor the maverick are necessary scientific characters, but each is valued in some ways by the scientific community.[37]

Heather Douglas introduces some conceptual distinctions that can provide further nuance to our understanding of epistemic standards and cognitive values. She makes a two dimensional distinction between epistemic standards, which she calls "cognitive values": between minimal criteria versus ideal desiderata on the one hand, and between standards for theories per se or for theories in relation to evidence on the other hand.[38] Minimal criteria for theories per se include, for Douglas, internal consistency; minimal criteria for theory in relation to evidence include basic empirical adequacy. Although "minimal criteria" suggests a problematic absoluteness to these values, versions of these are already included in the list of basic scientific values from the previous section. Ideal desiderata for theories per se include all the usual theoretical virtues; according to Douglas, these are all valuable insofar as they increase the fruitfulness of the theory for future research, its ease of use and testing, but they provide no independent support for the theory. On the other hand, those desiderata that relate theory to evidence, such as successful unification of diverse phenomena and novel predictive success, provide genuine epistemic support to a theory. We might also add the category of values that apply to experiments or data per se, such as careful measurement and controlling for confounding factors. These distinctions make the types and roles of both these values more understandable.

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36. This is also known as the "p-value" and is the probability at which at least the apparently positive observed results would be found, given that the null hypothesis (no positive effect) were true. Compare Benjamin et al., "Redefine Statistical Significance," for a proposal to redefine the standard to p = 0.005% or 0.5%.

37. Compare Kitcher, "Division of Cognitive Labor."

38. Douglas, "Value of Cognitive Values."

Democratic Values

It would be impossible to conclude a discussion of the various sources of values without reference to the transformative effect of democratic society on our values. An important cultural and political development for our understanding of values is the emergence of modern democracies. This is not only the political context in which much of science is practiced, but there are some complex interactions between the emergence of modern science and modern democracy.[39] While claims of necessary connections between science and democracy should be treated with some skepticism, it is of no doubt that democracy is in fact a major contemporary context for the interplay of science and values. Likewise, there is little doubt that democracy is a crucial normative context for contemporary science and society.

Some think of democracy as primarily a set of formal governance mechanisms (for example, voting, popular election of representatives), but these mechanisms are neither necessary nor sufficient for the presence of a democracy in any substantive sense. Many authoritarian regimes hold elections, and a few of them are even fair elections (as opposed to those intentionally rigged). This does not make the regime democratic. Likewise, very different formal mechanisms, such as sortition or anarchistic mutualism, combined with the right kind of communicative, representative, or cooperative practices might reasonably be said to instantiate a democratic society despite a lack of formal elections or representative voting. We might better think of democracy as a way of life in Dewey's sense, a particular genus of culture.

Democracy, like life, associated living generally, or the practice of science, has certain constitutive values that make it possible and allow it to flourish. Here is a tentative list of such values:

1. *Liberty*—This includes a wide set of freedoms and rights, such as freedom of expression and freedom of association, that allow for self-determination and that help guarantee the other democratic values.
2. *Equality*—All are equal in the eyes of the law and are granted rights and privileges fairly.
3. *Solidarity*—This is the idea of a common cause, that we are all in this together. What harms the least of us harms all of us. Communities should work together to solve shared social problems and advance the public interest.

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39. Compare Brown, *Science in Democracy*.

4. *Publicity*—Forms of public debate, communication of needs and concerns must exist and be broadly recognized. While we cannot expect to reach ground-level premises that everyone agrees upon, there should be uptake of criticism and broad inclusion.
5. *Plurality*—There is no one right way to live, but many good ways, and they can all coexist in our community.

These values tend to have a prominent place in the founding documents, declarations, and mottoes of many of the major democracies and republics. And it is no surprise that democracy becomes dysfunctional when these values are sacrificed for others, such as security or profitability or authority. In the present historical moment in the United States and in most of the rest of the world, it is easy to be cynical about supposedly democratic governments, and even about the value of democracy itself. Just like with basic scientific values and partial departures from them, we can recognize departures from these "constitutive" values as still democracies to some degree. We can also use these constitutive values as grounds for critique and reform. And we can point to the fact that so far no society has fully and whole-heartedly embraced these values, but that they provide a powerful ideal.

Democratic Decisions about Values

One core function of democracy, implicit in the norms of publicity and solidarity, is the process of making decisions about shared values, or the process of resolving disagreements about values when it comes to matters of public interest.[40] By "matter of public interest," I mean any activity of a person or group that impacts those not directly participating in said activity. A *public*, in these terms, are all of those who participate in or are impacted by such activities. Democracy could be defined as the cooperative process of resolving matters of public interest. This may involve values that are shared, integration of a plurality of values, or compromise.

Through democratic participation in public projects, publics form and reform their cultural values, and the members of these publics likewise modify their personal and professional values. The effect of democratic participation, learning to live in a cooperative community of equals, transforms our values. When matters of public interest arise, democratic decisions about values are essential.

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40. The account here is due to Dewey, *Public and Its Problems*; compare Brown, *Science in Democracy*.

Democratic decisions about values are not mere majority votes about which values will guide legislation and policy. They are deliberative, integrative, creative, and tentative. They also involve struggle and compromise. These processes do not transform pluralistic societies into homogeneous ones, but they also do not leave personal and group values wholly unchanged.

Consider the evolution of cultural attitudes and laws around smoking over the last few decades. Many nonsmokers found smoking unpleasant and distasteful, but smoking in public was common, even in restaurants. Though this was certainly a matter of public interest, there was little motivation for smokers to compromise in favor of the aesthetic preferences of the nonsmokers, nor for society to accommodate the preferences of the latter. As the science establishing the health hazards of smoking became publicly certified, especially the dangers of secondhand smoke, the concerns of nonsmokers were rightly weighed as more significant than when they were merely aesthetic or personal preferences. Legal restrictions were put into place to protect the public from the hazards of smoking, but cultural attitudes also changed. Smoking is no longer seen as something that nonsmokers must put up with in public spaces they have a right to occupy. Smoking is no longer glamorous, and in some circles, it is barely socially acceptable. Whether you agree or not with these trends, you can see how democratic decisions about values drive change, a democratic transvaluation of values.[41]

Two dysfunctions of modern democracies tend to obscure the central place of public value judgment in democratic governance:

1. The prevalence of *technocratic language* for the evaluation of policy, using objective-sounding cost-benefit analysis where genuine value judgment is needed.[42]
2. Waging proxy battles over facts, such as the reality of anthropogenic climate change, where what is really at stake is disagreement over values, allowing powerful actors to mask their unpopular values.[43]

Science often concerns matters of public interest. It also, as we have seen, requires the input of values. In such cases a democratic process for determining those values used is called for.

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41. With apologies to Nietzsche.
42. Richardson, "Stupidity of the Cost-Benefit Standard."
43. Hicks, "Scientific Controversies as Proxy Politics"; Pielke, *Honest Broker*, 47.

The Functional Types of Values

The variety of sources of our values canvassed in the previous section provides a way to think about the content of our values that is far from mysterious. We encounter these values regularly, and they are grounded in recognizable features of our lives and practices. Another key element of the pragmatic pluralism articulated at the beginning of this chapter, which introduced an additional dimension of diversity of our values, comes not from their sources, but from their functional role in guiding action and inquiry. A *functional role* in this sense defines a type not according to its content nor according to its origin, but rather by the way it is used. Values play a variety of distinct functional roles in our experience and can be distinguished for several purposes on the basis of those roles.

As we have seen, values are intrinsically connected with action. It would be better to speak of the verb *to value*, the gerund *valuing*, and the action nouns *valuation* and *evaluation* to remind us of the active nature of values. Speaking throughout in such terms would be awkward and out of step with the way most speak about values, and so I will avoid it. But I will use it to draw one major distinction:[44]

1. *Valuing*—Pre-reflective valuations already held (though perhaps the result of past reflective evaluation). The immediate desire for, say, a piece of cake or a parsimonious theory, without any reflection on its value, is a case of valuing.
2. *Evaluations*—Valuations reached by reflective value judgments (as described in the following chapter), whether they come as the reflective endorsement of immediate desire in the face of some doubts, or as the rejection of an immediate desire based on its relation to other short-term or long-term values.

Evaluations arise in response to problems in our practices and activities, pragmatic incoherencies in the conflicting courses of action our values suggest, or simply our inability to act based on our current knowledge, attitudes, and goals. The distinction is a functional one as well, as today's evaluations are tomorrow's pre-reflective valuings, especially as the process of evaluation grows distant and we lose sight of the reasons behind them. The distinction between valuing and evaluations is central to the following chapter.

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44. This distinction is due to Dewey, whose views are discussed in more detail in "The Deweyan Roots of My Approach," p. 171.

Beyond this broad distinction, we can distinguish a variety of functional roles for values. They are functional in terms of the role they play in our practices and activities as well as the role they play in inquiry, whether that inquiry is empirical or an inquiry into values. Immediate enjoyment and attitudes are relatively habitual or unreflective valuings, whereas desires, goals, and guiding ideals tend to be more reflective evaluations. Values play not only the role of desires or aims but also the valued attributes of things. Values can also be inherent in institutional structures, and they can play a role in ideologies and worldviews.

In the following subsections, I will describe a variety of types of valuations, tending from the more pre-reflective valuing side toward the more evaluative, as well as tending from the more immediate to the more systematic. Each type of value functions differently in our practices and activities, and it is important to distinguish them.

Immediate Enjoyment

Sometimes our valuing is merely an expression of a satisfactory or unsatisfactory experience, of a pleasant or unpleasant feeling, of enjoyment or suffering. Such experiences are immediate and affective rather than cognitive. Enjoyment of a thing does not constitute a judgment that the thing is good or valuable. Yet such experiences provide important evidence for value judgments. Such reactions are malleable in the face of experience and association, and so can potentially be modified by putting value judgments into practice.

Attitudes

We might call valuing as a habit or disposition an "attitude." In the moment they are operative, attitudes tend to be unreflective valuings, but the history of an attitude may involve more or less reflection. Sometimes attitudes are conditioned unconsciously in response to immediate experiences of enjoyment or suffering. Other attitudes are socially conditioned. But attitudes can also be the result of the reflective attempt to change your habits and dispositions, which may itself be a result of value judgment.

Many outright prejudices are examples of attitudes in this sense. The inclination thus may be to think of attitudes as mostly prejudices, and thus as unreliable, unreasonable, and to be kept out of science if possible (and certainly as not having any *cognitive* status of their own). This is fallacious reasoning,

however. Even if all prejudices are value attitudes, not all attitudes are prejudices in the problematic sense. For instance, on the basis of experience and evidence, I can replace a prejudice with an attitude of respect. And indeed, when an attitude plays a key role in a long-standing, successful, respectable practice or activity, that gives us reason to endorse it, and to regard it as having cognitive status and perhaps even evidential value, though that status is tentative and subject to revision. Even scientists, as part of their work, develop positive or negative attitudes toward certain approaches on the basis of past successes and failures and other background knowledge.

Desires and Goals

Unlike enjoyments and attitudes, wishes, preferences, desires, and goals are explicit, intellectualized claims about value. Sometimes, values are about what we want, and that's what we mean by *desires* and *goals*. Values of this type are future-directed, in that their object tends to be a future state of affairs, and the wide variety of terms we have for such future-directed values tracks the different levels of reflective evaluation involved in each. Wishes tend to be relatively unreflective, what we might also call "mere desires." On the other end of the spectrum, "goals" or "ends" tend to be highly reflective, future-oriented values.

That we desire something is prima facie evidence that it is desirable but not decisively so. That we are pursuing a goal does not automatically make it a worthy goal. Desires and goals are always subject to reflective evaluation. It is also not a given that desires and goals are reflected in attitudes; our intellectual image of ourselves may be out of step with our actual tendencies and habits.

Goals may have a cognitive status of their own in virtue of being formed or endorsed by value judgment. On the other hand, as future-directed, desires and goals rarely have evidential value in scientific contexts. That we have a goal of bringing about some state of affairs is no evidence whatsoever that the state of affairs actually exists already, and this fallacy would not only amount to wishful thinking, but ultimately the frustration of that very same goal, by removing the impetus to act to bring it about. On the other hand, that some goal is worthy gives us prima facie reason to doubt any scientific conclusions that would make it more difficult to bring that goal about. That reason is prima facie only; it is defeasible and must be weighed against reasons not to doubt. Moreover, a reason to *doubt* a claim is very different from a reason to *deny* a claim—the former is a perplexity

that encourages us to further inquiry, whereas the latter is part of the result of an inquiry that recommends a judgment against the claim.

Racial justice and equality are crucial goals in the contemporary context. When scientific research appears that would frustrate those goals in the same context, such as psychological studies that support racial differences in cognitive abilities, we have reason to doubt the conclusions even if we cannot immediately pinpoint methodological flaws in the study. That the history of such research shows that almost all such studies are flawed and unreliable adds support to our tendency to doubt them. We should be very slow to give credit to such results and should tend to demand further inquiry. In addition, our values of racial justice and equality are themselves evidence against the claims of innate racial disparity, given the conditions of the evidence-based value judgments that produced them (see "Values as Evidence," p. 97). At the same time, factual evidence about the realizability of a goal is prima facie reason to reevaluate the goal, as will be discussed in the next chapter. We cannot decide ahead of inquiry whether the perplexity created in such a case will be resolved by revising the claim or revising the goal. Neither reason for doubt has priority or is absolute.

This may seem like a dangerous claim. Could a denier of anthropogenic climate change not similarly argue that the worthiness of the goal of widely available, cheap energy gives us reason to doubt that global warming is caused by carbon emissions?[45] First, we can ask whether the goal, as stated, is truly worthy; to answer this question would be to subject it to a process of value judgment as described in the next chapter. I think, unqualified as it is, there is plenty of room to doubt that. Second, we have to measure this reason to doubt conclusions about global warming with the severe potential consequences of global warming and the risks of continuing to inquire further. Third, while the value of racial equality, itself the product of evidence-based value judgment, is evidence against claims of innate racial differences, the value of energy availability does not itself encode or provide evidence one way or another about climate matters. Fourth, if energy needs are entirely ignored by climate scientists as they make value judgments in the course of their inquiry, that would be legitimate cause for doubt; but, if anything, climate scientists have been overly cautious and conservative in their estimates of the potential problem, not reckless in this respect. My claim that the worthiness of a goal can give us a reason to doubt some scientific finding that interferes with that goal is really a much more modest claim than it might appear.

45. My thanks to Heather Douglas for raising this objection.

Guiding Ideals

Ideals are a particular subset of future-oriented values worthy of separate treatment. Ideal ends are highly reflective, but rather than representing ends-in-view that we can hope to obtain in the ordinary course of practice, they are far off, perhaps not fully attainable in principle. Still, they are not *mere* fantasies.[46]

Ideals play a special functional role in guiding activity. While the most obvious aspects of our practical activity involve acting on means that (we hope) will lead to ends, immediate or more long-term, ideals give us something to strive for that go beyond the means–ends continuum. In Christian religious traditions, the ideal is typically to be "Christ-like," with the acknowledgment from the outset that no mere human can ever attain the level of perfect virtue of the son of God. Secular civil societies are likewise governed by ideals of good citizenship and a just society, ideals such as "All [persons] are created equal" that do not specify a (reachable) end goal, but do point us in a direction we can continuously strive to improve. Some thinkers fancy themselves "realistic" and eschewing all ideals, but this extreme opposition to ideals is corrosive. It hampers our ability to see and to hope beyond our particular circumstances, and leads us to give unjust existing structures a pass.

Being not only future-directed but referring to ideal states, guiding ideals are not suitable to stand for evidence in most contexts. That equal rights and opportunities for all is an ideal is no evidence that such rights and opportunities have been achieved, nor even that they can be practically achieved in our time or completely. That said, guiding ideals are highly reflective, and they play a role in a wide variety of contexts. Giving up or altering our guiding ideals is difficult, tantamount to revising central life projects or altering our own cultural, professional, or personal identity. As such, they have significant cognitive status and carry significant weight when in conflict with other values or putative evidence. Their revision should be carefully considered and generally rare.

Value Attributes

Some valuations take the form of properties of things (objects, events). The economic value of a commodity (its utility, price, or exchange value) or the aesthetic value of an artwork is functionally an attribute of those objects. I don't mean here

46. See Dewey on "realistic" ideals versus rootless fantasies in *Human Nature and Conduct*.

the deep metaphysical or metaethical claim that these values *really inhere* in the things themselves, only that they function that way in our discourse and activity. Sometimes it is the object itself that is valued holistically, and sometimes it is certain characteristics of the object to which value attaches. For instance, it is often thought that simplicity is a valuable characteristic of scientific theories. It can make sense to say, for example, "All things considered, the theory has little value, but at least it is simple!"

That things are valuable or have valuable characteristics is functionally very different from the other types of valuation so far discussed. These "inherent" values are not in themselves future-directed, not oriented toward valued *potential* states of affairs, though they are associated with attitudes or goals of protecting or acquiring certain values that may be future-directed. We tend to act for the sake of things with value attributes, but they do not direct action as concretely as attitudes, desires, or goals. That a certain painting is aesthetically sublime or worth $20,000 is just a feature of the painting, and it is not equivalent to the attitude of seeking out sublime aesthetic experiences, nor is it the same as the goal of owning the painting. Yet our attribution of such values to things is subject to reevaluation and revision through reflective value judgments.

Claims about value attributes are the value judgments most easily accorded a kind of evidential status. Formally they attribute a property to a thing, like any other factual claims. In many cases one can elucidate evidence for attributing a value to an object. And there is a variety of contexts in which the value of a thing might provide evidence for or against other claims.

Virtues are a special case of value attributes characteristic of people or agents rather than other kinds of things. (We sometimes extend the term *virtues* to describe any value attributes whatsoever, but ethical theorists have tended to prefer the stricter use of *virtue*.) There is a flavor of the ideal in virtues, in the sense that they are improvable in a certain direction. Even someone who is rather honest, courageous, and charitable is probably not perfectly so. Still, that person's honesty is evidence that you can trust them. Yet care must be taken in treating virtue claims as evidence; there's a certain kind of moralistic fallacy involved in too casually importing such claims into social science. The early history of criminology, race science, eugenics, psychiatry, and many other human and social sciences were unfortunately bogged down with inappropriate use of moralistic language. These uses can reinforce problematic, status quo power relationships. The categories appropriate to first-person reflection about the improvement of one's character, and second-person interactions with people, may not and tend

not to be the appropriate categories for dealing in the third person with whole classes of people. "Thick concepts" or "mixed claims" often refer to value attributes of these sorts (see "The Conceptual Argument," p. 78). When we discuss topics such as gender, race, violence, poverty, or well-being, we are typically attributing properties to people, events, or objects. Claims involving this topic will inevitably mix the descriptive and the evaluative.

Institutional Structures

Sometimes social institutions encode preferential structures. Societies that limit suffrage and other citizen rights to a subset of members encode a hierarchy between certain of its members. Institutions have incentive structures that shape social practices in myriad ways. In the sciences, the institutions of training, grant funding, and tenure and promotion all play an important role in what science gets done and how it is done. Most of these structures are fairly conservative in who and what is rewarded, limiting the number of radical ideas and maverick scientists. In recent years, the intertwining of public research institutions and private capitalist institutions have reshaped research, not always for the better.

Institutional structures are difficult for individual judgments to change; members can spend their whole career advocating for a change with little progress. Institutional change is typically, if not always, slow and is necessarily a result of collective effort. For most individual actions, institutional structures are fixed features of the environment; the values that they encode are treated as merely natural. That does not necessarily excuse individuals from acting on bad values encoded in institutions; one always has the option not to act within institutional structures, to resist them, or to turn to activism, though those options themselves often have significant costs. On the other hand, that values are encoded in long-standing and well-functioning institutions speaks significantly, if tentatively, in their favor.

Ideologies, Value Systems, and Worldviews

The values discussed so far are taken separately: specific attitudes, goals, attributes, institutionally encoded preferential structures, and so forth. But valuations can and often do form parts of larger frameworks that include both values and factual and metaphysical ideas. Pejoratively, these frameworks are often called "ideologies." More neutral terms include *value systems* and *worldviews*.

All of these terms refer to complex evaluative standpoints where particular valuations are tied up with more general ideals, principles, and institutions, as well as factual beliefs, theoretical claims, and metaphysical commitments. Religious systems are one example, where value commitments, cosmologies, and accounts of the role of humans in the universe are combined into a unified framework.

I will reserve the term *ideology* to refer to a certain kind of worldview that is problematic in structure. Like any worldview, an ideology is a complex evaluative standpoint that combines both evaluative and factual commitments. These commitments are unified into a kind of self-reinforcing structure that allows all new evidence and experience to be assimilated to the ideology. The end result is closed-mindedness, with few resources from the inside that permit critique of the ideology. From the outside, it may appear that the ideology distorts all that it encounters; from within, every new experience supports the ideology.

Most worldviews or value systems are not nearly so tightly sealed. Some value systems may be light on theoretical and metaphysical commitments and form more of an ethical code. Other worldviews may be more expansive without becoming dogmatic. Instead of a self-reinforcing closed-mindedness, they have merely a degree of pragmatic coherence, the actions and activities guided by them largely complementary and compatible rather than in tension. In the best instance, worldviews can be productively revised through the experience of those who share that worldview in response to problems of pragmatic incoherence that arise as well as new evidence relevant to the worldview's commitments.

In some cases, ideologies stand to worldviews as unreflective attitudes and desires stand to value judgments or evaluations. That is, the latter are the product of explicit construction or reconstruction in order to solve real problems that arise in our practices, while the former are unreflectively held, the result of enculturation or indoctrination. Large-scale worldview construction is rare and always dependent on the remnants of prior worldviews.

Facts versus Values

Along the same lines as I have been pursuing in this section, facts can be understood functionally as well, and as functionally distinct from values even though they cannot in general be extricated from one another. As described in chapter 1, facts in the sense of "facts of the case" or observational evidence are defined by their functional role in representing or tracking the features of the problematic situation. On the other hand, experimental evidence is defined by its role in

testing hypotheses. If mixed claims with evaluative content play these roles, they should be considered as facts, functionally speaking, rather than values.

The role of values is to guide action, directly or indirectly, to determine what we to aim for, what to cherish, and what to avoid. In the context of inquiry, values, functionally defined, play a very different kind of role than either kind of evidence. They define the aims of and the constraints on inquiry. Mixing up the roles is, of course, a problem.

What Has Been Argued

This long argument section has been focused primarily on explaining and defending the first three elements of pragmatic pluralism about values, namely that values are connected with action and practice, that there are many sources of values in human experience and practice, and that there are many different functional types of values. In the course of laying out this great variety of sources and types of values, I have shown which values have what sort of cognitive status and evidential value and in what contexts. Although wishes are a sort of value, I've shown that values go well beyond mere subjective desires or fanciful wishes, representing a great variety of often well-grounded attitudes, reasonable goals, and higher ideals. I've shown that values are not mysterious or scientifically disreputable entities, but rather necessary parts of explaining human behavior, natural features of human life and activity.

ANALYSIS: PRAGMATIC PLURALISM DEFENDED

The picture of values provided above is one of great variety, a variety of sources and of functional roles for evidence. Daily we reckon with many different kinds of values, playing different roles in our activity. There is nothing mysterious about such values; they all derive from our nature as biological, social, and intelligent creatures with habits, practices, activities, and culture. Our selective interests, attitudes, goals, and ideals are a result of everyday features of our biological, psychological, social, and cultural makeup, and they play a variety of roles in our everyday lives. Neither skepticism nor mysterianism is needed. Science, as a human activity, must incorporate many such values, but this does not entail incorporating anything untoward.

In this section I will explore several general concerns that might arise in response to the aspects of pragmatic pluralism defended so far. First, I explain

further and defend the approach of "shallow metaethics" that I adopt in this chapter. Then, I consider two major alternatives to naturalistic metaethics that I wish to resist: reductionism and relativism. I compare these views to pragmatic pluralism to show the benefits of the latter. Finally, I consider in detail a recent objection to a specific social value that is central to this chapter and the argument of the book as a whole: empathy.

Shallow and Deep Metaethics

I have insisted that this discussion need not tread on the territory of deep metaethics or metaphysics of values. I have sometimes opposed my views to a "noncognitivism" or "subjectivism" that I find implicit in the way that many philosophers of science talk about values. The versions of these theses that I have in mind are coarse and shallow versions thereof, the idea that we cannot rationally revise our value judgments in light of evidence, that there can be no correct answer to conflicts of questions of values, that there are no value judgments as such but simply the expression of preferences, even occasionally an "emotivist" view where values simply express emotional reactions with no cognitive content. I am eager to find an account of values that makes sense of our everyday practices of evaluation and careful refinements thereof, and which allows us to make sense of engineering, medical sciences, and other fields whose goals are incomprehensible if such extreme, skeptical views about values are held.

We can rest at the level of shallow metaethics and leave deeper questions be for the purposes of this argument, though others have developed deeper metaethical theories based on the kind of account I have laid out here.[47] I do not mean to cast aspersions on metaethical inquiries, which have their philosophical uses. I am obviously quite sympathetic to pragmatist and particularist versions of deep metaethics. But such investigations, unlike the coarse positivistic subjectivism and noncognitivism that I have opposed, take our ordinary practices

47. For instance, Mark Johnson's *Morality for Humans*, from which this chapter draws significant inspiration, pitches itself not only as moral psychology and theory of moral deliberation, but as a deep metaethical pragmatism inspired by John Dewey. Steven Fesmire, Elizabeth Anderson, and Gregory Pappas have provided excellent overviews of Dewey's own metaethics: Fesmire, *John Dewey and Moral Imagination*; Anderson, "Dewey's Moral Philosophy"; Pappas, *John Dewey's Ethics*. Diana Heney (*Toward a Pragmatist Metaethics*) has defended a pragmatist metaethics that emphasizes the truth aptness of moral judgments and emphasizes general but not absolute or universal moral principles. Pragmatic pluralism bears some similarities as well to the metaethical tradition of moral particularism. See, e.g., Dancy, *Ethics without Principles*.

of valuation for granted, and mean to explain them while leaving them as they are. Furthermore, those inquiries tend not to pay close attention to scientific information from biology, psychology, neuroscience, sociology, anthropology, cultural history, the humanities, and other fields that can tell us about the origins and roles of values in practice. They remain neutral on the kinds of questions that concern this book, and so I hope to remain neutral with respect to them.

We also need not concern ourselves with fundamental normative ethical theory. Perhaps there is such a theory; perhaps you are certain that you have hold of the right one. Everything said outside this chapter should be entirely compatible with such a theory. But I am more cautious about such theories and choose to work with values at a less fundamental level, somewhat closer to everyday experience (though still a philosophical elucidation thereof). But if there is such a theory, it would fill the need identified in the previous chapter, and likewise the account of value judgment and moral imagination described in the following chapter will help us apply that theory more intelligently to specific cases. The kinds of values described in this chapter would have to be adequately explained by it and reduced to it.

Against Reductionism

Broadly speaking, the account I have given is a form of *naturalism*. I want to point out the distance between my pragmatic naturalism and reductive naturalist accounts of values. Some naturalists try to domesticate values too much, not only to point out their non-mysterious origins, but to reduce them to merely descriptive facts. Others seek a single natural origin for values, for example, to trace all values back to the imperatives of survival and reproduction. The paradigmatic example of such a moral reductionist is Herbert Spencer, the social Darwinist. These reductionist accounts commit a variety of errors. They substitute claims about values, that is, facts about what values certain people hold at certain times, for evaluative claims, riding roughshod over the functional distinction between facts and values.

Some of these accounts also ignore the crucial role of society, culture, psychological processes of identity formation, personal choice, and rational evaluation in forming our values. They focus on a small subset of valuational phenomena and attempt to treat the others as epiphenomena. These accounts commit the kind of fallacy of which William James accused Herbert Spencer (see "Biological Sources of Value," p. 118). Pragmatists like James and Dewey as well as

antinaturalists like G. E. Moore alike criticized Spencer's reduction of values to the evolutionary drive to survival.[48]

Pragmatic pluralism differs from reductionism in two respects. First, it does not conclude that by finding the natural origins of a set of values, the values have been reduced to facts about those origins. That society requires certain kinds of empathy or care to exist does not reduce the evaluative force of empathy or care to facts about social organisms. Second, pragmatic pluralism does not limit or privilege the sources of values. Values that emerge earlier in time are not therefore more important. Biological needs do not override personal commitments as such, though without satisfying a certain level of biological values we may be unable to act on any values. Pragmatic pluralism is a form of naturalism that respects both the variety and the autonomy of the evaluative.

As Compared to Relativism

I hesitate to declare myself against relativism, only because it is so unclear what is meant by *relativism* in many contexts.[49] Sometimes what might be meant is benign. Other senses of relativism need to be sharply distinguished from pragmatic pluralism. When relativism is just another term for context sensitivity or pluralism, we need not see anything pejorative in the term; these are features of the view I have been defending. However, when relativism means that truth is in the eye of the beholder, that type of relativism is problematic.

Here I would contrast the "pluralistic relativism" of David Wong, which is relativistic only in the sense that it holds that there is no one right moral system or set of values,[50] and the relativism of Gilbert Harman or Martin Kusch, according to which claims are true or false only relative to some kind of framework.[51] It is the latter that is problematic and that I will try to critique.

Suppose relativism means that a value judgment is correct if a culture or person holds it to be true. If that were the case, it is hard to see what could be at

48. See Weinstein, *Equal Freedom and Utility*, for a more sympathetic account of Spencer's ethics.

49. Kusch, "Relativism in Feyerabend's Later Writings," gives a sense of the complex space of possibilities.

50. Wong, *Natural Moralities*.

51. Harman, "Moral Relativism Defended"; Harman, "Moral Relativism Explained"; Kusch, "Epistemic Replacement Relativism Defended." Kusch is more interested in epistemic than in moral relativism, but the style of relativism is similar to Harman's, as Kusch himself acknowledges.

issue in everyday practices of evaluation and revision of values. Relativism seems to imply that there is nothing genuinely at issue when value judgments conflict, that there can be no genuine conflict of values. If it is true for me that murder is wrong, but it is false for you, though we may think we vehemently disagree, there is no incompatibility between our opinions.

The denial of genuine conflicts of value prevents us from making sense of many of our everyday practices. If personal relativism is true, why do we worry about teaching our children right from wrong? Why do we have a justice system that punishes criminals and provides relief to victims? Why do we discuss and debate values with passion among those whose opinions we value? If cultural relativism is true, why do we oppose sexist practices and authoritarian regimes in cultures outside of our own?

Relativism of this sort is a nonstarter. We must always assume that if there is a genuine conflict, there is a right answer. Sometimes the questions are so insignificant that live and let live is the best approach; we may label these issues "matters of taste." The case is similar when no genuine need for coordination of values exists. In some cases social and cultural conditions may vary so widely that what appears to be a genuine conflict can be shown not to be so. There is no one right way to live. But that does not mean that every way of life is automatically successful and acceptable, or that every apparent conflict is unreal. Conflicts of values happen within our own personal experience, and are also brought to the fore in our social interactions. We need to develop strategies for resolving such conflicts where they arise, not deny their existence through appeal to relativism.

The Value of Empathy

One of the values that I identified above as having a claim to something like universality is *empathy*. Empathy has come under fire lately, especially as a result of psychologist Paul Bloom's writings on the topic, though several others have argued a similar case.[52] *Empathy* as Bloom understands it is an affective psychological faculty that allows one to feel what others feel, to experience what others experience (or at least to simulate what you think they are experiencing). He does not include, as part of his critique, "cognitive empathy," the more reflective

52. Prinz, "Against Empathy"; Bloom, *Against Empathy*.

capacity to understand the point of view of others, to understand what they are thinking, to see their motivations.

Nor does he think that empathy has no benefits. Rather, he doubts that it is a reasonable guide to social policy or even personal ethical decision making. Indeed, in many cases feeling too much empathy can be harmful and prevent you from being able to take the right action. Imagine surgeons who feel, literally feel, their patient's pain every time they cut into someone. This would be unproductive if not absolutely harmful. Furthermore, empathy in practice is biased, limited mainly to whom one feels is part of one's in-group; thus basing ethics on empathy reinforces rather than ameliorates problematic moral failings like xenophobia and racism.

Taking empathy as a *value* rather than considering it merely as a psychological capacity changes our perspective a little bit. It means making others' feelings and perspectives a factor in your action and decision making, to act for the sake of how it will make them think and feel. As a value, empathy has an ideal element; it is something that can always be expanded by further acts of imagination. In addition, emotional empathy, as a largely unreflective response, is merely a starting place for deciding what to do. Empathetic understanding (or cognitive empathy) is much more important to that process, though not itself decisive either. Because values come from many places, empathy has to be balanced against other considerations. Finally, while the kind of affective community bonds governed by empathy and care may be a foundational feature of our sociality, they may not be the appropriate values to govern larger social institutions and large-scale democratic communities.

NEXT STEPS: WHAT DO WE DO WHEN VALUES CONFLICT?

Pragmatic pluralism raises an obvious and serious problem—what if the values conflict? As values come from many different sources, and play many different roles, it seems clear that values will conflict regularly. The discussion of relativism above brings this question to the fore. Value conflicts are not just an abstract possibility; they are a constant feature of our moral lives. What we desire in the short term, what our loved ones demand from us, our social duties, and our professional ethics may and often do pull against each other.

In the realm of our ordinary experience, such value conflicts are genuine and common. They cannot be resolved a priori, nor can the right abstract theory or taxonomy of values resolve them. The conflicts in question involve our

commitments, our personal projects, our needs, our ideals, and they arise in particular situations because of particular facts on the ground, often requiring us to understand the needs and emotions of other as well as the cause–effect relationships between means and consequences.

We need a process of value judgment that can resolve conflicts and indeterminancies in values and practices. We need to find ways to integrate values when we can, and to reprioritize and revaluate values when we cannot. A variety of strategies are available, but value judgments still tend to be less systematic than judgments to resolve conflicting views over matters of fact. Much of what we have learned from ordinary and scientific inquiry is applicable to value judgment, however. The next chapter will provide an account of value judgment that systematizes strategies already commonly pursued, and synthesizes them with the account of scientific inquiry provided in chapter 1 to provide an account of value judgment as problem-solving inquiry.

CHAPTER 5

VALUE JUDGMENT AS EMPIRICAL, IMAGINATIVE INQUIRY

If you cannot or will not imagine the results of your actions, there's no way you can act morally or responsibly.

—**Ursula K. Le Guin**

INTRODUCTION: THE NEED FOR VALUE JUDGMENT

The need for value judgment arises from conflict and uncertainty among our values. If there were one, unambiguous hierarchy of values, or nonoverlapping magisteria of value, each in its own separate unambiguous realm, then the only need for judgment would come from a lack of knowledge of the right values or uncertainty about how to apply them. Instead, in our lived experience we have a plurality of values, and no generally agreed-upon, principled, decontextualized way of ranking them or integrating them prior to the way they play out in our lives. When they conflict, which they inevitably will, we must make judgments. Even if we were to adopt a unified normative ethical theory, we would have to think about what to do when moral values conflict with prudential, religious, aesthetic, and epistemic values. Even if we had an unambiguous hierarchy of

Epigraph: LeGuin, quoted in Maya Jaggi, "The Magician."

such values, and some with strong commitments to certain values might feel that they have,[1] we would need to determine how our values apply to the particular complex situation in which we act, where we might also be uncertain of the facts, of how stakeholders will be affected, and of the consequences of our choices. No matter what, the burden of value judgment cannot be avoided.

The conflicts that arise in our everyday values are often not a matter of logical contradiction, a direct conflict between asserting and denying the same claim. Rather, the conflicts are a matter of *pragmatic incoherence*—our values pull us in different directions, suggesting or demanding different and incompatible courses of action. These incoherencies are often *contextual* in nature. They pull us in different directions because of the way they are both relevant to a particular situation, while they may be unconnected or incompatible in others. There are other ways our values can be pragmatically incoherent as well, when they fail to guide action at all or if they guide it to results we find inherently unsatisfactory. If it is ambiguous what our values would have us do in a particular situation, or if we lack valuations to guide any action whatsoever in a particular case, we are in a situation of pragmatic incoherence. Our values might be pragmatically incoherent in encountering certain genuinely novel situations. If we act on our values and nonetheless regret our actions, this may generate a state of pragmatic incoherence.

For example, consider the sense of regret expressed by scientists who had worked closely on the Manhattan Project after the atomic bombing of Hiroshima and Nagasaki, as well as during the beginning of the Cold War.[2] These scientists had begun to work on the atom bomb for putatively good reasons: not only was it considered possible, and scientifically interesting, but it was believed that Nazi Germany was also working on it, and may have had a head start. Here is how Richard Feynman describes the situation:

> After the thing went off [the Alamogordo test] and we heard about it, there was tremendous excitement at Los Alamos. . . . You see, what happened to me, what happened to the rest of us is we *started* for a good reason but then we're working very hard to do something, and to accomplish it, it's a pleasure, it's excitement. And

1. In particular, scientists may feel that they serve a higher calling that outranks all other values, and thus they have a highly relevant, unambiguous value hierarchy at hand. But recall the arguments of Chapter 3, particularly "The Priority of the Epistemic," p. 93, about the problems with placing absolute priority on epistemic (including scientific) values.

2. Ham, "As Hiroshima Smouldered, Our Atom Bomb Scientists Suffered Remorse."

> you stop to think, you know, you just stop. After you thought at the beginning, you just stop.[3] . . . I don't think that I was wrong exactly at the time I made the decision. I thought about it and I think correctly that it was very dangerous if the Nazis got it. There was, however, I think, an error in my thought in that after the Germans were defeated—that was later, three or four years later—we were working very hard. I didn't stop; I didn't even consider that the motive for originally doing it was no longer there.[4]

Feynman was not the most profoundly regretful about the Manhattan Project, but his account of it is illustrative. Having embarked on the project, the "technical sweetness" of the problem and its solution motivated the scientists to continue working on the project.[5] But the situation shifted significantly with the defeat of Germany. The values that originally motivated the project had become, in part, irrelevant; the scientists were in a state of pragmatic incoherence, but did not see it, did not even think to address it.[6] They were thus pained by it when they realized it retrospectively, too late to undo what they had done.[7]

Value conflicts are substantive and cannot be settled prior to all experience. Even foundational normative theories cannot settle them without understanding the particulars of the situation. They must be resolved by making a judgment in light of the empirical evidence. In this chapter I will argue that such value judgments are, or ought to be, a form of inquiry, sharing a common structure with scientific inquiry, as described in chapter 1.

ARGUMENT: VALUE JUDGMENT AS INTEGRATION, INQUIRY, AND MORAL IMAGINATION

In this section, I will discuss four aspects of value judgment. First, I will discuss some practical strategies for resolving pragmatic incoherence among values that can be integrated or prioritized within the situation without calling those values

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3. Feynman and Robbins, *Pleasure of Finding Things Out*, 90–91.

4. Feynman and Robbins, *Pleasure of Finding Things Out*, 231.

5. *J. Robert Oppenheimer Personnel Hearings Transcripts*, 2:95/266; Douglas, "Bitter Aftertaste of Technical Sweetness," 247–51.

6. Feynman reports that only Robert Rathbun Wilson at Los Alamos had any doubts during the project itself. But we also know that Joseph Rotblat left the project in 1944 after it became clear that Germany did not have a credible project to produce an atomic bomb, though he was not allowed to share his reasons for leaving with any of the other scientists.

7. This is a prime example of what I will call a "failure of moral imagination" in the next chapter.

into question, and thus full-blown inquiry into values is not necessary. Then, I will discuss more in-depth inquiry into values as a type of empirical-practical inquiry. Third, I will emphasize the role of imagination in all forms of value judgment. Finally, I will briefly discuss the particular constraints on value judgment that exist in democratic societies when the judgments in question concern matters of public interest.

Strategies for Integrating and Prioritizing Values

One general way to resolve conflicts of values is to find ways to integrate or harmonize among values that seem to pull in different directions and thus to be pragmatically incoherent. There are several practical strategies for doing this. They all involve reinterpretation and creative thinking in order to discover unrecognized ways of finding best compromises.[8]

The main strategies are as follows:

1. *Do not take dilemmas for granted; search for third ways.* Dilemmas can often be analyzed as false dichotomies and a third way found through creative problem solving. Few real-life ethical choices are either-or choices. Often there are middle ways, compromises, or third options that don't occur to us at first. Taking dilemmas for granted prevents us from multiplying options, a kind of morally vicious failure of imagination. In the political sphere, false dilemmas, presented in tendentious ways ("us" vs. "them," "left" vs. "right," "proscience" vs. "antiscience") are the stock-in-trade of partisan politics, and they serve partisan agendas but inhibit shared solutions to social problems.
2. *Reinterpret the values.* Maybe the values you are committed to do not require precisely the actions you assume. Many deeply held values are somewhat ambiguous in practical situations. For instance, if one is committed to "animal rights" in a broad sense, this might be interpreted to mean that no research involving animals is permissible. Or, in light of what we know about animal psychology and animal lives "in the wild," it might mean merely not doing research on animals that causes them suffering and distress; well-regulated and painless research might be permissible. Alternatively, it might only require giving animals significantly better lives than those lived by wild animals, despite minimal pain and distress.

8. Compare Follett, *Creative Experience*; Weston, *Creative Problem-Solving in Ethics*; Weston, *How to Re-imagine the World*; Weston, *21st Century Ethical Toolbox*.

To take another, more controversial example, Focus on the Family defines "the sanctity of life" as an edict to "defend, protect, and value all human life."[9] They take this to necessarily imply support for legally banning abortion. In light of the fact that lack of access to safe and legal abortions leads to increases in disease and death, one might defend an alternative interpretation of that broad value which lacks that implication, without challenging the value itself.[10]

3. *Reinterpret the situation to determine if the conflict is forced or avoidable.* Perhaps it is not the values, but the nature of the situation that you have misunderstood. Gathering facts about what is causing the (appearance of) conflict may indicate that the issue can be avoided entirely with little or no cost. The conflict between animal rights activists and hunters' associations involves significant differences in moral principles, but if we examine specific policy contexts, we find that they often agree on what should be done: the protection of wilderness areas from development, for example.[11] The more fundamental issue between them can be left alone for purposes of that particular question then.
4. *Look for short- and long-term compromises that maximize the values in question.* There's a wide range of possible interactions between values. The means to some ends may crowd each other out simply because of time and resources, as when forming the end to become a master violinist, the time and practice I will have to put in excludes other similarly time-consuming means to other ends. Sometimes certain ends and means conflict directly. Understanding how means and ends relate, how following some ends excludes others, how one short-term end can also be a means (or exclude a means) to some long-term end can help us find the best trade-offs among values. By investigating these means–ends, cause–effect relationships, you may discover that, for example, pursuing your goal of becoming a master violinist now, by practicing six hours every day, may in the long run make it more difficult to achieve the long-term career goal of becoming a well-regarded research scientist, because one would not have time for developing the capacities and credentials to be competitive for that position. However, practicing less might still allow you to become a pretty good violinist, while allowing you to both play the violin and compete for a position as a research scientist later in life.

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9. Earll, "'Sanctity of Life' Ethic."

10. Antiabortionists might alternatively conceive the value more narrowly, in Kantian terms, to imply only the impermissibility of taking a life, which would be harder to reinterpret in this way. Where policy making falls along the doing–allowing continuum, however, is a potential similar line of reinterpretation.

11. Norton, *Toward Unity among Environmentalists*, 188.

Not all conflicts can be avoided or mediated away in these ways. Sometimes we must make hard choices, and we cannot always avoid those hard choices. Sometimes we must reprioritize or deprioritize values in the face of such conflicts. But there are various ways to do this as well. Starting again with the relation discussed in (4) among means, ends, and the consequences of using those means to achieve those ends, we can weigh the worth of the end versus the costs of the means. We can determine how some goals preclude or inhibit the achievement of other goals, over the short and long term. For example, hedonistic abandon leads to health problems that make it hard to pursue a wide range of ends. Whatever joy it brings now is not worth it when seen in a more inclusive context. We can even try to take the broadest, most inclusive context, and consider the influence of pursuing certain values on one's personal growth, the quality of one's character, the shape of one's life, one's general well-being and the well-being of others.

Value Judgment as Empirical Inquiry

The considerations and strategies discussed above, pursued in an ad hoc manner, are often enough to resolve pragmatic incoherencies, at least in the short term. They can be made much more systematic by thinking of the process of empirical, practical inquiry, in parallel with the image of inquiry laid out in chapter 1.

Problematic Situations of Practice and Value

Call particular cases of pragmatic incoherence among our values "value perplexities." The terminology here is intentionally meant to mirror the language of chapter 1. There I gave an account of empirical, scientific inquiry as practical inquiry, as problem solving aimed ultimately at the question of what to do, at the transformation of situated practices. The problem posed by pragmatic incoherence is likewise a kind of uncertainty about what to do, and the form of inquiry that will resolve it shares a basic pattern with that discussed in chapter 1. Value judgment, the evaluation of values, ought to be a type of empirical inquiry.

As I've said, value perplexities arise when, through conflict, uncertainty, or indeterminacy, values are pragmatically incoherent. When they are recognized specifically as a problem to be solved, we can call them "problematic situations of value" or simply "problems of value" (keeping in mind, from chapter 1, the difference between perplexities, problematic situations, and problem *statements*).

It is fair to say that perplexities and problems of value arise from tensions

between means and ends. It is important to recognize that means and ends form a continuum. The ends we aim to satisfy constrain the acceptability and suitability of the means we select to pursue them. The implications and consequences of the means we select constrain the ends we may pursue. Diachronically, an end in the short term (what we might call an "end-in-view") becomes a means to a further end later on.

If there were no difficulties or disharmonies between means and ends, then the only value conflicts would be direct logical contradictions, two goals literally opposite of one another. These explicit logical contradictions are few and far between as compared to the pragmatic incoherencies that are dependent on the relationship between means and ends in particular situations. If everything experienced as valuable were easily attained, every desire immediately satisfied, then it is hard to see how any pragmatic incoherence arises. But it is also hard to see what pragmatic use value propositions would serve. In reality, means involve costs and trade-offs, the means to one end preclude the means to another end, or worse, the means to one end positively frustrate and destroy other values.

Problems of value are problems of practice, that is, problems concerning what to do in some situation. Value problems are a particular species of problems of practice concerning the choice of an end or the determination of something's worth in relation to our practices and ends, on the basis of an understanding of the connection of means and ends. Problems of value call for a reevaluation of the values that guide action. By contrast, scientific problems are the species of problems of practice particularly concerned with connections between means and ends at a highly general level, with the practices of prediction, explanation, and control necessary for reliably choosing the means to our ends. Ethical theorizing, as distinct from inquiry into problems of value as defined here, concerns the evaluation of ends as such independent of the continuum of means and ends. The role of ethical theorizing in value judgment might be analogous to the role of mathematical theorizing in empirical inquiry.

Consider an example value perplexity for the purposes of discussion in the rest of this argument. Suppose you are a hypothetical researcher in neuroscience who works primarily with mice and rats, who does both some cognitive-behavioral research and also some biomedical neuroscience research. You consider your research important and valuable, both for producing new knowledge about the nature of the nervous system and the mind, as well as for producing new beneficial treatments for neurological diseases. However, you are becoming increasingly sympathetic to concerns about animal welfare or animal rights, in

part because of your own research, which uncovers the impressive affective and cognitive capacities of the animals you study. You've recently become a vegetarian, and you're starting to wonder about the morality of your own animal subjects research, some of which involves pain and distress to the animals, some of which requires that they live their lives in isolation, because of the surgeries that they undergo, and all of which require that you sacrifice the animals at the conclusion of the study. There are some obvious options available to you—cease all animal research, and advocate for your colleagues to do likewise, or try to quash your qualms about the research—but neither of these seems satisfying. You realize that the core issue is that you don't know how to resolve the tension between the valuable aims and results of your research and your concern for the well-being and rights of the animals involved. This is a paradigmatic value perplexity. I will refer to it again below as an illustration.

Facts in Value Inquiry

The role of factual evidence in inquiry, in the sense of "facts of the case" in chapter 1, is to record the features of the current situation that define the problem. The facts are not givens, but are an attempt to represent the fixed conditions of the situation that must be reckoned with. The conditions themselves are fixed, but what we regard as the facts, our representations of them, can be and generally are revised many times as inquiry proceeds in order to make them more adequate.[12] This is a general definition, however. What kind of facts are relevant to value inquiry?

First, we need to take stock of our existing value attitude and value commitments, explicit and implicit, and whatever priorities we may already have among them. Gathering facts about our value attitudes can be a difficult, sometimes psychoanalytic or sociological affair. Our hypothetical neuroscientist is already well along the way to identifying these facts—the commitments to both her research goals and animal welfare, the lack of any clear priority between them. Trying to get clearer about the nature of those commitments will be a core part of the fact gathering of the inquiry. Self-reflection is part of this, but you can also discuss your concerns with trusted mentors, colleagues, and collaborators; read books about the ethics of animal experimentation, animal welfare, and animal rights; and investigate current regulations, policies, and best practices.

12. This is related to the Rawlsian concept of a "provisional fixed point" in our moral reasoning. See "Reflective Equilibrium," p. 183.

The valuings we start with are the facts of the case, not in the sense that they are all taken as fixed, but in that they are accurate representations of where we start. Whatever values are not actively problematized in the course of the inquiry will be treated as fixed conditions going forward, but every valuation is open to problematization in the course of inquiry, either because it is represented ineptly for present purposes or because those things previously thought to be fixed and stable values turn out not to be. Generally the vast majority of prior beliefs will remain stable across most particular inquiries. In our example the problematic values (research goals, animal welfare) would exist against a larger background of values and commitments, many of which would remain unchanged, but some of which might help resolve the problem.

When values represent or are directed toward aims or goals, then a whole range of cause–effect facts are relevant. We need to understand the means to those ends. If I need to evaluate the worth of a goal, it is apt to ask at what cost it can be achieved. Rarely do we think an end is worth pursuing no matter the cost, that the end justifies any means whatsoever. It is what your growing knowledge of mouse and rat cognition and neurology tells you, our hypothetical scientist, about the costs of your research that have led you to this value perplexity in the first place. You would do well to investigate further the nature of mouse and rat welfare, replacing assumptions with empirically grounded understanding.

We also need to know how our ends do (or do not) function as means to further ends, that is, the consequences of pursuing relatively near-term goals on our ability to pursue a variety of long-term goals. Going north makes it harder to go south later. It does not invalidate an end to know that it makes certain other ends harder to obtain later, but it is an important piece of data. To a large extent, understanding these means–ends relationships requires that we draw on both common sense and a scientific background knowledge of cause and effect, and sometimes that we engage in new inquiries to understand their relation before we can resolve the value question itself. Here, you might ask yourself, how well does your research really support the further long-term goals, whether that be, for example, knowledge about human neurology or improvement of human health.

There are also affective facts, namely, facts about how it feels to satisfy the desire or goal in question. Our affective responses are important material for judging the desirability of certain ends. Emotions, like perceptions, are sources of data. While understanding the relation of means and ends requires scientific knowledge, the emotional and affective facts relevant to value judgment are more dependent upon our own experience, and reports of experience from

those we trust. Do you feel more uncomfortable with performing certain kinds of experiments on your rats than others? This is relevant to thinking through the problem at hand. Thought experiments, conducted in our imagination, can help us tentatively gauge our emotional response, but these are regularly corrected by actual experience. Would a different kind of experimental protocol be less troubling? Another important kind of evidence for or against value judgments is the success of certain values in guiding action. Success has both a subjective, felt, affective component as well as an objective, practical component, the latter being a fact about whether the actions carried out on the basis of values help or hinder the activities and practices they play a part in.[13]

Here, as another kind of example, I point again to the history of feminist values in science. Across a variety contexts, these values have more successfully guided science than science done in the absence of such values. Primatology, archaeology, and other sciences have been positively improved by the use of feminist values, and that success will turn out to be an important fact in many future inquiries.[14]

Suggesting and Refining Solutions

Value judgment is a process of inquiry into what to do in the particular kind of case where existing values fail to adequately guide action. Perhaps one has pragmatically conflicting goals and desires, the value one attributed to an object or person seems not to square with new facts about them, or one's values are incoherent because of the novelty of the situation one finds oneself in, with great uncertainty about how to act. Hypotheses, which I have previously identified with problem solutions, then take the form of reevaluations, that is, the proposal to adopt new values or new prioritization of values.

Initial suggestions for solutions may be rather crude or extreme; they may throw the baby out with the bathwater. For instance, if one cannot easily see how

13. *Subjective* and *objective* here are meant in pretty deflationary senses. *Subjective* has to do with how it feels to the person making the judgment, whereas *objective* concerns facts that do not depend on the subjective feeling of the judge, but from "third-personal" observation of their interaction with their environment.

14. Fausto-Sterling, *Myths of Gender*; Haraway, *Primate Visions*; Clough, *Beyond Epistemology*; Anderson, "Uses of Value Judgments in Science"; Hicks, "New Direction for Science and Values"; Goldenberg, "How Can Feminist Theories of Evidence Assist Clinical Reasoning and Decision-Making?"; Schiebinger, "History and Philosophy of Women in Science"; Schiebinger, "Has Feminism Changed Science?"; Richardson, "Feminist Philosophy of Science."

to reconcile two goals that are pragmatically incoherent, one impulse may be just to give up on one or the other. Underdeveloped suggestions may be too tepid to really solve the problem; they might allow us to muddle through the problem now, but they will not keep it from popping right back up in a similar situation. Our hypothetical neuroscientist has already articulated two such dissatisfactory-seeming suggestions: give up on animal research or give up on animal rights.

These suggestions must be refined, and new suggestions may need to be sought. One way to refine these suggested solutions is to reason through them, their implications and consequences, connecting the more obviously problematic values, as well as possible revaluations, with wider schemes of ideals and commitments. Understanding whether, for example, my short-term goals fit with my long-term goals and ideals requires unpacking the meaning of all of these values. It may also require becoming more precise about ambiguous commitments. For example, what is the right way to understand the vague talk so far about "animal welfare" or "animal rights," which are not, by the way, the same thing? When do we think it is right to sacrifice some humans' welfare for that of others, if ever? Is the inability of animals to give informed consent a relevant consideration? There are many questions we can explore as we try to reason through the possible options.

Another option is to gather more facts, guided by a value hypothesis. We may need to know more about how effective certain means to our ends are, what their side effects may be. We might need to know how well achieving a short-term end will enable (or frustrate) a long-term end. These require background facts about cause and effect. If we need to judge whether an object is beautiful or economically valuable, whether an act is offensive or humorous, or whether a person is courageous or trustworthy, we likely need to gather various supporting facts about that object, act, or person. These facts not only help us refine our hypothesis, but the refined hypothesis allows us to refine our facts, telling us where to look for additional information, revising characterizations of the facts to better suit the developing inquiry. In our example, knowing more about animal needs and wants will be a big part of this.

Suppose, having engaged in all this reasoning, you've produced a hypothesis that is fairly conservative: some kinds of animal research should continue, while others should be limited, and still others halted entirely. Animal welfare should be prioritized over research goals, not absolutely, but more so than is currently done. What matters is the harmfulness of the research to the animals' welfare, understood as best we can from the indirect evidence we have about what that

consists of. Harmless behavioral research should continue, but it should not involve sacrificing the animals; to continue that research, ways of re-homing the animals after research must be pursued. Potentially harmful research should be done only when the likelihood of benefit is high, and much more stringent requirements on replacement (of animals by nonanimals or less sentient animals), reduction (of the number of animals used), and refinement (to minimize harm) of animal protocols put in place. I do not put this forward because I think it is the right approach, but it is a hypothesis that many researchers might propose. How might we test this proposed revaluation?

Two Kinds of Tests

Gathering facts allows us to better understand the value problem and to find a suitable problem statement. Initial suggestions for solutions to the problem are posed and then refined in concert with facts and the problem statement. Before making a value judgment, as with any inquiry, it is imperative to test the suitability of the increasingly coherent set of data, problem statement, and hypothesis. There are two ways that we experimentally test hypothetical value judgments:

1. *Dramatic rehearsal*[15]—Rehearsal in imagination of the proposed course of action based on the new value judgments helps determine whether the implications and consequences would be acceptable or preferable, as far as they can be anticipated.
2. *Tentative application*—Actually acting on the basis on the new value judgments, on a trial basis, helps us see how the judgment will pan out.[16]

In some contexts, dramatic rehearsal may be enough to convince us that our proposed judgment is sound; in others, when the decision to act is all-or-nothing, it may be our only option for testing. Dramatic rehearsal builds on, but is also limited by, our background knowledge, our embodied and tacit knowledge, and our past experiences. Insofar as our imagination is richly shaped by engagements with the empirical world, our imaginative simulations draw on a large body of

15. I choose the term *dramatic rehearsal*, originally from Dewey, rather than *thought experiment* to emphasize the active, imaginative nature of the act.

16. Compare to the policy paradigm of *adaptive management*; Norton, "Pragmatist Epistemology for Adaptive Management," 171–90; Mitchell, *Unsimple Truths*, chap. 5.

explicit and tacit empirical knowledge. You, our hypothetical neuroscientist, would use your extensive laboratory experience to anticipate whether the research done would be less worrisome, as well as to understand what might be lost under the new approach. Tentative application of the value judgment in limited circumstances replaces the imagined with genuine interactions and reactions, and so, where possible, makes for a stronger test. New protocols might be pursued using the proposed revaluation, to see how the research, and the comfort of the researchers, is affected.

Warranted and True Value Judgments

When we arrive at a coherent set of facts, problem statement, value hypothesis, and successful tests, when the constraints of the situation seem satisfied, it is time to make and implement a final value judgment. Terminologically we should distinguish a judgment from a hypothesis; if the hypothesis is a proposal, the judgment is a policy. A value judgment is not merely intellectual, but it is a practical decision to act on the policy proposed by the hypothesis, and the assertion that this policy fits the need of the situation that occasioned the value perplexity in the first place.[17] In the context of our example, the judgment would put into place, for the individual researcher, a new (personal) policy for whether, when, and how to conduct animal research, and possibly a further policy of advocacy for more widespread adoption of that approach.

There are two ways of evaluating a judgment. First, we determine whether a judgment is *warranted* on the basis of the quality of the inquiry that produces it. How thorough was the inquiry? How coherent are the data, problem statement, value hypothesis, and the experimental evidence? How well coordinated were the activities of observation, problem formulation, suggestion, reasoning, and testing? A highly warranted value judgment will answer these questions to a high degree.

Second, always retrospectively, we evaluate the actual fitness of the judgment in resolving the problematic situation that led to inquiry. Does it resolve the tension that caused the perplexity in the first place? Does it do so only temporarily, or in a lasting way? We might call a judgment that failed to resolve the problem "false," and a judgment that successfully resolved the pragmatic incoherence that caused the perplexity in a lasting way "true," understanding those terms

17. See Dewey, "Logic of Judgments of Practice"; Welchman, "Logic and Judgments of Practice."

pragmatically and situationally. Those allergic to such a use of the terms *true* and *false* might say, instead, that we judged correctly or incorrectly if we did (or did not) achieve pragmatic coherence.

Warranted and true value judgments in this sense *do* have cognitive status and epistemic value in the *same* sense that the judgments of scientific inquiry do. When they are the result of adequate inquiry, when they have been shown to work in practice, that lends them weight in future inquiries. Of course they may not be suitable to the new contexts of future inquiries. Any such assessment of status is tentative and contextual, and less reliable the further the new situation lies from the prior.

Values as Evidence Revisited

Recall that the distinction between values and evidence has to do with the *functional role* of each within inquiry and practice. This functional distinction does not depend on some essential quality of the thing that acts as evidence. A piece of evidence does not have to be a representation of a particular, occurrent sense datum, nor merely a collection of such data. Under the right conditions, general descriptions of a phenomenon can play the role of evidence. According to Bogen and Woodward's data/phenomena distinction, the primary evidence for scientific theories consists of phenomena, which are general descriptions of regular processes.[18] (In turn, there is a different evidential relation between particular data and phenomena.) In other conditions, theories can provide evidence for other theories. For instance, when many of the predictions of a well-tested theory can be derived from a new theory, the former theory provides evidence for the latter.

Claims with significant normative content, which we would normally call "values," act as evidence under the right conditions. One way this can work is when evidential claims contain value-laden concepts, that is, thick normative concepts. The attribution of dishonesty to a subject can, in one context, be a value judgment against their character, and in another context, a data point for some social scientific inquiry. Another sort of case concerns the role of feminist value systems in science that I brought up earlier. Feminist values have a strong track record of successfully guiding science, and they are central to practices and projects that feminist scientists hold to be very valuable. As such, coherence with feminist values ought to speak in favor of some theory or hypothesis, and failure to cohere

18. Bogen and Woodward, "Saving the Phenomena."

a piece of evidence against it.[19] More generally, just as established phenomena have an important evidential role to play in evaluating theories and hypotheses, the values at the center of established practices have an important evidential role to play. We should not think of this evidence as definitive in most cases, but as inquiry builds a case for a particular judgment, it is one significant line of evidence.

"Values as evidence" remains somewhat loose talk. Strictly speaking, the "values" in question are playing the functional role of facts of the case or of the results of experimental testing. The role of values in inquiry is different. Values are the result of a judgment about what to do in cases of significant contingencies; they are reasons for or constraints against acting in a certain way among contingent options. The idea of "values as evidence" is a result of the contextual or situational nature of inquiry, that superficially the same claim can be the result of a value judgment in one context while it is evidence for an empirical hypothesis in another.

The normative content in such pieces of evidence, the potential dangers of wishful thinking, and the continuity of experience and inquiry that lead the results of one inquiry to have an impact beyond the narrowly conceived situation mean that the contingencies involved in evaluating and using such evidence must be subjected to careful value judgment. Here, moral imagination must be carefully exercised to ensure that such value-laden evidence is relevant to the inquiry at hand, that it is reliable evidence in the situation, and that its normative content coheres with other commitments and satisfies the needs of the situation.

Contingency and Value Inquiry

This account of value judgment as a kind of empirical inquiry raises an important question: Is value judgment not thus itself contingent at least to the extent scientific inquiry is, as discussed in chapter 2? And if so, does this not raise a serious worry about the whole structure of my argument, as, according to the contingency argument, value judgments are meant to settle the contingencies that arise in the course of scientific inquiry? At the very least it seems that since value judgment is itself contingent, the use of value judgment to settle contingencies in science will lead to persistent disagreements, even to partisan or politicized science. It is the case that contingent moments are as much a part of value inquiry as scientific inquiry. For a variety of reasons, however, this does not especially pose a problem.

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19. Clough, *Beyond Epistemology*; Anderson, "Uses of Value Judgments in Science"; Hicks, "New Direction for Science and Values."

First, the modest form of cognitivism I have argued for here calls for modest expectations about what value inquiry can deliver. On the one hand, value inquiry should be able to sort good and bad, or warranted and unwarranted, value judgments in response to particular value perplexities. It would be too much to expect a single most-warranted solution; perhaps there is no unique best solution, or perhaps our tools of inquiry simply are too coarse to deliver such judgments. On the other hand, there are significant constraints on value judgment. Factual information, especially concerning the relation of means and ends, is one constraint. The requirements of inquiry, that problem statement, evidence, and hypothetical solutions all fit together in such a way as to resolve the pragmatic incoherence, is another significant constraint. Pragmatic incoherence is not the same as a problem statement; we are free to try out different ways of capturing the incoherence, but only some statements will lead to successful solutions. Recall the two types of evaluations of value judgments above, *warrant* and *truth*; whether the pragmatic incoherence in question is resolved, and thus whether a value judgment is *true*, is not determined by meeting standards of inquiry (warrant), nor by arbitrary description, but as a practical matter—can the practice or activity in question proceed?

We should expect some degree of pluralism, here. There is not one right way to live in every detail, but many types of good lives. Different people, *in different situations*, might successfully make different value judgments. This matches perfectly well with the diverse and largely pluralistic enterprise of the contemporary sciences. On the other hand, where we have groups of people sharing a situation, that is, brought together around a shared interest, or a matter of public interest, diversity becomes problematic disagreement. That is, the diversity of values *causes* a pragmatic incoherence for the group. Where widespread cooperation is necessary for resolving the matter, there is a pressure to integrate, if not to form some sort of agreement (see "Democratic Decisions about Values," p. 133). How this concern plays out for science, and why it will not lead to undue partisanship or politicization, is discussed more fully in the next chapter ("Joint Satisfaction of Values and Standards," p. 196).

The Central Role of Imagination

The account of value judgment provided so far may sound overly rationalistic or scientistic. The comparison of value judgment to empirical, scientific inquiry in the previous section in particular raises this concern. This would be a

misunderstanding of my account of values and value judgment. Because of the value-free ideal, we are tempted to treat any intellectual process, especially one that bears formal similarities to the scientific process, as emotionally disengaged, hollow, as empty of precisely that which gives values their distinctive force. We critics of the value-free ideal typically think of that ideal as distorting our understanding of *science*. Another way to understand the argument of chapter 3 is that it has also distorted our understanding of *values* to such an extent that even critics of the value-free ideal fall prey to a poor understanding of values. Noncognitivism and absolutism about values are the flip side of the value-free ideal's distortion of science.

Value inquiry, like all forms of inquiry, but perhaps even more so, is affectively and emotionally engaged, practical and *imaginative*. These are not only fully compatible with value judgment as a rigorous form of inquiry; value inquiry could not *be* rigorous without actively engaging our emotional responses or exercising our imagination. Imagination is crucial to every stage of value inquiry, to the very possibility of integrating or transvaluating our values. Philosophers and psychologists have often subscribed to a strict dichotomy between reason and emotions, the latter being incompatible with and corrupting of the former. But this dichotomy has been roundly refuted by a variety of thinkers.[20] The mention of dramatic rehearsal above already indicates a significant role for imagination in value judgment, and what was said there need not be repeated. But there are several other important roles for imagination in value judgment that show its centrality.

Empathetically Understanding Perspectives

One crucial role for the imagination in value judgment is helping us to understand the perspectives of others who are impacted by our decisions and actions, how the impact affects them, and how they would react. This act of imaginatively understanding the perspectives of others is a type of empathy. Some have distinguished between "emotional empathy" (feeling what others feel) and "cognitive empathy" (understanding and being motivated by what others think and feel, also sometimes called "compassion"). Paul Bloom thinks the former

20. Damasio, *Descartes' Error*; Nussbaum, "Aristotle on Emotions and Rational Persuasion"; Gee, "Role of Emotional Intuitions in Moral Judgments and Decisions"; Woodward, "Emotion versus Cognition in Moral Decision-Making."

is a problematic basis for ethics, while the latter is an important component of compassion (see "The Value of Empathy," p. 147). Emotional empathy is reactive, perhaps largely unconscious. I am not as sure as Bloom that it is totally useless, but certainly it is *data* for value judgments at best, not the source of judgment. Too quickly sliding from data to judgment inevitably will be problematic.

Cognitive empathy, on the other hand, clearly requires the exercise of the imagination. One must project oneself into the position of the other, imagine what it is like to be in their shoes, and imaginatively play out the consequences of the decisions being entertained. This kind of projective, imaginative empathy, rather than reactive emotional empathy, is a crucial part of testing values. Our own reactions to the values in question are not, by themselves, enough; the very content of our social and ethical values particularly tells us that. We must understand how others will be affected.

This kind of empathy is not *merely* imaginative, of course. The exercise of imagination is rarely, if ever, *mere imagination* unconnected from reality. We can draw on our experiences to the extent that the person in question is like ourselves, but that is always a limited and tentative source of information. We gather all sorts of other information about those we're trying to understand: from the way they act, from their facial expressions, and importantly, from what they say. When in doubt about how to be empathetic, it is often best to ask.

Reframing Problems

A key roadblock to inquiry of any sort is premature settlement of one's understanding of the problem one is trying to solve. As Dewey put it, "a problem well put is half-solved."[21] Two corollaries of this bromide are that stating a problem poorly is an impediment to its solution, and a problem is never definitively stated until the solution has been found. Without creatively reframing problems, we can never be sure we have a good solution.

In the case of values, problems are often stated in the form of dilemmas. Is it more important to tell the truth or act to protect others? Should we care about duty or consequences? Dilemma-driven thinking is a typically unhelpful and unproductive way of thinking about the pragmatic incoherencies that cause value problems in the first place. Few genuine problems are either-or propositions. Imaginative thinking can help us avoid this trap, rethink our starting point, and reframe

21. Dewey, *Logic*, 112.

the problem; this pushes us to gather more facts so we can show the dilemma to be false. In addition, the focus on dilemmas can be an impediment to finding creative solutions that integrate existing valuations and lead to win-win scenarios.

Finding Integrative Solutions

A concomitant creative problem-solving technique to reframing problems involves imaginative generation of solutions that integrate values rather than forcing a tragic choice. When we are stuck in dilemma-based framings of the problem, we are generally presented with two extreme suggestions for possible solution. In this case the hypothesis is not only suggested by the problem framing, but entirely contained within it. Being stuck in the problem solutions that first suggest themselves is a near certain recipe for inadequate inquiry. The way around this roadblock is to multiply possible solutions creatively. Unfortunately, this crucial activity for practical value judgment is often precisely what is *discouraged* in ethics class, where dilemmas are carefully crafted to exclude additional possibilities, not in service of genuinely figuring out what to do, but rather in service to various theory-building needs. Even if those theory-building activities have their use, the opposite strategy is needed in practical value judgment.

To generalize this issue: failures of imagination often result from taking various assumptions about the problem space or solution space for granted. Imaginative challenges to those assumptions can thus clear another crucial roadblock. In other words, value judgment is often improved from ideas coming out of left field. Still, hard choices must sometimes be faced. Life is not without tragedy, and we must be prepared to prioritize values in such a way that of two things that we acknowledge are valuable, we can have only one.

Value Judgment in a Democratic Society

Up to this point this chapter has treated the issue of value judgment as if it were an individual decision-making process, rather than having a social aspect, just as I have in other aspects of scientific inquiry in prior chapters. Here again the choice is strategic and does not represent a philosophical commitment to individualism. Often we make decisions as teams, forming values together. Domestic partners, families, committees, workplace groups, and scientific collaborators all have occasions to work on shared value judgment. Though the process is interpersonal and distributed, rather than intrapersonal, the logic of it is the

same. Thus modeling it as individual choice is an idealization that does not distort too much.

There are other ways in which sociality informs and constrains value judgment that *do* affect its logic. These are cases where the value judgment depends upon more than those involved in the decision-making processes. These considerations are important in any sufficiently social situation, especially where matters of public interest are concerned. Because of the central value of collaboration to democracy, these concerns are especially salient in a democratic society.

First, disagreement with peers is a strong reason to doubt our values and consider reevaluation. While we should not expect that there is only one right way to live, or that we should somehow conform to what the bulk of our neighbors value, insofar as our lives impinge constantly on one another, a certain overlap is needed. Within a reasonable amount of pluralism, we are constantly forced through democratic collaboration to form shared ends, to cooperate on shared goals. Persistent disagreement can be an impediment to shared social projects. Moreover, we should recognize that rarely are our peers less able to form value judgments than we. Persistent disagreement should at least give us reason to question our values.

Whenever a values perplexity is a matter of public interest, the public ought to have a say in the values that are adopted to guide action. This is an ethical and political point, rather than a logical one. The slogan "Nothing about us without us" captures a basic political right, the right to representation and participation in processes that affect you. In the context of the American revolution the slogan was "No taxation without representation," though the sentiment goes back at least to the Renaissance, as in a statement in the 1505 Polish constitution: "Nihil novi nisi commune consensu" (Nothing new without the common consent).

The public is especially important for contemporary science. So much of contemporary scientific and engineering research consists of work on matters of public interest. That said, it would be easy to put too much value on consensus, first, because the kinds of consensus we look for are situationally limited and must be compatible with a reasonable amount of pluralism, and second, because too much emphasis on consensus can erase the importance of politics.[22] As mentioned previously, where we need to forge consensus, it is because we have disagreement about matters of shared or public interest that create pragmatic incoherence in our attempts to cooperatively address those matters. The area of

22. I am grateful to Dan Hicks for reminding me of these points.

consensus need not be complete nor need it extend to fundamentals. At most it should cover those valuations that are relevant to the activities concerning the matter at hand. Creating consensus of that sort often requires significant exercise of the imagination, where parties seemingly very far apart in their value judgments (such as the hunters and animal rights advocates mentioned in "Strategies for Integrating and Prioritizing Values," p. 153) can be shown to be, on a limited question, on the same side. Creativity, empathy, and intellectual flexibility are crucial to overcoming perceived disagreement in such cases.

More significantly, we often want to focus not on *consensus* but on *consent* in democratic decision making. Where the public in question is too large for genuine deliberation and participation in the problem-solving process, where the questions are too deeply technical for nonexperts to understand the stakes and thus to make value judgments on their own, where disagreement is too entrenched: then it is necessary to put our trust in experts and representatives of our interests. The trust itself requires the active exercise of imagination in much the same way empathy does. One must be able to see the authorities (experts and representatives) as genuine trustees of one's interests, that they would act, if not how you would act if you were in their place, with concern for your perspective and values.

This kind of trust also requires a variety of democratic mechanisms for representing the public, and these mechanisms should in some cases extend to the experts as much as to the politicians and policy makers. These experts should be authorized through legitimate mechanisms. They should be accountable in specific ways to the public. The public, or a subset of them, should be able to participate and deliberate about the matter where and to the extent possible. In some cases we should ensure that the values and characteristics of the authorities resemble those of the public. While these elements of democratic representation go beyond the scope of this book, they are elaborated and defended in detail by Mark B. Brown in *Science in Democracy*.[23]

ANALYSIS: RELATED AND ALTERNATIVE APPROACHES

The approach laid out in this chapter builds on several philosophical traditions in ethics and value theory, particularly on the classical pragmatist tradition rooted in the work of John Dewey. In the first part of this section, I lay out my debts to this tradition. There are also several sophisticated approaches to values that the

23. Brown, *Science in Democracy*.

views in this chapter can be productively contrasted with. I focus on neopragmatist feminism, conservative and existentialist approaches, and the method of reflective equilibrium.

The Deweyan Roots of My Approach

I've come to the views described in this chapter thanks to a long engagement with the works of John Dewey on the interplay of science and values. While the ideas of this chapter are not the result of a purely exegetical inquiry into Dewey's own doctrines, the equation of value judgment with inquiry, the broad outlines of the model of inquiry used in chapter 1 and here as well, and the centrality of dramatic rehearsal are all inspired by Dewey's ideas. In this section, I will trace the roots of my approach to value judgment in two central texts of Dewey's, "The Logic of Judgments of Practice" and *Theory of Valuation*, I will look at those who draw on Dewey to provide a theory of *moral imagination*, and I will look at two other Deweyan ethicists, Anthony Weston and Elizabeth Anderson, whose approaches to values have played a role in the account here.

Ethics and value theory were abiding concerns of Dewey's, figuring prominently in his work throughout his career. Two important works for understanding Dewey's theory of values are his essay "Logic of Judgments of Practice," collected in his *Essays in Experimental Logic*, and the monograph he contributed to the *International Encyclopedia of Unified Science* entitled *Theory of Valuation*. A central thread in Dewey's theory of values is the distinction discussed in "The Functional Types of Values" (p. 135) between two senses of *to value*—the pre-reflective experience or holding of something as valuable versus the judgment that something has value. Dewey uses various terms to mark this distinction: prizing/appraising, esteeming/estimating, valuing/evaluation. The distinction is important and often elided in the philosophical literature. The former (valuing, prizing, esteeming) marks "the direct experience of something as good"[24] or "a practical, nonintellectual attitude" or habit of regarding something as good,[25] while the latter (evaluation, appraisal, estimation) marks a judgment, "a process of inquiry for the determination of a good precisely similar to that which is undertaken in science in the determination of the nature of an event."[26]

24. Dewey, "Logic of Judgments of Practice," 31.
25. Dewey, "Logic of Judgments of Practice," 27.
26. Dewey, "Logic of Judgments of Practice," 31.

According to Dewey, we make value judgments because we need to act, and we either have too many ends in apparent tension, or because our ends are vague and hard to act on. Value judgment is a kind of practical, empirical inquiry for Dewey because it always concerns ends in relation to means in a particular situation, and questions about means and ends, like questions about cause and effect, are largely empirical, practical issues. Value propositions for Dewey can be warranted by inquiry, just as science can. As Dewey argues in *Theory of Valuation*:

> (1) There are propositions [value propositions] which are not merely about valuations that have actually occurred (about, that is, prizings, desires, and interests that have taken place in the past) but which describe and define certain things as good, fit, or proper in a definite existential relation: these propositions, moreover, are *generalizations*, since they form rules for the proper use of materials. (2) The existential relation in question is that of means–ends or means-consequences. (3) These propositions in their generalized form may rest upon scientifically warranted empirical propositions and are themselves capable of being tested by observation of results actually attained as compared with those intended.[27]

We can identify here two ways for Dewey in which value judgments can be tested empirically. The first, indirect form of test involves connecting means–ends relations with cause–effect relations. Whether X is a means to Y, or whether Y is the consequence of X, depends on whether X reliably causes Y. A value proposition "rest[s] upon scientifically warranted empirical propositions" when our previously warranted cause–effect knowledge supports the means–end connections involved in or presupposed by the value proposition. Second, we test value propositions directly by comparing the consequences of acting on the value propositions with the end intended; if the results are different from what was expected, or if the results are not experienced as good in the way expected, then this is evidence against that value proposition.

The close connection of ends to means helps define the sense of "ideal" that Dewey accepts, as distinct from mere fantasy: "'Idealism' must indeed come first—the imagination of some better state generated by desire. But unless ideals are to be dreams and idealism a synonym for romanticism and phantasy-building, there must be a most realistic study of actual conditions and of the mode or law of natural events, in order to give the imagined or ideal object definite

27. John Dewey, *Theory of Valuation*, 212.

form and solid substance—to give it, in short, practicality and constitute it a working end."[28] The difference is that worthy ideals are formed in reference to what is attainable and the actual conditions which call for an ideal. Idealistic goals, produced by imagination, are not the end point, but the beginning. From the beginning as a sketchy suggestion of a better state, empirical inquiry helps us specify the ideal into an end we can work toward.

While the language of *desire* can be misleading, Dewey sometimes uses the term to describe valuation and distinguishes it systematically from *wishing*:

> Because valuations in the sense of prizing and caring for occur only when it is necessary to bring something into existence which is lacking, or to conserve in existence something which is menaced by outside conditions, valuation involves desiring. The latter is to be distinguished from mere wishing in the sense in which wishes occur in the absence of effort. "If wishes were horses, beggars would ride." There is something lacking, and it would be gratifying if it were present, but there is either no energy expended to bring what is absent into existence or else, under the given conditions, no expenditure of effort would bring it into existence—as when the baby is said to cry for the moon, and when infantile adults indulge in dreams about how nice everything would be if things were only different. The designata in the cases to which the names "desiring" and "wishing" are respectively applied are basically different. When, accordingly, "valuation" is defined in terms of desiring, the prerequisite is a treatment of desire in terms of the existential context in which it arises and functions.[29]

The relevance for concerns about wishful thinking is central here. Wishful thinking arises when our valuations are mere wishes, where they are not informed by the conditions of the current situation, and where we make no effort to take the steps to genuinely bring them about. Mere wishes, in this sense, have no place informing scientific inquiry. But values as representations of things that are genuinely lacking from the current situation, or as existing things that are precarious or threatened, informed by warranted ideas of the connections of means and ends and the conditions of the specific situation, with specific plans and efforts to bring about or protect the valued things, are not problematic in the same way. Rather, they are coherent parts of a broader process of inquiry.

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28. Dewey, *Human Nature and Conduct*, 162.
29. Dewey, *Theory of Valuation*, 204.

Moral imagination is central to Dewey's theory of values, as imagination is central to all inquiry, but especially because dramatic rehearsal of possible courses of action, prior to committing to action and facing the consequences, is the most important way of "testing" value propositions. As Dewey writes in *Art as Experience*, quoting Percy Shelley, "Imagination is the chief instrument of the good."[30] Several Dewey scholars and Dewey-inspired philosophers have focused on the role of moral imagination in Dewey's ethical writings.

In *John Dewey and Moral Imagination: Pragmatism in Ethics*,[31] Steven Fesmire attempts to give an account of Dewey's ethical theory as moral imagination and make it plausible as an approach to ethics in the company of the work of Martha Nussbaum and Alasdair MacIntyre. Typical of much Dewey scholarship, Fesmire's approach is to "think with Dewey" about the topic of moral imagination, rather than to simply provide an interpretation of Dewey's work. This still requires significant interpretative work on Dewey's views on moral imagination, which Fesmire's work guides us through.

Fesmire distinguishes two key ways that imagination plays a role in moral deliberation: *empathetic projection* as the imaginative adoption of values, perspectives, and attitudes of others, and *creatively tapping a situation's possibilities* by imaginatively exploring different aspects of the situation and dramatically rehearsing the possible courses of action they afford. (The latter, Fesmire claims, is Dewey's main focus.) This kind of imagination is the ability "to see the actual in the light of the possible."[32] According to Fesmire, Dewey thinks of moral deliberation as a kind of problem-solving inquiry, where problems arise from the conflicts between currently held values in particular situations. For Dewey, deliberation or inquiry requires that rather than just *acting* in the face of a problem, we step back and withhold immediate action, channeling our conflicting impulses into dramatic rehearsal of possible courses of action. Exploring these possibilities through careful examination of the facts of the situation, bringing prior knowledge to bear, along with dramatic rehearsal is what intelligent moral deliberation requires. Finally, action is treated as an experimental test of the chosen hypothesis, whose success or failure will modify future conduct. Fesmire incorporates George Lakoff's and Mark Johnson's works in cognitive semantics to argue that the imaginative process depends heavily on metaphor, and these

30. John Dewey, *Art as Experience*, 350.

31. Fesmire, *John Dewey and Moral Imagination*.

32. Fesmire, *John Dewey and Moral Imagination*, 67; compare Alexander, "John Dewey and the Moral Imagination."

metaphors are in fact central to our cognitive and linguistic machinery. These metaphors are, of course, embodied, in a way that fits well with Dewey's emphasis as organism-environment-culture interaction as the scene of human mind.

Mark Johnson himself is a perceptive interpreter of Dewey, and builds heavily on Dewey's ideas in his earlier work *Moral Imagination*[33] and his more recent *Morality for Humans: Ethical Understanding from the Perspective of Cognitive Science*.[34] In the latter Johnson provides a broadly naturalistic, Deweyan pragmatist account of morality centered on moral deliberation and the role of imagination in moral deliberation. Unlike Fesmire, Johnson emphasizes Dewey's distinction between "valuing" and "evaluation" (though he calls the latter "valuation"), and he discusses at length the relationship between science and ethics, not only the influence of science on ethics, which is a central part of Johnson's story, but also the sense in which moral deliberation is a kind of empirical inquiry.

Johnson is probably most well known for his long-term collaboration with cognitive linguist George Lakoff and their work on embodied metaphor theory in cognitive semantics and its philosophical implications. It is no surprise that Johnson so adeptly reviews the empirical literature and draws implications for our understanding of morality. Johnson does not limit himself to embodied metaphor theory, but draws on the affective neuroscience of Antonio Damasio, the moral psychology of Jonathan Haidt, the neurophilosophy of Pat and Paul Churchland, the feminist developmental psychology of Carol Gilligan, and many other scientific sources, as well as philosophers' insights from a variety of traditions, in a way that is satisfying and provocative without becoming reductionistic or scientistic.

Johnson is happier to wade deeper into the pool of metaethics than I am here. He provides a powerful argument against the idea that there is a special realm of "moral experience" and against the Kantian idea that there is a peculiar kind of "moral judgment" distinct from our ordinary repertoire of problem-solving strategies. Drawing on a wide variety of sources from evolutionary biology, neuroscience, anthropology, and moral psychology, Johnson canvasses the various sources of our values, including biology, kinship, social institutions, and cultural sources. Johnson points out that some values will be universal or near-universal simply due to the necessities of biological functioning and the requirements of any functioning social interaction or institution, though there will also be a lot

33. Johnson, *Moral Imagination*.
34. Johnson, *Morality for Humans*.

of cultural variation. Obviously this part of Johnson's argument was a major influence on chapter 4, especially "The Many Sources of Values" (p. 116).

Johnson's account of moral deliberation is fully Deweyan. Moral deliberation is problem-solving inquiry that addresses a particular situation in which our habits, desires, and values are inadequate to the conditions of the particular situation. It involves gathering information about the situation and dramatic rehearsal in imagination of various possible courses of action. Johnson adopts completely Dewey's view that this process is regulated by qualitative considerations and that the goal of inquiry is to transform a situation characterized by an indeterminate, perplexing, problematic quality to one that is determinate and stable, allowing us to move forward in a satisfactory way. The process of moral deliberation as inquiry is "reasonable" if it actually transforms the situation in a way that resolves the problem or perplexity that occasioned deliberation. This process changes not only our values and our perception of the world, but the world itself and ourselves via a new structure of activities and interactions.

I think there is one major missed connection in Johnson's account that connects very closely with my own interests. On the one hand, Johnson appears to hold a basically realist (if critical and fallibilist) attitude toward the science he relies on in his account. On the other hand, he denies moral realism because it is supposedly absolutist and foundationalist in untenable ways. However, Johnson himself denies that there are distinctive types of experience and inquiry. It is the first major argument of *Morality for Humans*. Presumably, this would require us to reject the dichotomy between scientific and moral experience and inquiry, and to see his pragmatist process metaphysics as applying broadly to human knowledge, not just to values and norms. If this still permits a realist attitude about science, which I think it does, why can it not permit a realist attitude about the valuations that result from reasonable processes of moral deliberation?

Another broadly Deweyan thinker about ethics and values is Anthony Weston. Weston accepts a pluralistic account of the sources of our values, which can be traced back to Dewey—for example, in "Three Independent Factors in Morals."[35] He also heavily emphasizes the role of imagination or creative thinking in ethics.[36] Weston is perhaps more interested in practical strategies for exercising moral imagination and resolving ethical problems than he is in ethical theorizing. One of his most interesting works in this respect is *How to Re-imagine*

35. Dewey, "Three Independent Factors in Morals."

36. For example, Weston, *Creative Problem-Solving in Ethics*; Weston, *21st Century Ethical Toolbox*.

the World: A Pocket Guide for Practical Visionaries.[37] As Weston puts it in his opening words, "This book is a guide to creative thinking in service of radical social transformation."[38] It covers a wide variety of exhortations, strategies, and tips for creative thinking about our lives and our world.

Weston is relentlessly positive, perhaps even romantic, without coming across as utopian in an out-of-touch, unconstrained, idealistic sort of way. The emphasis of the book is on *vision* and *ideas*. This is not a guide for practical activism on the ground, though there are tips and suggestions here and there about how to bring visions and ideas to life. No doubt those truly hardened by realpolitik and incrementalism, and many others besides, would find this book hokey and unrealistic. I see it as an invitation to be perceptive about the actual, and bring imagination to bear in order to discover the possible. One of the best parts of the book is that it is constantly fleshing out its advice with examples that are meaty enough to be suggestive, but brief and sketchy enough so that you don't get bogged down in the details.

Finally, in terms of values in science, the Deweyan thinker deserving the greatest acknowledgment is Elizabeth Anderson. Anderson's "Uses of Value Judgments in Science"[39] is in my mind one of the landmark works in the contemporary discussion of values in science, and the position taken there is resolutely Deweyan, and probably the closest anywhere in the literature to my own. In some ways my work further elaborates Anderson's position by going back to Dewey and then forward to the contemporary discussions of moral imagination and of values in science. Anderson protests philosophers of science who claim that "all moral and political values are on a par with respect to their epistemic value."[40] She objects to the common idea that values are "an exogenous influence on theory choice."[41] That is, she objects to the idea that values have no epistemic status, that they might be unmoved movers of scientific inquiry, and that science will have no impact on our values. The root of the problem for Anderson, the one I identified in chapter 3, is the "undertheorization of value judgments."[42]

Anderson's positive account of values in science emphasizes the idea that there can be evidence for value judgments, and that the evidential warranting of value

37. Weston, *How to Re-imagine the World*.
38. Weston, *How to Re-imagine the World*, 1.
39. Anderson, "Uses of Value Judgments in Science."
40. Anderson, "Uses of Value Judgments in Science," 2.
41. Anderson, "Uses of Value Judgments in Science," 2.
42. Anderson, "Uses of Value Judgments in Science," 2.

judgments is what prevents closed-mindedness and wishful thinking from being serious problems. They are not serious problems because most people are not ideological fanatics, and "the mark of a nonfanatical valuer is that she treats her intrinsic value judgments as open to revision in light of experience."[43] That is, most people recognize that new evidence or experience is relevant to the reappraisal of their values and are willing to engage in such reappraisal. Anderson emphasizes the evidential relevance of emotions or "emotional experiences" in particular:

> Do emotional experiences really provide evidence for value judgments? This is to ask whether we should take seriously the appearances they present to us as bearing on our value judgments and hence on the choice of our final ends and objects of concern. In fact, we do take such experiences seriously. We tend to judge what arouses our favorable emotions as good, and what arouses our unfavorable emotions as bad. If we experience a hobby as boring, we seem to take this as evidence that it isn't worthwhile, at least for those of us who find it boring. If we view the giant California redwoods with awe, we seem to take this as evidence that they are splendid.[44]

Anderson then defends this tendency, arguing that emotional experiences are suitable to act as evidence because they have cognitive content of the appropriate sort, they are appropriately independent from the values they provide evidence for, and they are "accountable to the way the world is," that is, they track information about the world and are revisable in the light of further evidence.[45] Connecting back to the discussion of Dewey, these emotional experiences are a special case of the comparison of the actual consequences of acting on some value judgment with the consequences intended by the value judgment. Anderson adds to this idea the relevance of contemporary psychology of emotions, but we need not focus exclusively on emotion, except insofar as all relevant experiences of the qualities of things have an affective component.

Neopragmatist Feminism

Another important set of related approaches, contrasted with the classical pragmatism of Dewey and those more directly inspired by him, are those based in the *neo*pragmatism of Willard Van Orman Quine, Donald Davidson, and Richard

43. Anderson, "Uses of Value Judgments in Science," 9.
44. Anderson, "Uses of Value Judgments in Science," 9.
45. Anderson, "Uses of Value Judgments in Science," 9.

Rorty, and the relevance of neopragmatism for values and value judgments in science in particular has been explored in depth by two neopragmatist feminists: Lynn Hankinson Nelson and Sharyn Clough.[46] Hankinson Nelson and Clough share the idea that values can *be* evidence in scientific contexts, though they disagree on much else. That values can act as evidence, and are also sensitive to revision in light of evidence, according to Hankinson Nelson and Clough, is the reason their views are sometimes referred to as "feminist radical empiricism."

Hankinson Nelson starts from Quine's holism, according to which all of our beliefs, whether beliefs about basic facts or beliefs about highly generalized theory or even mathematics, form a coherent system, a web, that meets experience as a whole, is corroborated or falsified by experience as a whole, and is revised accordingly. Hankinson Nelson adds the idea (advocated earlier by Morton White)[47] that values, too, are nodes in this "web of belief." Values are modified as conflicts are revealed, new evidence is gathered, et cetera, in order to maintain coherence. As such, because everything in the web in a sense serves as evidence for everything else, as long as the web stands up to experience, values can be regarded as evidence, having evidential status. Quine himself rejected this view. In a response to Morton White, he held that while factual and theoretical beliefs, as a whole scheme, still aimed to correspond to the world, values only aimed to cohere with each other.[48] Quine proposes two separate webs, for beliefs and for values, while White and Hankinson Nelson argue for one.[49]

Clough starts instead from Donald Davidson and Richard Rorty's interpretation of Davidson's views, both of whom reject the way that Quine's epistemology continues to be *representationalist*, that is, to separate the *content* of our beliefs about the *world* from the *scheme* of *ideas* by which we represent those contents.[50]

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46. Hankinson Nelson, *Who Knows*; Hankinson Nelson, "Question of Evidence"; Clough, *Beyond Epistemology*; Clough, "Radical Interpretation, Feminism, and Science," 405–26; Goldenberg, "How Can Feminist Theories of Evidence Assist Clinical Reasoning and Decision-Making?"

47. White, *What Is and What Ought to Be Done*; White, "Normative Ethics, Normative Epistemology, and Quine's Holism."

48. Quine, "Reply to Morton White."

49. Rumor has it that Quine came around to the one-web position before he died. According to Lynn, Quine acknowledged that "you have me dead to rights," but never clearly stated that he was convinced (personal correspondence, March 27, 2012).

50. Donald Davidson was strongly influenced by, but also critical of, Quine's philosophy. Representationalism, or the dichotomy between empirical content and conceptual schemes, was a dogma that Davidson argued Quine needed to give up. See Davidson, "On the Very Idea of a Conceptual Scheme"; Malpas, "Donald Davidson." Richard Rorty appropriated Davidson's views to develop a radical form of neopragmatism. See Rorty, "Pragmatism, Davidson, and Truth."

According to this style of neopragmatism, we should reject this scheme-content dualism. Davidson's argument, as well as his alternative, and the ideas that follow upon it, are not easy to explain in brief. The basic idea is that we should deny that we have, on the one hand, experiences of a world prior to or independent of the concepts that we "organize" the experiences of the world into and, on the other, that our concepts can exist purely subjectively, independently of the way we use them in the world. What we have instead is a web of beliefs, formed in active engagement with the world, without trying to break beliefs down into their conceptual component and their content. We determine whether they are true or false, warranted or unwarranted based on how they are used and how they relate to other beliefs, not on whether they represent "the real world." One can take the step from here to the idea that among the beliefs or sentences in the web are our values, just as Hankinson Nelson does, but without the residual dualism.

Miriam Solomon[51] and Audrey Yap[52] critique both of these views, and one of the problems they raise is that these views have too simple a model of beliefs, evidence, theory, and values, where these are too undifferentiated from one another to do the work they need to do. Solomon refers to the model as "the web of valief" (a portmanteau of "value" and "belief"), and argues that, because of its simplicity, it is not only unable to do the epistemological work of accounting for beliefs, but also the ethical and political work of accounting for how values work. The view I've developed, following in the line of Dewey's contextualism, allows us to reject the absoluteness of the dichotomy without failing to differentiate these things at all; indeed, we can recognize the distinctions as both *functional* (operative for certain purposes) and flexible (drawn differently in different contexts).

Yap raises two other important concerns. First, there are value judgments that we should consider unrevisable, for example, certain basic antisexist or antiracist commitments.[53] Although I myself have a hard time imagining conditions in which I could revise antisexist or antiracist commitments, I do not think that supports a closed-minded attitude of the type that Elizabeth Anderson argues strongly against.[54] The difficulty in believing that these values might be revised is in part based on the significant empirical evidence in their favor, which feeds into Yap's second concern. While these feminists argue that

51. Solomon, "Web of Valief."

52. Yap, "Feminist Radical Empiricism, Values, and Evidence."

53. Yap, "Feminist Radical Empiricism, Values, and Evidence," 62; compare Alcoff, "Commentary on Elizabeth Anderson's 'Uses of Value Judgments in Science.'"

54. Anderson, "Uses of Value Judgments in Science."

the empirical evidence is in and supports feminism and antiracism, those who hold patriarchal or racist beliefs will also claim that the evidence supports their beliefs instead.[55] Yap attributes the problem to an idealized picture of agents and their open-mindedness. I see the problem again as a result of an inadequate model of inquiry, lacking the functional distinctions between values, facts, and hypotheses, as well as an account of when beliefs or values become legitimately problematic and so open to inquiry in the first place. At the same time I think we must make it clear that while racists may *claim* that their views are supported by the evidence, it is a false equivalency to treat this as ultimately undermining the claims of antiracist or of feminist neopragmatist accounts of values and evidence. That both sides claim that their values are empirically well supported does not make it so, just as it is a false equivalency to give attention to both those who claim that anthropogenic climate change is strongly evidentially supported and those who claim that it is doubtful.[56]

Existential and Conservative Approaches to Values

One could reasonably raise a criticism in light of a tension between my account of value judgment and my commitment to pragmatic pluralism. Namely, it seems to presume a progressive account of values, according to which our values must yield to new experience. This seems radically at odds with two plausible kinds of value commitments, which I will call existential and conservative, associated with existentialist and conservative theories of valuation.

According to the Sartrean existentialist, values are commitments made without a rational basis, inescapable, made freely, and held to come what may.[57] A young man must decide whether to go off to war, to fight for his country, or to stay home and care for his ailing mother. To make this choice is to make a commitment to be a certain person. It makes no sense to compare the consequences of the two choices, as in some very real way the two options result in there being

55. Yap, "Feminist Radical Empiricism, Values, and Evidence," 62–63.

56. Ultimately, I do not think that Yap engages in such false equivalences. Her point is not that we cannot provide the evidence and argument that definitively show that one view, and not the other, is empirically supported. Rather, her argument is that the recalcitrance of racists in the face of such evidence and argument, and their continuing insistence on an alternative evaluation of the evidence, suggests that there is not enough machinery in the feminist radical empiricist view to counter the recalcitrant racist. I agree, but place the burden on the account of inquiry rather than a more psychological account.

57. Sartre, *Existentialism and Humanism*; Crowell, "Existentialism," §3.2.

two very different (possible) people the consequences happen to, with very different characters, and incommensurable values. This kind of commitment seems deeply at odds with the account described here.

Conservatives are committed to the principle: do not sacrifice or risk values that are secure today for the promise of values tomorrow. Problems that arise are merely threats to our values, which should be protected rather than reevaluated. Human reason has limited efficacy, according to the conservative principle, and when it comes to our values and our society, the slow evolution of tradition is to be preferred to intentional intervention. Something like this principle can be found in Edmund Burke and in various other classical conservative thinkers.[58] To bet what is valuable now on possible future values is never the worthy sacrifice, especially at the level of social values. One should not attempt to reengineer society on a rational basis, but rather allow organic change to slowly adapt to new contexts. This type of valuation likewise seems at odds with the transformative value inquiry, the transvaluation of values described here.

I would argue that this account captures what is valuable in both of these views, while avoiding their excesses. Pragmatic pluralism shares the conservative's view that we should take our values as they are, but it takes that as a starting, not an end point. It shares the conservative's skepticism about the powers of human reason and the folly of trying to rationally reconstruct society from first principles. Pragmatic pluralism also agrees, in part, with the view that we should not overturn settled values, restricting this view to the context where no pragmatic incoherence arises. If there is no value perplexity, there is no call for inquiry, no real possibility of transformative value judgment. Conservatives may have a higher tolerance for indeterminate value situations, a lower threshold before recognizing such situations as problematic. And in many cases of pragmatic incoherence, they may prefer a strategy of trying other types of inquiry (factual, technological), while leaving values fixed, before pursuing value inquiry. However, insofar as the conservative principle blocks the road to inquiry and prevents successful resolution of undeniably pressing indeterminate situations, it is a form of closed-mindedness that brings harm. If we are in a genuine and pressing state of pragmatic incoherence, we can either suffer, or engage in inquiry. And we can prevent much suffering by seeking out pragmatic incoherence that has not yet caused a crisis.

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58. See Gray, "Conservative Disposition," 132–60; Hamilton, "Conservatism."

Likewise, this account can accommodate, to some extent, existential commitments. After all, not *all* values need be existential commitments, only particularly central or sacred ones. Other, less central values might, perhaps often will, create pragmatic incoherence with one's existential commitments, and value inquiry can help one determine how to adjust them. The real problem comes when existential commitments themselves conflict. In the face of such conflicts, existentialists have three options: 1) pursue a value inquiry, and adjust their commitments in a way that is reflective and warranted; 2) alter their existential commitments by the same a-rational, free process that produced the commitments in the first place; 3) live in a state of pragmatic incoherence, despite the difficulties it causes. It seems to me that (1) has significant benefits, but I would not claim that the benefits are absolute and unlimited, or that there is something deeply immoral about resolving value problems other ways. However, it is hard for me to see the justification in failing to use our intelligence when it might help.

Reflective Equilibrium

There is another tool in the ethicist's toolbox for resolving conflicts and indeterminacies of value: the process of reflective equilibrium, most often associated with the work of John Rawls.[59] According to reflective equilibrium, one probes one's existing values, determining some general principles one is committed to, as well as some more specific valuations in particular cases. Where inconsistencies emerge, one revises to preserve as much as possible and repeats until a consistent system emerges.

Reflective equilibrium is an important reasoning technique, very useful in refining suggested hypotheses, especially where the problematic situations are far-reaching. In many ways, it mirrors the account of value judgment outlined here. Making judgments about specific cases can be understood as a dramatic rehearsal—for example, while making judgments about general principles—and judging the coherence of the two is connected with the refinement of solutions through reasoning. But by itself reflective equilibrium gains no purchase on practical experience. Nothing guarantees that the values produced through reflective equilibrium will work in practice, as this method does not involve

59. Rawls, *Theory of Justice*. The approach was also put forward by Nelson Goodman, *Fact, Fiction, and Forecast*, in the context of justifying the principles of inductive logic.

gathering facts or cause–effect knowledge about means and ends, nor does it have a place for actual testing of value hypotheses. It takes the virtue of logical consistency, which is an important *aspect* of warranted value judgment, to be an *absolute criterion* of value inquiry. But logical consistency is not enough to guarantee pragmatic coherence.

NEXT STEPS: FROM VALUE JUDGMENTS TO IDEALS

In this chapter I have provided a theory of value judgment, responsive to the conflicts that arise from the plurality of our values laid out in the previous chapter, with moral imagination at its center. With this theory of value judgment in hand, the question that remains is how we can build an alternative to the theories of values in science discussed in chapter 3. The next chapter will lay out the ideal of moral imagination, an ideal for values in science with this theory of value judgment at its core.

CHAPTER 6

THE IDEAL OF MORAL IMAGINATION

The great instrument of moral good is the imagination.

—**Percy Bysshe Shelley, "A Defence of Poetry"**

INTRODUCTION: THE IDEAL STATED

As I have argued previously, ideals are needed to guide action, to give it vision and direction beyond the most immediate needs and problems that face us. Ideals are the enduring ends and purposes that guide individuals and communities, that give a sense of unified perspective to individuals and associations. They are far from utopian fantasies, at least when they are worthy ideals, because they speak to the needs of the present sufficiently well to guide activity.[1] Insofar as science is a social practice and a vocation, it requires ideals to give it shape, identity, and meaning. We have also seen that scientists have a responsibility to engage in value judgments whose depth is seldom appreciated. Whatever other ideals guide and animate science, such as the scientific values and community norms discussed in chapter 4, an additional ideal is needed, one to replace the value-free ideal in light of the arguments in chapter 2 that showed its failure.

Epigraph: Shelley, "Defence of Poetry," 17.

In addition, value judgment, in contrast to habitual valuing, centrally involves moral imagination.

From this account of value judgment, I propose the following new ideal for values in science:

The ideal of moral imagination:

Scientists should recognize contingencies in their work as unforced choices, discover morally and epistemically salient aspects of the situation they are deciding, empathetically recognize and understand the legitimate stakeholders and their interests, imaginatively construct and explore possible options, and exercise fair and warranted value judgment in order to guide those decisions.

The ideal suggests four activities to engage in in order to deliberate about any contingency (see Figure 6.1):

1. Identify the goal or task at hand.
2. Identify and imaginatively multiply options for how to carry out the task.
3. Determine the standards and values that are relevant to the situation.
4. Identify the legitimate stakeholders to consider and identify their interests.

Mutual refinement and development of these four areas provide the materials necessary for acting on the ideal of moral imagination. The process will not typically proceed in a linear order (see the discussion in the Conclusion and the worksheet provided in the Appendix).[2]

The ideal of moral imagination, in turn, allows us to recognize new ways of being irresponsible in scientific research. We're already familiar with the problem

1. John Dewey draws a distinction between "inclusive ideals" and "utopian ideals"; Dewey, *Common Faith*; compare Dewey, *Human Nature and Conduct*, 162; see also "The Deweyan Roots of My Approach," p. 171.

2. A major inspiration for this approach is the Socio-Technical Integration Research (STIR) protocol developed by Erik Fisher and his collaborators. Fisher and Schuurbiers, "Socio-Technical Integration Research"; Fisher, Mahajan, and Mitcham, "Midstream Modulation of Technology"; Fisher and Mahajan, "Midstream Modulation of Nanotechnology Research in an Academic Laboratory"; Fisher, "Ethnographic Invention"; Fisher and Mahajan, "Embedding the Humanities in Engineering," 209–30. This is described more fully in the Conclusion, "Situated Ethics and Socio-Technical Integration Research," p. 223.

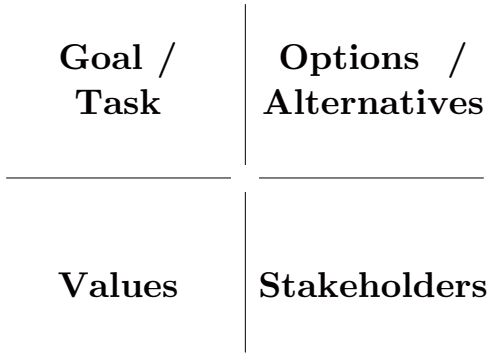

Figure 6.1. The Moral Imagination Framework. Four steps that must be engaged in and developed in reference to one another in order to deliberate and make a value judgment about scientific contingencies.

of *scientific misconduct*, whether deliberate or not, when scientists violate clear codes or norms of responsible research, such as fabricating data, plagiarism, and performing human-subject research without consent. Now we can recognize a second form of irresponsibility:

Failures of moral imagination:

When scientists fail to recognize contingencies or fail to consider superior options where their decision has significant effects on stakeholders or other morally salient aspects.

The first kind of irresponsibility, scientific misconduct, is a standard concern in research ethics. Though scientists do not always live up to it, there is nothing controversial about it, except for some disagreements about the details about what the standards require (i.e., what exactly counts as informed consent or fudging data). The second kind of irresponsibility is something new, suggested by the new ideal. It is also not an all-or-nothing matter. For the most part, scientific misconduct either does or does not happen. Perhaps there are borderline cases of plagiarism or informed consent, but mainly you plagiarize or you don't; you get informed consent or you don't. On the other hand, failures of imagination come in degrees—there are extreme cases, but they are notable *as* extremes, with many gradations between them.

But the main focus of the ideal of moral imagination is not on the negative aspects of irresponsibility on the part of scientists. It is on the positive improvements to science and society that come from an increase in the exercise of moral imagination. On the one hand, the ethical and social benefits of the ideal of moral imagination arise due to the increased consideration of the values at stake in research activities. On the other hand, there are significant epistemic benefits involved in going through the processes laid out in the ideal of moral imagination, which requires activities central to divergent thinking and creative problem solving.[3] That is, the ideal of moral imagination requires explicit reflection on the nature of the goal or task at hand and on the constraints for adequately fulfilling it, a part of the creative problem-solving process known as "problem finding." The ideal also requires multiplying options beyond the obvious in hopes of finding solutions that better integrate value considerations. Both of these processes create significant epistemic benefits in helping prevent scientists from being stuck in "local optima" in the space of solutions, that is, solutions that appear best because too narrow a view of possibilities has been taken, where better solutions are available but beyond the horizon of where we've looked.

Consider the case of the restrictions on embryonic stem cell research discussed in the Introduction. Whether or not you agree with the value judgment about the status of embryos behind the ban—and I think there are some serious concerns to be raised about the soundness of that judgment—there is no doubt that the landscape of stem cell research was shaped significantly by funding decisions and other types of restrictions, especially in the United States from 2001 to 2009.[4] As a result, scientists dependent on federal funds and interested in stem cell research had to creatively multiply their options, and this led to the development of techniques for using non-embryonic stem cells from a multitude of sources. It is almost certainly the case that such research would not have advanced as far as it has without the ban.[5] One can see this as either a silver lining or a superior result, depending on whether one agrees with the value judgments behind the opposition to research on human embryos. Either way, values and imagination worked together to break new ground, with distinct benefits that may have been less developed if different values and politics had led research

3. Weston, *Creativity for Critical Thinkers*.

4. Though restrictions on public funding for research using human embryos go back even further, to at least 1973. Wertz, "Embryo and Stem Cell Research in the United States."

5. Vogel and Holden, "Developmental Biology"; Rao and Condic, "Alternative Sources of Pluripotent Stem Cells"; Murugan, "Embryonic Stem Cell Research"; Grinnell, *Everyday Practice of Science*, 95.

funding decisions in a different direction. Losses and frustrations from one perspective become gains from another.

The ideal of moral imagination is suggested, somewhat naturally, by the account of values and value judgment provided in prior chapters. I will now work to articulate and defend it as an ideal for scientific practice.

ARGUMENT: THE IDEAL ARTICULATED AND DEFENDED

This section attempts to show that the ideal of moral imagination can indeed be defended as an ideal for values in science, and to draw out the consequences of the ideal, in broad strokes, for how we think about science, scientific practice, and the role of values therein. The Conclusion applies the ideal in greater detail to the various ways that values are needed in scientific inquiry.

The Limits of Compliance-Oriented Ethics

Why should we concern ourselves with failures of imagination, rather than focusing on scientific misconduct? The moral failings involved in scientific misconduct do seem potentially much more significant and worrisome than these failures of imagination. The account of failures of imagination may seem like it will muddy the waters significantly, leading to a potential *increase* of scientific misconduct. The account of research ethics behind this set of concerns is what we might call a "compliance-oriented" account of ethics, and without denying the importance of addressing scientific misconduct, I believe these concerns are overblown. Compliance-oriented accounts of ethics emphasize hard-and-fast norms, rules, and principles. They are a feature of many of the problematic ideals for values in science canvassed in "Analysis: Problematic Approaches to Values in Philosophy of Science" (p. 100). On the one hand, an ethics focused exclusively on compliance has significant practical, pedagogical, and normative limitations. On the other hand, nothing in the ideal of moral imagination prevents us from acknowledging that there are minimal standards for scientific conduct.

On the first point, consider, for example, what the ethics education literature suggests about teaching ethics exclusively in terms of rules to be complied with. There are serious shortcomings to this approach. It is difficult for students to apply the rules to new cases. Compliance with rules fails to motivate social engagement or better behavior, in part because the rules are seen as an imposition on the activity, rather than organically a part of it. Compliance-based, rule-bound approaches to ethics education creates both disengaged attitudes and leads to

minimal efforts to meet a floor of standards rather than reaching higher. As one study puts it: "General principles do not always provide people with effective guidance for working through the complexities of concrete ethical dilemmas, and even knowing what to do does not always translate into actually taking the right course of action. By providing practical strategies for working through ethical problems, however, ethical decision making becomes more likely. As a result, it seems reasonable to conclude that ethics training might benefit, and benefit substantially, by providing students with strategies for working through ethical problems."[6] In contrast, the account of value judgment as practical problem solving laid out in the previous chapter answers just that need: that is, it provides a general framework for addressing ethical problems and making ethical decisions. Ethical problems are conceived of as situations of pragmatic incoherence of our values, where they either pull us in different directions or are ambiguous, in particular situations demanding conflicting courses of action or leaving how we ought to act indeterminate. The framework spelled out there provided guidance for specifying, integrating, and prioritizing values in light of evidence and moral imagination.

Compliance-oriented accounts stifle creativity, leading to the sense that ethical decisions consist of strict dilemmas, with pre-given options. Our moral life is in fact frequently beset by tensions, by values pulling in different directions. Sometimes through ethical inquiry, social agreement, or existential commitment, we hit upon hard and fast rules that are lasting guides to behavior. More often, however, we adopt rules as shortcuts that are good enough in most cases. Hard-and-fast rules often fail to account for nuanced situations, the role of judgment, tacit knowledge, skill, and wisdom in ethical behavior. What's more, compliance does not necessarily facilitate the cultivation of a good character or deliberative practices. As Charles Harris Jr. points out, "preventative ethics" (his term for compliance-oriented ethics) focusing on negative rules does not account for many key ethical concepts, including "(1) sensitivity to risk, (2) awareness of the social context of [science and][7] technology, (3) respect for nature, and (4) commitment to the public good."[8] The ideal of moral imagination allows

6. Mumford et al., "Sensemaking Approach to Ethics Training for Scientists."

7. Harris is focused on engineering ethics, but his argument is equally applicable to professional ethics in the sciences.

8. Harris, "Good Engineer," 153; see also Ladd, "Quest for a Code of Professional Ethics"; Small, "Codes Are Not Enough."

us to take into account the full range of social and ethical considerations, and it encourages us to strive to do better rather than stopping at a level of minimally responsible behavior.[9]

Focusing on moral imagination allows us to go beyond what compliance-oriented ethics accounts for, while also acknowledging that there are still minimal standards for scientific behavior, both epistemic and ethical standards. The reasons go back to chapter 4 and the discussion of the preconditions of the practice of science. Certain standards, such as not falsifying evidence or not stealing credit, are epistemically and ethically for the functioning and flourishing of anything that we would call science. It does not mean that these are always the right or obligatory things to do; scientific integrity is not the most important value in every situation. But these standards rightly need to be policed. It would be a failure of moral imagination to engage in a form of deliberation that caused us to lose sight of those standards and their significance.

Failures of Imagination

The ideal of moral imagination identifies another way of being irresponsible in science besides failure to comply with minimal principles or standards of scientific behavior: *failures of moral imagination* (or "failures of imagination" for short). Failures of moral imagination occur when scientists fail to meet the ideal of moral imagination to a sufficient degree. Based on the definition of the ideal, this happens in a number of ways:

1. When scientists fail to recognize contingencies as such, and treat them as forced or natural, or ignore them altogether.
2. When they miss morally salient factors in their problematic situation, and so fail to consider or be responsive to them in their decision making.
3. When they fail to identify legitimate stakeholders for their decisions or include putative stakeholders who have no genuine stake, or when they fail to determine their perspectives, values, and well-being through either empathetic projection or actual consultation, or when they weigh their interests unfairly.
4. When they fail to consider relevant options that could better satisfy our values.
5. When they fail to exercise fair, warranted value judgments over those options.

9. Compare the distinction between "ideals" and "floors" in Douglas, "The Moral Terrain of Science."

Unlike failure to comply with the rules, failure of imagination is a sliding scale. There is little principled limit to the scrutiny to which scientific practice can be subjected, to the degree that consequences can be imaginatively projected, or to the multiplication of possible options, though the practical limitations are obvious. As such, we should not expect that bright lines can be drawn between acceptable and immoral failures of imagination. In this type of failure one cannot automatically infer from "they could have been more responsible" to "they were irresponsible." On the other hand, that does not mean we can never assert the latter; though we cannot state floors for moral imagination in terms of unambiguous criteria, we can recognize cases of obviously unacceptable behavior.

The ideal of moral imagination also suggests its own limits. There's a second-order evaluation of whether it is worth the time and resources to be more sensitive to the morally salient implications and consequences of decisions. Further scrutiny, greater attention, making things more explicit, and multiplying options all come with costs attached: they all slow the process of inquiry down. Depending on the context, this could be a good thing or a bad thing; the ideal of moral imagination itself can help us judge which it is. Openness and sensitivity to value factors and options do not and cannot amount to endless reflection without costing us what is valuable about science in the first place. This reflexive self-limitation is one of the beneficial features of the ideal of moral imagination.

Including Stakeholders

One potentially bothersome feature of the ideal of moral imagination is the sense that it might seem that the view is too value-neutral and apolitical. Many have already criticized Helen Longino's approach for being too focused on diversification and inclusion, even of irrelevant or vicious points of view.[10] Two elements of the ideal mitigate this problem, however. The first is that the stakeholders considered must be *legitimate* stakeholders. Not everyone who claims to be interested in a question actually has an interest in that question. The second is that the interests of stakeholders must be considered *fairly* or *justly* as part of a process of *value judgment*. No one individual's or group's interests are decisive factors from the start.

10. See "Critical Contextual Empiricism," p. 106, as well as "Critical Contextual Empiricism Revisited," p. 207.

The legitimate stakeholders must actually have a legitimate stake in the question at hand.[11] This includes everyone who is affected by the decision, as well as everyone who rightfully participates in or affects the decision making.[12] I previously defined "matters of public interest" in a Deweyan way as any activity that has an impact on those not directly participating in it.[13] We can define "a public" in terms of those actually affected by the matter of public interest (as opposed to "the public," which is just another way of referring to society in general). A personal correspondence between two people speaking as private individuals is probably a purely private matter. Those two people are likely the only legitimate stakeholders in that correspondence; nosy gossips are not.[14] Regulation of industrial pollutants is, on the other hand, obviously a matter of public interest. That matter constitutes a public that might consist of, for example, the industries producing the pollutant, the residents downstream or downwind of the factories who use the pollutant, future generations who would be affected, managers of those ecosystems that might be impacted, representatives of the welfare of animals and ecosystems that might be harmed, environmental scientists who study the impact of the pollutant in question, and farmers, fishers, or hunters whose crops or game might be affected by the pollution. All of these seem to be legitimate stakeholders in the question of regulation. On the other hand, industries not involved in producing the pollution, as well as environmental lobbies whose members do not include or represent affected residents but instead distant groups of people,[15] may not be part of that public and so are not legitimate stakeholders.

Obviously, a great deal turns on the term *legitimate*, here. We cannot exclude anyone by clever acts of definition of the term *stakeholder*, nor ensure anyone's inclusion. It must instead be a part of the exercise of moral imagination itself. It is, in other words, a matter of value judgment. The question is also empirically

11. For some of the complexities in defining stakeholders and their legitimacy, see Reed et al., "Who's In and Why?"

12. Compare Freeman, *Strategic Management*.

13. See "Value Judgment in a Democratic Society," p. 168.

14. Future historical scholars might be, depending on who the two people are.

15. However, for many pressing environmental controversies, there are no genuinely unaffected persons. In the case of greenhouse gas production, for instance, the resultant global climate change affects all living persons as well as future generations. Furthermore, the more we learn about the global flow of energies and materials, the less it seems that such environmental problems can be genuinely localized.

informed: we must know who will or might be affected, and who can have an effect. We must answer a number of questions to determine who is legitimate. Who has a right to affect the decision? Who will be affected by the decision, and how much? How are we to weigh the interests of the various stakeholders? Since the ideal of moral imagination is focused primarily on scientific inquiry, the inquirers themselves are necessarily part of the decision. Beyond that, surely not just anyone who has the wealth, social or political capital, or power to intervene has the right to do so, or to have their interests considered as part of a value judgment. The public that is created by the decision is of course a relevant stakeholder, though determining who that consists of will involve imagination, investigation, and judgment calls. How to weigh the interests might vary not only with the degree of impact but also with considerations of justice; perhaps the interests of the less powerful and less well off should be given greater heed.

Some would argue that it is inappropriate to even include the interests of industry in our value judgments about regulatory issues in the course of regulatory science. The profit-driven values of industry will always be opposed to regulation, they might argue, and so including them will tend to make regulation too conservative. In many cases, industry has shown that it does not even properly value inquiry itself, choosing to manufacture inappropriate doubt rather than participate in good-faith efforts to find the right answers.[16] But this kind of exclusion is generally inappropriate. First, "Nothing about us without us" is a crucial constraint on value judgment in a democratic society (see "Value Judgment in a Democratic Society," p. 168), even when the "us" are powerful groups. Second, while some of industry's values are illegitimate, such as profit over human welfare and profit over truth, others, such as providing useful goods and jobs, are legitimate, at least in the larger social context we find ourselves. Third, industry has a lot of local knowledge that is worth considering in the creation of regulation.

What is crucial is that industrial interests not be allowed to exercise an undue and unfair influence over the value judgments necessary to regulation (or to research). The problem is not the consideration of the interests of industry, but rather that industry often has the power to short-circuit genuine value judgment by insisting that its interests trump others. But fairness and justice require that we balance these interests with the interests of the other stakeholders. Industry

16. McGarity and Wagner, *Bending Science*; Oreskes and Conway, *Merchants of Doubt*.

often represents a small number of the stakeholders in any particular context. If anything, the greater economic and political power of industry means that their interests should count for even less, and the interests of those who are less well off should be weighted more heavily, both for reasons of justice as well as to combat the obvious biases that we are prey to. All of these interests are only suggestive, only data for the eventual value judgment, which also must consider the connections of means and ends, the trade-offs between various putative values, and the evidence warranting the proposed value judgments.

The issue here reflects a debate that took place between John Dewey and the philosopher and social activist Jane Addams over labor strikes in the 1890s, particularly the Pullman Strike of 1894. Young Dewey tended to see the issues at play in grand dialectical terms, as the antagonism of "Labor and Capital" at work in history, an antagonism that would not be resolved prior to a revolutionary change in the underlying conceptual and social conditions. Jane Addams responded that the antagonism itself was not an essential feature of institutions and ideas, but a by-product of individual narrow-mindedness and selfishness. While Addams acknowledged the interests of working people, and supported the strikers, she urged the necessity of negotiation and cooperation, and actively campaigned for Pullman and the strikers to sit down to arbitration. It was not the revolutionary overthrow of capitalism, or the "victory of the [*sic*] labor over capital"[17] that was necessary, but the broader public interest that included both labor and capital that Addams supported. To be sure, Addams believed that the striking workers represented the "social claim" and "social morality," the more democratic values, while Pullman and the capitalists generally represented only their selfish and individualistic ends. The resolution would require them to take the broader view. While she did not succeed in resolving the Pullman case, she did convince Dewey that he had things backwards, that unity, not antagonism, was the appropriate end of both inquiry and social action.[18]

While these examples are focused on policy rather than research per se, they apply equally to the value judgments made in the course of research. Depending on the scope and significance of the contingencies in question, different senses of inclusion are appropriate. For major decisions, scientists may wish to actually

17. Schneirov, "Pullman Strike."

18. Addams, *Democracy and Social Ethics*; Addams, "Modern Lear"; Dewey, *Correspondence of John Dewey, 1871–2007*, no. 00206; Martin, *Education of John Dewey*, 161–68; Knight, *Citizen*, chap. 13; McKenna and Pratt, *American Philosophy*, 48–51; Schneirov, "Pullman Strike."

include stakeholders in a consultation process. For more everyday decisions, where such consultation is impractical, it is still important for researchers to be aware of, and consider, the interests of the legitimate stakeholders when making the necessary value judgments.

Joint Satisfaction of Values and Standards

The ideal of moral imagination does not provide any kind of general hierarchy between social/ethical values and epistemic standards (what are sometimes called "epistemic values"). Implicit in the ideal is the position that the two are equally important, and no recipe is provided for how to resolve conflicts that arise. Many suppose, to the contrary, that the epistemic has priority over the ethical as far as scientific inquiry is concerned, at least within certain bounds. As Dan Steel puts it, "Science as an institution should promote [social and ethical] aims *by* advancing knowledge."[19] Steel acknowledges that there are ethical constraints on science prior to consideration of epistemic values, concerning, for example, the ethical treatment of research subjects. Beyond these minimal ethical standards, the epistemic aim of advancing knowledge, and whatever values and standards are involved in that aim, come first in this view; even in biomedical or toxicological research, advancing knowledge is prior to promoting health, well-being, safety, and so on. Such epistemic priority views require standards for science that categorically settle the question of what to do with conflicts of ethical values and scientific standards, rather than leaving it up to making a judgment. In other words, they are committed to some form of lexical priority of evidence or epistemic standards.

As we've seen in chapter 3, this kind of position rests on a mistake about the nature of values, or a mistake about the aims of scientific inquiry. They assume that there is a sharp separation between epistemic and non-epistemic aims, when in fact, inquiry itself has the practical goal of addressing problematic situations for our activities of prediction, explanation, and control, activities that in turn cannot be explained in purely epistemic terms. Likewise, the sharp and hierarchical distinction drawn between epistemic standards and non-epistemic values implies that values themselves have no objectivity, cannot be justified by evidence, or are little more than mere wishes or preferences; that they have no standing or systematically lower standing than evidence and epistemic standards; and

19. Steel, "Qualified Epistemic Priority," 58, my emphasis.

that satisfying other kinds of values cannot also be a way of achieving knowledge. In other words, they deny that value judgments can be genuine and warranted judgments at all.

The ideal of moral imagination makes no such hierarchical and dichotomizing assumptions. To an extent, I have shown that the converse of Steel's formula is the case—the consideration of social and ethical aims or values through moral imagination *advances* knowledge by making it both more socially relevant and improving problem solving.[20] While recognizing that they play entangled but different roles, evidence and values should be regarded as equally necessary to successful scientific inquiry. Nevertheless, this attitude does not weaken our standards for science; it strengthens them. The ideal of moral imagination requires the *joint* satisfaction of ethical and social values and empirical and epistemic standards.[21] Neither epistemically weak nor ethically vicious science is adequate. It places greater burdens of rigor on scientists, requiring the addition of ethical responsibilities. It would be a mistake to see a commitment to joint satisfaction as more permissive; if anything, by itself it is much less permissive. It *adds* constraints rather than weakening them.

This point helps us address a significant worry about the accounts of science and of value judgment discussed so far: science is contingent, and values help settle contingencies, but meanwhile value judgment is also contingent; and so we might have fragmentation in science because different groups will settle the scientific and value contingencies in different ways (see "Contingency and Value Inquiry," p. 164). In other words, we might end up with Democratic science and Republican science, or industrial science and environmentalist science, depending on how inquirers choose to resolve contingencies.[22] But the joint satisfaction of standards and values suggests three ways of responding to this concern.

First, the way that the various constraints are linked narrows, rather than broadens, the range of possibility, as compared to many other accounts. Value-free science is not made less contingent for excluding values; if anything, it is more so, as it has only epistemic standards available to settle those contingencies, and the use of epistemic values is itself contingent.[23] Introducing values and requiring joint satisfaction of values and standards increase constraint.

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20. My thanks to Sara Cardona for helping me put my point in this way.

21. See Kourany, *Philosophy of Science after Feminism*; Brown, "Source and Status of Values in Socially Responsible Science."

22. My thanks to Kevin Elliott for this precise formulation of the problem.

23. Kuhn, "Objectivity, Value Judgment, and Theory Choice."

Additionally, the pragmatist account of value judgment I've defended requires evidence and epistemic standards as constraints on value judgments. When value judgment is embedded in a scientific inquiry, the obvious requirement that inquirers not be hypocritical means that the range of possible value judgments is further constrained by the empirical commitments of the larger inquiry. Compared to accounts where values amount to mere personal preferences, values are significantly constrained.

Second, pluralism is not a problem until it is. That is to say, as long as inquirers to do not share a problematic situation that turns difference into disagreement and creates pragmatic incoherence, there is no problem with different inquirers arriving at different conclusions to similar problems.[24] In most cases a plurality of approaches is a sign of healthy science.

Third, when we do have shared problems requiring cooperation and joint action, healthy diversity becomes problematic disagreement. Here it is necessary that inquiry becomes more inclusive, more socialized, and more cooperative. Finally, the ultimate test of the resolution achieved is not merely the coherence of evidence, hypothesis, standards, and values, but rather how that coherent set functions in practice: Does it resolve the problematic situation, or is the supposed resolution still unsatisfactory?

Mutual Coordination of Evidence and Values

It may appear at first that the joint satisfaction view is too strict, potentially providing a barrier to science insofar as the evidence may not line up with what one's values indicate are acceptable. Supposing that the facts of the case stubbornly frustrate values, or standards and values prove impossible to simultaneously satisfy, then science will be permanently stalled, and the problematic situation that scientific inquiry is meant to address will prove impossible to resolve. By adopting the joint satisfaction of evidence and values, it seems that the ideal of moral imagination has gone down the wrong track. If evidence, epistemic standards, and values are treated as unmoved movers of scientific inquiry, as themselves permanently fixed, this problem would be acute. But this is not compatible with other aspects of the view I have defended of the nature and role of evidence, standards, and values, nor is it in line with what philosophy of science

24. The similarity being somewhat superficial, as it ignores the different situational contexts in which their separate inquiries take place.

has taught us about the way evidence is constructed and standards change over time.

"What the evidence is" cannot be taken for granted until inquiry has concluded. Until that point, all facts are trial facts, all data are potentially evidence, but none conclusively so. As there is no such thing as immediate or foundational knowledge, we cannot take any putative evidence for granted. No happening in the laboratory, nor any data collected, wears its suitability to serve as evidence on its sleeve, in general or in a specific case. Judgments must always be made as to the relevance and reliability of evidence to the problem at hand or the hypothesis in question. Scientists reasonably adjust their data collection methods, characterization of data, and sense of what counts as relevant evidence in light of a variety of considerations, such as prior experiences, broader theoretical expectations, assumptions about competency, technique, and equipment, as well as fit with the hypothesis under investigation and their value judgments. This is a reasonable way to proceed because the practical resolution of problems, not the (logical or formal) consistency of hypothesis and evidence, is the criterion of successful inquiry. Consistency is a necessary condition; practical success is the criterion.

We have also seen in the previous chapter that because something is desired or regarded as a value does not mean that it is *valuable*, or valuable in every context, or valuable without limitation. When values come into doubt, value judgment is required to evaluate and warrant them. Difficulties that arise in the course of inquiry count as reasons to doubt the values used to guide said inquiry. Uncertainties about the status of a value, its limitations and scope, also require value judgments. Whether epistemic standards are understood as a kind of value, or a feature of evidence or hypothesis–evidence relations, they too are part of the process of mutual adjustment and coordination. In this way the significant demand posed by the joint satisfaction account can become more flexible and responsive to context and to the fallibility of our knowledge, our evidence-gathering procedures, and our values, if the latter are open to change.

Pragmatic Functionalism about Values and Evidence

Now we may seem to have swung too far in the other direction. If joint satisfaction seems to raise the bar too high for responsible, successful science, then mutual adjustment seems to drain the ideal of any restriction whatsoever. As already mentioned in the prior section, this worry is mitigated by the fact that "mutual

coordination" is not a matter of achieving mere (logical) coherence, but rather pragmatic functional fitness. That is to say, evidence, hypothesis, standards, values all have to fit together, not merely in the sense that the logical relations between them are mutually supporting or compatible rather than contradictory, but that the actions or activities they involve have to fit together coherently in order to resolve the problematic situation that occasioned the inquiry.[25] Such coherence is not trivially or easily achieved.

In other words, recalling discussions from chapters 1 and 5, the ideal of moral imagination involves a commitment to pragmatic functionalism about values and about what counts as evidence. There are two kinds of roles for evidence: *facts of the case* and *experimental testing*. Facts result from observational search of the situation at hand to determine its fixed features. Facts are the products of a process of taking stock, discriminating the empirical versus conceptual elements of the situation. The main use of facts is in determining the nature of the problem that occasions inquiry in the first place, that is, the fixed features of the problematic situation that must be dealt with; the facts of the case can also suggest options for the problem's solutions (which are represented by hypotheses). Experiments, on the other hand, are carefully controlled, limited, or tentative applications of the hypothesis to the situation to gauge its probable efficacy in resolving the problematic situation.[26] Where revisions to hypotheses and problem statements are needed, experiments also contribute new facts to the case.

Values play two kinds of roles in scientific inquiry: determining the *aims* that guide inquiry and the *side constraints* that restrict it. In some sense, the aim of all inquiry is to resolve the problem that occasioned inquiry in the first place. But there are more substantive things to say about aims. First, scientific fields or domains, such as astronomy, biomedicine, anthropology, and ecology have particular aims and purposes which shape the activities of prediction, control, and explanation within them; these are the activities that scientific inquiry in particular deals with, and so those aims and purposes must be kept in mind. For instance, biomedical research aims at health, toxicological research aims at safety, education research aims at learning and growth, and feminist social science

25. Hasok Chang calls this "operational coherence"; Chang, "Operational Coherence as the Source of Truth and Reality"; compare also Chang, *Is Water H_2O?*

26. The emphasis in this account of experiments is on their role as *interventions* rather than on control of conditions or the laboratory setting.

research aims at gender equality. Second, we can look at the vocational purposes of particular inquirers or labs—some may be committed to social justice, others to profits for the corporations that fund the research.[27]

As side constraints, values are not directly connected to the aims of inquiry, but instead serve to evaluate and rank, and potentially rule out, the options for inquiry. While human health and safety may be the aim of some inquiries and be unrelated to the aims of others, it is always the case that the welfare of human research subjects should be highly valued. It is a side constraint on all inquiries where humans are involved, not just as a minimal standard but as something weighted heavily in the various other value judgments that are made. Likewise, we may want to consider the impact of research on marginalized groups as a side constraint on many areas of research.

These distinctions are, as I have stated, "functional" distinctions. In one context, something may be a value, while in another context, it is a fact. For instance, in one kind of inquiry (in economics) claiming that a certain corporation engages in rent-seeking behavior may be a fact, whereas in another (political) context it is a condemnation of that corporation. In one inquiry a value may be an aim, while in another it is a mere side constraint; human health and safety are often a mere side constraint, until we come to biomedical inquiries. Something that is a fixed fact of the case in one context may have been merely hypothetical in a previous inquiry, and may be reopened as a problem in a future inquiry; historically, the hypothesis that all matter is atomic played such a shifting role. Nothing essentially qualifies a statement, model, or happening as fact, value, hypothesis, and so forth.

What ultimately tells us whether we have done well in each of the phases of inquiry is whether all of them hang together so as to successfully resolve the problem. Recalling the discussion from chapter 1, problems are constituted *pragmatically* not *intellectually*. The mere ability to state a problem does not guarantee its legitimacy as a reasonable topic of inquiry. A genuine problem is an actual and pressing interruption or indeterminacy of an embodied and situated practice or activity; it can take one by surprise or it can be anticipated (scientists are very good at pressing the boundaries in search of genuine problems). Likewise, it is not, in any troubling sense, "up to us" to *decide* that a problematic situation is resolved. We may judge truly or falsely that we have resolved it, but only the

27. That these are their aims does not mean that the aims are *warranted*.

successful resumption of practice makes those judgments true or false. This pragmatic functionalism is sufficient to ensure that inquiry is not so flexible as to lose contact with reality.

The Positive Role of Values in Science

We don't want scientists and engineers to merely comply with the standards of minimally acceptable behavior. We want them to be fully committed to being socially responsible, to engage in science as an ethical vocation, for the benefit of all. Having an ideal like moral imagination can give scientists a stronger sense of a professional identity; this sense is important to the ethical responsibilities in professions like medicine and the law, and may provide greater leverage to scientists put in difficult situations by those with more power.

There are clearly moral benefits to increasing the role of values in science. Scientists will be more deliberate about the consequences and benefits of their research for society. It will be easier to encourage public interest in science, and so potentially society will get a better return on its investment in the scientific enterprise.[28] There are also epistemic benefits. There's a significant benefit to creativity that comes from introducing constraints, as the psychological study of creativity has shown.[29] Connecting science with values and practical aims ties science to clearer standards of progress than a purely epistemic image of science.[30] The ideal of moral imagination is well suited to encourage the positive benefits of values in science. Its advice is positive and prospective, not merely preventative of failings.

ANALYSIS: THE IDEAL COMPARED

A variety of other ideals have been proposed as replacements for the value-free ideal. As described in chapter 2, the value-free ideal held that, at least in certain central, internal, or justificatory parts of the scientific process, science should remain neutral about and uninfluenced by our values. But what was the ideal *for*? What was it supposed to do?

The value-free ideal was meant to guide scientists in thinking about what to

28. Sarewitz, "Saving Science."
29. Stokes, *Creativity from Constraints*.
30. Douglas, "Pure Science and the Problem of Progress."

do when the requirements or standards of their work seemed to clash with their values: to remain neutral and impartial with respect to the latter. This guidance served an epistemic function, to putatively guarantee the objectivity of science. It also served an ethical and political function, defining scientific integrity and the responsibilities of scientists in society. In some cases the value-free ideal was defended in explicitly political, democratic, antitechnocratic terms (that scientists should not be making value judgments for us).[31] Finally, the fact that the ideal is difficult or even impossible to reach is a benefit, not an objection. It gives scientists something to strive for, which in turn gives a certain shape and purpose to science as a vocation. The problem with the value-free ideal is not that it is *ideal*, but rather that it is not a *good* ideal; that is, it is not something worth striving for, and indeed is a pernicious thing.

The ideal of moral imagination provides everything that the value-free ideal was meant to provide, and more. It also provides an account of the relationship between the scientific process, its epistemic standards, and our values. The guidance is, admittedly, more complicated; whereas the value-free ideal provides the simple recipe of a blanket prohibition, moral imagination provides a complex picture of value judgment, to be applied in each context of a scientific contingency. While the value-free ideal was meant to guarantee the objectivity of science, what it really did was obscure the necessary role of values in science; value-free science settles contingencies *irresponsibly* but no more *objectively*. The ideal of moral imagination better guarantees the objectivity of science. First, it clearly distinguishes where values play a legitimate role in science: only where there are genuine contingencies. Second, it ensures that the value judgments in science, rather than reflecting mere personal or political preferences, are grounded in empirical evidence and fair consideration of the legitimate stakeholders.[32]

The ideal of moral imagination emphasizes most centrally the ethical responsibilities of scientists. Although their responsibilities are not different in kind from the ordinary responsibility to consider the way one's decisions affect other people, the particular shape of those responsibilities is given by the role of contingency in the scientific process, and the strength of those responsibilities is heightened by society's significant material support for science and the social and

31. Betz, "In Defence of the Value Free Ideal"; Bright, "Du Bois' Democratic Defence of the Value Free Ideal."

32. In this account, however, we may come to see *scientific integrity* as more important than *objectivity*. Brown, "Is Science Really Value Free and Objective?"

cultural authority of scientists. The political aspects of the ideal of moral imagination are less central than in some other views, but the reflections on the role of democratic consideration and consultation in the previous chapter open it to a social and political dimension. Finally, the ideal of moral imagination provides an open-ended ideal to strive for, difficult in principle to satisfy. Unlike many other ideals, however, the ideal of moral imagination is reflexively self-limiting. We can exercise our moral imagination on the second-order question of how much scrutiny we should apply to first-order questions (or contingencies) in the scientific process, and the possibilities we might miss out on from our slowing down or being overly cautious are highly relevant.

Ever since arguments against the value-free ideal have been made, replacement ideals have been proposed. In chapter 3 I examined many of those accounts in light of their implicit and explicit views of values. In the remainder of this section I will look at these alternatives in comparison to the ideal of moral imagination. This is admittedly somewhat backward, in the sense that the work I'm about to talk about has been highly influential in my coming to the ideal of moral imagination. I will argue that each ideal has both positive features and limitations. It goes too far to say that the ideal of moral imagination successfully synthesizes all the goods and overcomes all of the bads, but I think the ideal goes a significant way toward synthesizing what is best in many of these accounts.

Holism and Feminist Radical Empiricism

Holist theories of values in science begin from holist theories of confirmation or semantics, of the sort proposed by Quine or Davidson. Holism contrasts with foundationalism, treating bodies of knowledge as wholes rather than analyzing them into atomic parts and distinct lines of support. Confirmation holists replace the foundationalist picture of hypotheses tested in isolation on the basis of observational evidence with a picture of the whole interlocking structure of theories, hypotheses, auxiliary assumptions, and empirical/factual beliefs (the "web of belief") meeting and accommodating new experiences as a whole. While the foundationalist might insist that if a new observation conflicts with a general theory, the theory must be considered falsified, the holist has other options: find auxiliary assumptions to replace or add that render the theory and observation consistent, or reject the observation itself. Semantic holists hold even more strongly that the meaning of any belief is dependent on its role in the entire linguistic system.

Morton White was perhaps the first to extend Quinean confirmation holism to include values.[33] He made the argument based on mixed inferences that involve both descriptive and normative premises, for example:

1. Whoever takes the life of a human being does something that ought not to be done.
2. The mother took the life of a fetus in her womb.
3. Every living fetus in the womb of a human being is a human being.
4. Therefore, the mother took the life of a human being.
5. Therefore, the mother did something that ought not to be done.[34]

Or:

6. Every act which is a lie is an act that ought not to be performed.
7. The prisoner's act of saying yesterday at 4 p.m. "My regiment went north" is a lie.
8. Therefore, the prisoner's act of saying yesterday at 4 p.m. "My regiment went north" is an act that ought not to have been performed.[35]

The good holist,[36] if strongly committed to rejecting the conclusion (5 or 8) of such arguments, may reject either the ethical premises (1, 6), the factual premises (2–3, 7), or the logical connections that license the inference. The examples are somewhat cartoonish, but they illustrate the core of the kind of connection between factual and normative claims that the more nuanced, scientifically focused holists like Lynn Hankinson Nelson and Sharyn Clough make in the context of philosophy of science.[37] It is common for defenders of this kind of view to claim that values *are* evidence and that values are *sensitive* to evidence.

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33. White, *Toward Reunion in Philosophy*; White, *What Is and What Ought to Be Done*; White, "Normative Ethics, Normative Epistemology, and Quine's Holism." It is worth mentioning that Quine himself rejected White's argument; Quine, "Reply to Morton White."

34. White, *What Is and What Ought to Be Done*, 30.

35. White, *What Is and What Ought to Be Done*, 36.

36. One who accepts the Duhem-Quine thesis, according to which any experiment tests not a single hypotheses, but a whole system of theory and background assumptions (named for Pierre Duhem and Willard Van Orman Quine, who both argued versions of the thesis).

37. Nelson, *Who Knows*; Nelson, "Question of Evidence"; Clough, *Beyond Epistemology*; Clough, "Radical Interpretation, Feminism, and Science"; Goldenberg, "How Can Feminist Theories of Evidence Assist Clinical Reasoning and Decision-Making?"

The positions of Hankinson Nelson and Clough have sometimes been called "feminist radical empiricism,"[38] the radical applied to the empiricism rather than the feminism. What's taken to be radical is the claim that values are subject to empirical confirmation and disconfirmation. That is, as the web of belief faces new evidence successfully, the value judgments themselves are strengthened by virtue of participation in the web. Likewise, as the web is adjusted to accommodate new evidence, value judgments may be revised or rejected. There have been some significant worries about this view in terms of its ability to sort relevant from irrelevant, or appropriate from inappropriate roles for values in science.[39] And as discussed previously, one must worry about reprehensible values gaining evidential support.[40]

Holism and feminist radical empiricism have some significant overlap with the ideal of moral imagination. In particular, both are committed to the mutual adjustment of evidence and values, and both reject any hierarchical ordering between considerations of epistemic standards and non-epistemic values. Additionally, I agree with the feminist radical empiricist that value judgments are empirical inquiries, though our understanding of that connection is quite different. While I agree that past success of a value in guiding inquiry can provide support in some sense for that value, I don't think that is the only mode of support, or even a definitive one. Rather, it is a relevant datum in a process of inquiry, not a deciding factor. Similarly, while some values can act as evidence or, more carefully, some propositions with broadly normative content can be treated as facts of the case, it is at best a partial overlap, not an identity. Strictly speaking, "values as evidence" is an equivocation across functional distinctions; the continuity between inquiry contexts, however, allows us to speak loosely about "values as evidence" in a sensible way.

My main concern with this family of ideals for the interplay of values and science, perhaps already implicit in the contrast above, is that it does not have enough structure to do the work we need done. That is, it seems to me that we want to distinguish between legitimate and illegitimate influences of values on science, as well as good and bad uses of evidence in value judgment, but the holist doesn't generally give us a way to do this. While a moderate holism is the lot of science, we need additional structure in our account than mere coherentism

38. Solomon, "Web of Valief"; Yap, "Feminist Radical Empiricism, Values, and Evidence."

39. Solomon, "Web of Valief."

40. Yap, "Feminist Radical Empiricism, Values, and Evidence"; see "Neopragmatist Feminism," p. 178.

can give us. The additional structure provided by pragmatic functionalism, its theory of empirical inquiry and of value judgment, provide the necessary levers for doing the job.

Critical Contextual Empiricism Revisited

A different kind of view, developed by Helen Longino, is what she calls "critical contextual empiricism" or "social value management."[41] This view is, at first look, very different from the ideal of moral imagination, in that it provides little constraint on the individual reasoners, but instead focuses on the activities and institutions of the scientific community to manage good and bad influences of values in science. That is, social values management accepts that, left to themselves, scientists will use whatever values they hold to influence their theorizing, evidence gathering, inferences, and other scientific activities in a myriad of ways. Those influences are managed at the social level, once the scientists submit their theories and results to the community for critical discussion. As discussed in chapter 3, it is the norms of this critical discussion that manage the use of values and secure the objectivity of science. Recall that the norms are:

1. *Public venues for criticism* where research can be shared and critiqued by the community,
2. *Uptake of criticism*, that is, responsiveness to the criticism the community provides,
3. *Public standards of criticism* shared by the community,
4. *Tempered equality of intellectual authority*, which requires *diversity* of the scientific community.

There is much to like about Longino's account. In particular, it highlights important points about the social aspects of science that are not clearly highlighted by the ideal of moral imagination. The social critical process in a diverse community that the social values management ideal recommends is structured in such a way as to avoid idiosyncratic failures of imagination at the level of individual scientists, even of groups coming from the same point of view. Something like this kind of community structure is not only compatible with the ideal of moral

41. See "Critical Contextual Empiricism," p. 106; Longino, *Science as Social Knowledge*; Longino, *Fate of Knowledge*; Kourany, "Replacing the Ideal of Value-Free Science."

imagination; the exercise of moral imagination at the meta-level of designing scientific institutions suggests that something like these norms are necessary. This harkens back to the discussion of basic scientific values in chapter 4.

On the other hand, critical contextual empiricism is problematic when taken alone, for several reasons. First, as discussed in chapter 3 ("Critical Contextual Empiricism," p. 106), it plausibly requires encouraging a diversity of values even when the values seem pernicious.[42] Purely social processes are not enough, in myriad ways, to guarantee the responsibility of science.[43] The value judgments of individual scientific reasoners can, in practice, go unchecked by the kind of community process discussed by Longino, while having a significant effect on the public or policy making. This is so even if the work is published after peer review, which generally involves only a handful of other scientists looking at the work. The cases where scientists get away for years with blatant plagiarism, or fabrication and falsification of evidence, are an important cautionary tale for thinking about individual versus social accounts of values in science. Moreover, the requirement for a diversity of scientists or scientific approaches is not sufficient to guarantee thorough vetting of the values in science from a variety of perspectives.[44]

Socially Responsible Science

Janet Kourany's view, which she calls "the ideal of socially responsible science," centers on the joint necessity of evidence and values, or the joint satisfaction of standards and values.[45] On Kourany's account, science is held to both epistemic standards of evidence and reasoning and ethical standards of social responsibility. Neither component has priority over the other, nor in cases where evidence and values clash can epistemic considerations trump ethical ones (or vice versa). Kourany's view is self-consciously "less sophisticated" than many other views that she considers, providing no structured account of community norms, evidence for values, or trade-offs between objectivity and ethical responsibility.[46]

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42. Kourany, "Philosophy of Science"; Kourany, "Replacing the Ideal of Value-Free Science"; Intemann, "Feminism, Underdetermination, and Values in Science"; Hicks, "Is Longino's Conception of Objectivity Feminist?"; Pinto, "Philosophy of Science for Globalized Privatization."
43. Douglas, *Science, Policy, and the Value-Free Ideal*, 19.
44. Kourany, "Replacing the Ideal of Value-Free Science"; Fehr, "What Is in It for Me?," 133–55.
45. Kourany, *Philosophy of Science after Feminism*; Brown, "Source and Status of Values in Socially Responsible Science."
46. Kourany, *Philosophy of Science after Feminism*, 68.

For Kourany neither well-meaning but empirically poor, nor epistemically solid but ethically problematic science is acceptable.

Kourany and I share the commitment to joint satisfaction, and I believe Kourany would agree with my rejection of the lexical priority of evidence or epistemic standards. I also believe that good science must be *both* epistemically *and* ethically good and that there is no priority between the two. So far there is a great deal of similarity between our accounts. However, Kourany's view, because of its simplicity, puts us in a tricky spot, potentially placing too high a burden on scientists and halting scientific progress. The issues arise from a lack of clarity in Kourany's approach to, first, the sources of the values and, second, to the status of values when their use in science becomes problematic.[47]

On the first point, there is something of a tension in Kourany's view between the idea that the appropriate values are determined by society and thinking that the values are determined by normative ethical argument or universal moral truth. So in one context Kourany argues that "the ideal of socially responsible science . . . recognizes that we, as a society, have a definite say . . . as to what these social values will be," while in close proximity she says instead, "these social values should be chosen so as to meet the *needs* of society."[48] The ambivalence here is, in a way, unsurprising; every feminist and critical theorist is aware that what people say they want and what meets their needs frequently come apart, while at the same time being resistant to top-down dictation of what they "really" want. In specific cases Kourany typically takes the values for granted; a primary example throughout her work is the value of *egalitarianism*, especially gender and racial equality. By turns, she seems to take this value to be both right and uncontroversial—though of course she recognizes the persisting problems of racism and sexism and the barriers they present to genuine egalitarianism. Kourany's answer to the source of values may be both-and; at the end of *Philosophy of Science after Feminism*, she describes the collaborative construction of ethics codes by scientists, philosophers, and public stakeholders, in which both public input and normative ethical argument appear to play a role. Such a collaborative enterprise is salutary, but Kourany's account lacks a theory of value judgment to guide such collaborations, or to guide scientists in applying such codes to their work. In addition, the focus on codes returns us to the compliance-oriented accounts critiqued above.

47. Aspects of the discussion in this section were first developed and are elaborated in Brown, "Source and Status of Values in Socially Responsible Science."

48. Kourany, *Philosophy of Science after Feminism*, 68, my emphasis.

More disconcerting, in my view, is the absolutist attitude toward epistemic standards and social values that is implicit in the ideal of socially responsible science. Whether the values are determined by ethicists or by the public, they are fixed ahead of time as standards of good science. So whether epistemic standards are determined by scientists or by epistemologists, they are fixed prior to an inquiry. When they conflict persistently, Kourany's ideal gives us no guidance on how to proceed.[49] While Kourany allows that our values might change, or that science and values might interact in complicated ways, socially responsible science does not appear to sanction revision of our values or our evidence as a possible solution to an impasse in the course of inquiry. It intentionally leaves behind the lesson that the feminist empiricists made central to their thinking, that the progress of science could teach us something about our values as well. In other words, Kourany seems to deny that value judgment is a dynamic, empirically-grounded affair, or that the persistent failure of a value to guide inquiry toward a successful conclusion can problematize that very value. This absolutist stance must give way to mutual revisability of values and standards.

Well-Ordered Science

Philip Kitcher laid out his own ideal of well-ordered science as an alternative to the value-free ideal in limited form in *Science, Truth, and Democracy* (2001),[50] and in a more fully developed form in *Science in a Democratic Society* (2011).[51] Like Longino's *social value management* account, Kitcher's theory focuses on

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49. In a very interesting footnote in *Philosophy of Science after Feminism*, Kourany asks us to think about values in terms of motivating a Lakatosian research program. We might consider a research program whose "hard core" consists of the denial of some stereotype(s); the hard core is motivated by egalitarian social values. The negative heuristic protects the stereotype denial from refutation, and the positive heuristic provides methods for revealing evidence compatible with the egalitarian-friendly conclusions. Kourany claims that "there are conditions under which it will be rational to abandon (to consider 'refuted') [this sort of] research program, conditions that Lakatos tried to describe in detail" (72). However, a significant concern about Lakatos's view—pointed out by Feyerabend—is that while it becomes rational to abandon a degenerating research program, it *never* becomes *irrational* to stick with it either (and if it did, this would have problematic results as well). The only thing that is expressly forbidden is to *call* a degenerating research program "progressive." Feyerabend, *Problems of Empiricism*, 214–15; Feyerabend, *Against Method*, 158. Thus Lakatos's methodology has no bite, and the worry that dogmatic values-driven researchers can put off revision forever remains.

50. Kitcher, *Science, Truth, and Democracy*.

51. Kitcher, *Science in a Democratic Society*.

the social/communal level to manage the influence of values in science. Unlike Longino's account, Kitcher does not provide specific instructions about how to order the interactions of the scientific community internally, nor with the surrounding society. Rather, Kitcher provides a thought experiment[52] about how, ideally, the diversity of social values in a pluralistic modern society should guide scientific activity democratically.

Kitcher asks us to imagine a congress of ideal deliberators representing the variety of social positions, interests, and value systems existing in society. These deliberators are not subject to Rawls's veil of ignorance; they know whom they represent, but they are idealized in the sense that they are rational. They are perfectly committed to mutual engagement and uptake of criticism, as well as to equality of opportunity for all. They're subject neither to the irrationalities or closed-mindedness of the actual agents they represent, nor to selfish majoritarian tyrannies. Value judgments should be accepted on this account if they would be endorsed by a conversation among these ideal deliberators. In the case of value judgments in science, that means that the deliberators should be well informed about the questions at hand, for example, about research agenda or standards of evidence, and the right judgment is what they would endorse.

There are several things to like about this view. It acknowledges the point from chapter 3 that many accounts of values in science have missed, namely that we must take value judgments seriously, and we must have an account of better and worse value judgment to ground our understanding of appropriate and inappropriate uses of values in science. At the same time it addresses a central worry about accounts that focus on getting the values right: namely what to do about public science in a pluralistic democratic society. Kitcher's account is explicitly constructed to resolve this problem by making the democratic consideration of a plurality of points of view central to the account of value judgment. Finally, it does so in a way that requires the thorough exercise of the imagination, via the thought experiment of ideal democratic deliberation.

I have several concerns about the ideal of well-ordered science. The first is that it treats value judgment and empirical inquiry as entirely different kinds of processes, whereas I have argued in the previous chapter for significant

52. Kitcher claims to be inspired by Rawls's contractarian *original position* thought experiment (Rawls, "Outline of a Decision Procedure for Ethics"; Rawls, *Theory of Justice*), though in many ways, his approach is closer to Habermas's "ideal speech situation" (Habermas, *Theory of Communicative Action*).

similarities between the two processes. Second, the ideal seems limited in its ability to generate concrete judgments about particular questions. How far we can determinately say what the ideal would and wouldn't do is far from clear. I have no gripe with the ideal because it is an ideal, but I am concerned that it is not clear how to make the ideal operative for individual scientists, and so it ends up merely utopian.[53] Last, it seems to me that Kitcher is wrong to privilege ideal, hypothetical democratic engagement over *actual* engagement in a variety of cases.[54] Democratic ethicists like Jane Addams and John Dewey would argue that in many cases it is better for the public to be involved and do badly, than to receive good outcomes in a technocratic or paternalistic fashion. Self-determination is itself an important value.

Douglas's Functionalism

In "The Role Restriction Ideal" (p. 108), I discussed Heather Douglas's *role restriction ideal* at length, and some of the issues that arise from it. I will not try to recapitulate that discussion here, but point to other issues with the view brought to light by comparison with the ideal of moral imagination.

The account falls short in a number of respects. First, as Douglas herself acknowledges, it is hardly a true *ideal*; rather, role restriction provides an account of minimally responsible conduct. But even as a minimal floor, it is problematic for at least three reasons. First, it is dogmatic about standards. According to the role restriction account, the only epistemic standards that should play a direct role are empirical adequacy and internal consistency. These may seem minimal, but that depends on how they are interpreted: Interpreted in a truly minimal way, they lack teeth; they require only that scientists interpret their practice consistently and choose their evidence and hypothesis to be consistent with one another. Interpreted to be genuine restrictions on scientists, they are too strict. Requiring hypotheses to be compatible with *all* putative evidence, without evaluating that evidence is obviously too strong. Likewise, internal consistency, interpreted in terms of some particular logical system, would prevent the use of formally inconsistent systems that scientists nonetheless know how to use consistently, ruling out a variety of important theories as well as the possibility of revising our logic to fit the needs of inquiry.

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53. Kitcher's, like Rawls's, is the kind of view Amartya Sen calls "transcendental"; Sen, *Idea of Justice*.
54. Douglas, "Philip Kitcher, *Science in a Democratic Society*."

Douglas's account denies that values can stand as evidence. As such it fails to fully commit to its functionalism. While values are legitimate or illegitimate according to their role, what counts as a fact or a value seems to be an essential feature, rather than itself defined in a functional role. This makes it ultimately unclear how we are to deal with thick value-laden concepts in science, as they cannot be ruled out from being used to characterize evidence. Worse, it makes empirical value judgment, which must treat values themselves as facts of the case, incoherent, or break the relation between scientific inquiry and value judgment.

Finally, Douglas does not fully commit to functionalism: the direct/indirect division is treated as absolute division, and it ultimately rests on the lexical priority of evidence, which in turn rests on a mistaken conception of values and value judgments. We could, I believe, reinterpret the distinction in terms of a more thoroughgoing functionalism and pragmatism to avoid this conclusion, but to some extent this also takes the bite out of the distinction. On such a reinterpretation, direct and indirect don't line up with external and internal parts of inquiry, but with the functional distinction between reasons-for-claims and reasons-to-act. It would be a mistake to treat reasons-to-act as reasons-for-claims closely because of what Douglas says about direct and indirect roles: it confuses motivation to do something with epistemic support, and that leads to wishful thinking, bullshitting, and other problems. At the same time, the prior discussions of values as evidence show that sometimes values (broadly speaking) can work as reasons-for-claims. Moreover, there are clearly cases where strong enough reasons-to-act tell us we should not assert a claim no matter how strong its epistemic support. There might even be cases where we might have reasons *to* assert even in the absence of reasons *for* the assertion, though that would be exceedingly rare, as it violates important norms of assertion.[55]

The Aims Approach

Another approach has come onto the scene in the last few years, largely in reaction to Douglas's functionalist approach, which emphasizes instead the *contextual* nature of what distinguishes legitimate and illegitimate uses of values in science. In particular, defenders of the aims approach argue that the right way to

55. Franco, "Assertion, Nonepistemic Values, and Scientific Practice."

use values in science depends on the aims of a particular inquiry.[56] Fundamental work in biology might have different aims (primarily epistemic) than biomedical research (health) or toxicological research (human and environmental health and safety). According to the aims approach, whether the appropriate values are being used, and whether they are playing the appropriate role, depends on whether they promote or frustrate the aims of inquiry. My work has been associated with this view, but I have some disagreements with the way the view has been articulated.

What's right about the aims approach is that it acknowledges the central importance of getting the values right. Sometimes it is the content of the values that cause problems, but many of the ideals reviewed here cannot accommodate that insight. In addition, the contextualism in the account is to be lauded. How the role of values plays out will differ significantly based on the context of inquiry, and one central element of that context is the larger aims of the inquiry.

In many other respects, the account is inadequate.[57] First, the aims approach focuses too exclusively on aims. In many cases values act as side constraints on inquiry totally independent of the aims. It does not matter what the aim of the inquiry is, if human subjects are involved, their safety and consent is a paramount constraint. Similarly, the environmental impact of the inquiry itself should act as a side constraint. In many cases the values not only do not promote the aims of inquiry, they positively frustrate it, and yet the role of values remains legitimate. Some have argued that a wide range of inquiries (e.g., in evolutionary biology and psychology) would be furthered by the production of human-chimpanzee hybrids, and this might be possible with advanced genetic engineering technologies.[58] Nevertheless, the clear ethical objections to such research prevent it from being done, even though the ethical values in this case are antagonistic to the aims of the relevant scientific inquiries. This is the right result. While the defenders of the aims approach surely would not deny that values can and do act as side constraints, these concessions tend to appear as caveats to the view, rather than being incorporated in it in a principled way.

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56. Elliott, "Douglas on Values"; Elliott and McKaughan, "Nonepistemic Values and the Multiple Goals of Science"; Hicks, "New Direction for Science and Values"; Intemann, "Distinguishing between Legitimate and Illegitimate Values in Climate Modeling"; Melo-Martín and Intemann, "Risk of Using Inductive Risk to Challenge the Value-Free Ideal."

57. Because these accounts are new, developing, and differ significantly among each other, these general criticisms may not hit the mark with every proponent of the approach.

58. Adler, "Ape Man."

Second, the aims approach provides us with no way to make judgments about the aims of inquiry themselves. Perhaps they believe that this question should be settled democratically (by well-ordered science?), or that it is impossible to reason about final ends. Either way, this seems to me a significant problem for the view, a lacuna that is filled by the account of value judgments provided in the previous chapter and built into the ideal of moral imagination. Finally, the aims approach may be too intellectualistic, insofar as it treats aims as specific criteria for inquiry to fulfill. Inquiry does not begin with a clearly specified aim or intellectually specified problem to solve, but rather with a practically indeterminate situation, where the specification of problem and aims is a part of inquiry, not criteria existing outside of inquiry.

NEXT STEPS: THE IDEAL IN PRACTICE

How has the ideal of moral imagination fared in comparison to the other ideals that have been proposed? While I cannot claim complete synthesis, I think I have shown it compares rather favorably. Thus I think we are in a better position than the pluralism of ideals that Heather Douglas recommends in her recent work, where she claims that "there is no one all-encompassing ideal that can replace the traditional value-free ideal."[59] The ideal of moral imagination has moved us a significant distance in that direction. On the other hand, some of the ideals herein, while compatible with the ideal of moral imagination, add content in a helpful way, particularly those ideals that speak to community structure and democratic obligations, which suggests that Douglas is right. Something like the ideals on that level offered by *social value management* or *well-ordered science* is necessary. A full account of the social certification process in science using the ideal of moral imagination would have to synthesize with or somehow recover norms of this general type. But the ideal of moral imagination unapologetically follows the focus laid out in the Introduction on guiding individual scientists and evaluations of science. If a further ideal is needed to do justice to the large social contexts, that is another project.

I have provided general and dialectical arguments for the ideal of moral imagination up to this point. As a pragmatist, I think the probative value of such arguments remains limited. Ideas, even philosophical ones, prove their merit in their use; the proof of the pudding is in the eating, not in the formal correctness

59. Douglas, *Science, Values, and Democracy*.

of the baking. Likewise, the proof of an idea is in its success in guiding practice, not in the quality of the arguments for putting it to use. Those arguments can establish only the worthiness of pursuit. To go further we must ask ourselves the questions: How can and should scientists practice the ideal of moral imagination? And how can we use the ideal to evaluate scientists and hold them responsible? The conclusion will explore these questions with respect to a variety of different kinds of contingencies and choices in the scientific process and the interpretation and evaluation of science. The adequacy of the view in evaluating cases and guiding future inquirers is the ultimate test.

CONCLUSION

CONTEXTS FOR MORAL IMAGINATION IN SCIENTIFIC PRACTICE

I began the introduction by discussing three cases where science and values have influenced one another for better or ill, to motivate the project of the book. I have shown not only that values have played a role in science, but that they ought to, and I have provided an image of scientific inquiry and an ideal to guide scientific practice with respect to *how* values should be incorporated into science. The ideal of moral imagination provides both guidance for scientists facing value-laden contingencies in the course of scientific practice as well as ways for retrospectively evaluating scientific work for whether it has been done responsibly with any integrity.

In this conclusion, the "argument" section revisits the three cases with which the book began, to see what additional light the ideal of moral imagination sheds on those cases. In the "analysis" section, I discuss concrete ways that the ideal of moral imagination can be used to inform Responsible Conduct of Research (RCR) or research ethics training. I end by pointing to some complications and future directions for developing the ideal to be more comprehensive for scientific practice.

ARGUMENT: OUR THREE CASES REVISITED

Scientific Racism

It might seem obvious or even obtuse to chalk up an episode in the history of racism and white supremacism to a "failure of moral imagination." Scientific racism, as I discussed in the Introduction, posited innate biological differences between the races along a spectrum of value-laden capacities, including *intelligence*—differences that happened to reinforce existing hierarchies of racial power and discrimination. We don't have to assume any maliciousness on the part of the scientists in particular (though doubtless there was some) to see how science could end up reinforcing and naturalizing the status quo of racial relations through failures of moral imagination.

First of all, when contingencies are not recognized as such, or the need for value judgment is not seen in resolving those contingencies, it is easy for intellectual habits, social expectations, and prejudicial bias to play a role in deciding them. Faced with open decisions about whether to regard a certain set of skulls as representative, or how to interpret a psychological measure, background beliefs play a role in determining which doubts are salient. Lack of sensitivity to the contingencies is the first failure of imagination in this case. Researchers could have been less subject to social prejudices, and more responsible in their research, if they had been more aware of the contingencies. Sensitivity to such contingencies can be increased by developing a habit of stopping and questioning the appropriateness of questions, framings, ideas, and methods; by tending to especially second-guess assumptions or results that seem to support the social status quo; and by regularly subjecting one's work to input and evaluation by a variety of voices outside the research community.

The second failure of imagination is a failure to empathetically recognize, understand, consult, or weigh the interests of legitimate stakeholders. The race science in question was the product of white European and American scientists who had stereotyped views about, and did not actively try to consult with, members of other races. There was little chance of the genuine interests of nonwhites to be known to the scientists, much less taken into account. Local knowledge about facts or values could not be used to correct the assumptions of the scientists. There is a distinct failure of the democratic values of solidarity and publicity, a failure to follow that crucial democratic slogan "Nothing about us without us."

These concerns are not merely an anachronistic moralistic judgment about

historical actors.[1] Human differences research continues unabated, not only in tests of cognitive function, but now bringing in powerful techniques of genetics and genomics. The same failures of moral imagination threaten contemporary research. How can such research proceed responsibly, with integrity, and yet be a reinforcing cause of injustice?

First, scientists must ask before even embarking on the research: Why do research on the topic of human racial differences in the first place? One cannot simply point to the desire to know the truth about human differences. There are too many potential truths out there to be discovered, and not enough time or resources to research all of them.[2] Why focus on this question, when the results of such research have been so fraught and have caused such unnecessary harms? Second, the framing of the question, of hypotheses, and the methods of data collection and characterization must be chosen carefully, with an eye to avoiding stereotypes and prejudicial framing. Third, it is essential to have people of color closely consulted in the research, probably as members of the research team, preferably as leaders or coleaders of the team. Even then, communities of color should be consulted during the research process to avoid further failures of empathetic understanding.

Consider as a positive example of human differences research Carolyn West's study of domestic violence as described by Janet Kourany.[3] The aims of the research are intentionally attempting to recognize difference while avoiding problematic stereotyping: "The aim of this program is complex: to uncover the similarities in intimate-partner violence within the black and white communities of the United States without negating the experiences of black women and simultaneously to highlight the differences within the black and white communities without perpetuating the stereotype that black Americans are inherently more violent than other ethnic groups" (69). The definition of *partner violence*, the way violence was measured, the complex combination of quantitative and qualitative methodologies, all aimed to avoid problematic stereotypes without erasing important differences. Nor were sloppy inferences to innate differences ever made. West, herself a black woman, involved research participants not only by collecting data about them, but as Kourany says, "the program involves integrating participants into every stage of the research process, from

1. Though I would deny that we are inevitably anachronistic in a vicious sense when judging the past.
2. Kitcher, *Science, Truth, and Democracy*.
3. Kourany, *Philosophy of Science after Feminism*, 69–75.

planning to implementing, interpreting, and disseminating results, in order to reduce one-sided research interpretations."[4] Failures of imagination are avoided throughout, and careful integration of both values and rigorous evidential standards are maintained throughout the research. This sort of work is exemplary of the ideal of moral imagination.

Feminist Psychology

How does the work of Holloway, Byrne, and Marston fare according to the ideal of moral imagination? In their experimental and theoretical work, they were clearly inspired by and attempted to provide support for their radical feminist values. If scientific racism displays an impermissible social bias influencing science, does the use of feminist political values to guide research not likewise constitute a failure of moral imagination?

On the contrary, the track record of feminist science critique and feminist science projects is generally very positive.[5] Feminist scientists and science critics have discovered distortive biases in the science. They have put new approaches, broader and more nuanced, into place, leading to more robust research results. This contrasts with the highly problematic nature of racist or patriarchal science. The reasons for the difference is easy to see through the lens of the ideal of moral imagination. First, egalitarian values, or values that emphasize justice for the marginalized and oppressed, are clearly more warranted than sexist or racist hierarchical social values. Second, feminist scientists enter inquiry with a more representative sense of who the stakeholders are in the work, and they are more willing to try to understand their interests. Third, feminist scientists are more likely to be distrustful of the status quo, of the conventional ways of settling scientific decisions; instead they are conscious of both unrecognized contingencies and problematic, habitual ways of resolving those contingencies. All of these add up to a situation where feminist scientists are more likely to multiply options, hitting on better solutions by making value judgments that are more fair and warranted.

Though feminist science in general has largely been a positive contribution to science, we should probably see the work of Holloway, Byrne, and Marston

4. Kourany, *Philosophy of Science after Feminism*, 69–70.

5. Schiebinger, "History and Philosophy of Women in Science"; Schiebinger, "Has Feminism Changed Science?"; Richardson, "Feminist Philosophy of Science."

in a somewhat tempered light. On the one hand, their work shows many of the positive hallmarks of science according to the discussion above. They approach science distrustful of commonsense concepts and theoretical frameworks that might be influenced by and reinforcing the status quo. They are able to use their moral imagination to sniff out distorting limitations of method and theory and to multiply other options. On the other hand, their lack of transparency is less than ideal. They did not discuss the role of their values in the decisions made throughout inquiry, and while that's hardly a surprise given the scientific norms of the time, it does not set a good model for the researcher today. While transparency is far from a universal criterion, it is helpful for both the intra-scientific credibility process and the extra-scientific consumers of science to be able to evaluate the integrity of the science in question. Similarly, their use of heterodox views and values in publicizing science and science advising is problematic. Nevertheless, given the prominence of sexism and other harmful features of the status quo of both science and society at the time, Holloway, Byrne, and Marston may have been making the most responsible decisions open to them in their context.

Stem Cell Research

In the Introduction, I presented the move from embryonic stem cell research to pluripotent adult stem cell research as an exercise of moral imagination. A relevant value in the political context of the time was the sanctity of life, and the judgment of many was that this meant that destroying embryos for the purposes of scientific research, despite the potential gains in basic knowledge and medical treatments, was not permissible. Let us put aside the question of whether this was the considered judgment of most citizens or the ideological position of a powerful minority. The decision was that no federal funding could be spent on research that destroyed new embryos. As a result of working under these constraints, some researchers multiplied their options and, through ingenuity or serendipity, discovered ways of producing stem cells that did not violate the stricture against destroying embryos: moral imagination par excellence.

One difficulty with this diagnosis, in the context of the ideal of moral imagination, is that the value judgment—that research on human embryos is impermissible and should not be supported—is made separately from the decisions of the scientific researchers. Not only do many scientists not share the religiously motivated valuing of embryonic life, but they did not participate in the decision-making process that was to guide their research. One might find this to thus

be an unjust imposition of values on the scientists' freedom of research. Some scientists feel precisely this way. But note that *even if* the values were imposed unjustly, they did not act to simply stifle scientific progress. Rather, exercising moral imagination within the constraints set by those values allowed science to advance in an unanticipated direction with some unique benefits (for instance, it is thought that adult stem cells will have fewer issues related to transplant rejection). Thinking about this process in terms of the moral imagination framework, although the values and stakeholder elements were in part fixed, options could still be multiplied and additional values promoted in ways that allowed valuable research to be done.

Was the case an unjust interference with the freedom of scientific research and an imposition of values? While there may well be fundamental rights to freedom of research and academic freedom, these rights certainly do not decide the case on their own. They cannot be used to compel unrestricted social support for scientific research, and they must be balanced with other ethical concerns such as the rights and well-being of research subjects. They do not justify federal funding for projects or methods that citizens regard as immoral. In a specific case we require careful value judgments to assess and integrate values such as the right to research, the potential social benefits of embryonic stem cell research, the putative right to life of embryos, and the accountability to the public on how public funds are spent. These value judgments must guide both science policy and the decisions of the scientists themselves. Democratic constraints on the value judgments used by scientists to resolve contingencies where public interests are at stake can require compromise. Ideally this is a process where all legitimate stakeholders feel their voices are heard and accounted for, even if they do not agree with the final decision.

ANALYSIS: MORAL IMAGINATION AND RESPONSIBLE CONDUCT OF RESEARCH

The previous chapter laid out four tasks in order to deliberate about any contingency in a way that fulfills the duties laid out by the ideal of moral imagination:

1. Identify the goal or task at hand.
2. Identify and imaginatively multiply options for how to carry out the task.
3. Determine the standards and values that are relevant to the situation.
4. Identify the legitimate stakeholders to consider and identify their interests.

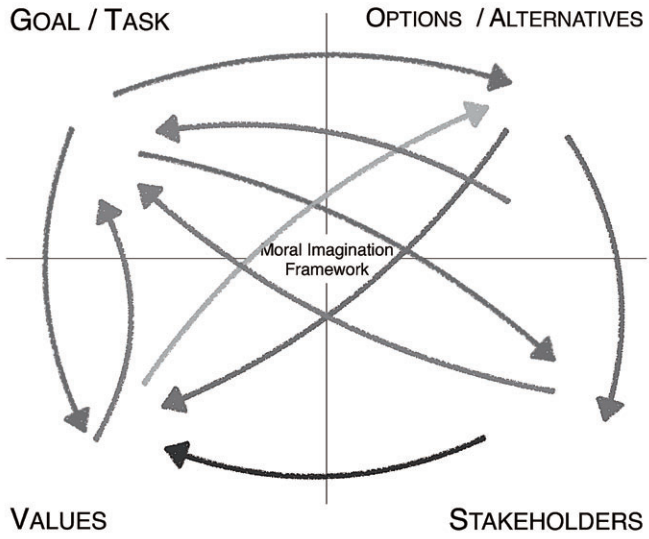

FIGURE C.1. The Moral Imagination Framework in Action. The four tasks must be iteratively revisited as each task reveals new information and we try to integrate and reconcile considerations.

These four elements should be revisited in light of each other, revised in a kind of reflective equilibrium until a satisfactory value judgment can be made on their basis. Not only do we seek a coherent judgment on these bases, but also each task asks us to look to the facts about (1) the practice we are engaged in and its aims, (2) the situation and its relevant values, (3) the legitimate stakeholders and their interests, and (4) the possible means to realize our aims. A value judgment that satisfies these tasks is in the ideal a kind of empirical inquiry.

These four tasks form the four elements of a tool to help scientists understand their responsibilities and make better value judgments in order to fulfill them. In this section I will describe the background of this tool and then show how it can be put into action in RCR training and by scientists in the lab.

Situated Ethics and Socio-Technical Integration Research

With a multidisciplinary group of researchers, I began working in 2013 on a project to understand engineering ethics and to improve ethics education in

engineering programs, focusing on ethics that were situated in actual research and design projects.[6] The view of our group was that so far ethics education focused too much on either general principles, as captured in codes of ethics, or on cases of major disasters or malfeasance far removed from the everyday experience of most engineers. Ethics is often delivered as a single, separate course, while it is merely paid lip service elsewhere in the curriculum. Whether the course is taught by an ethicist, an engineering professor, or faculty with a different background, its lack of connection to the curriculum reflected its disconnect from the engineering process in the minds of students. Our goal was to put ethics into the research and design process in both senior design project courses and in research labs.

A major source that we discovered early in our project was the Socio-Technical Integration Research (STIR) protocol developed by Erik Fisher and his collaborators.[7] The STIR protocol involves embedding a social scientist or humanities scholar (the "embedded humanist [EH]") in a science or engineering laboratory for twelve weeks, where the EH engages members of the lab in semi-structured interviews around a generic model of research decisions. The model has four components:

1. *Opportunity*—The problem, goal, or occasion requiring a decision.
2. *Considerations*—The "internal" and "external" factors that influence the decision (that is, the epistemic standards and the social values).
3. *Alternatives*—The options for the decision; the courses of action available in response to the opportunity.
4. *Outcome*—The final decision in favor of one of the alternatives in response to the opportunity and in light of the considerations.

The interview protocol did not require the EH to ask these questions in order. Rather, the researchers and the EH should use the framework to guide a

6. A description of our project and results so far can be found in Lee et al., "Exploring Implicit Understanding of Engineering Ethics in Student Teams"; Lee et al., "Roles of Implicit Understanding of Engineering Ethics in Student Teams' Discussion"; Grohman et al., "Engineering Ethics and an Expert Guided and Socially Situated Activity."

7. Fisher and Schuurbiers, "Socio-Technical Integration Research"; Fisher, Mahajan, and Mitcham, "Midstream Modulation of Technology"; Fisher and Mahajan, "Midstream Modulation of Nanotechnology Research in an Academic Laboratory"; Fisher, "Ethnographic Invention"; Fisher and Mahajan, "Embedding the Humanities in Engineering."

discussion which might revisit each of the components repeatedly in a nonlinear fashion. By requiring researchers to externalize[8] the elements of their decision, the STIR protocol hoped to make the decisions more reflective and reflexive, and to increase the salience in particular of "external" considerations (social values), and to eventually re-internalize such a decision-making process in the individual activities of the scientists. The STIR protocol showed success across the board in a variety of studies, demonstrating the possibility of increasing both awareness of decisions and the role of social values in those decisions.[9]

The STIR program was not only a major influence on our engineering ethics project, but it was also a major influence on my framing of both the contingency argument and the moral imagination framework. Through some small changes in terminology, and the larger change of highlighting stakeholders separately from values, the moral imagination framework represents a modified version of the STIR decision model. I have also had the opportunity to use the moral imagination framework as a tool on a couple of occasions when I have been invited to lead a session of my university's Responsible Conduct of Research training series on Responsibilities to Society. In the next section I will describe how I've used the model in those settings, and in the subsequent section I will describe how scientists can take the moral imagination framework back to the lab to guide their decisions.

Applying the Moral Imagination Framework to Cases

In presenting the moral imagination framework to researchers in the RCR training series, while I spend a little time on the theory and the general framework, we spend most of our time using the framework to help us think through cases. After presenting the basic ideas, I distribute several copies of the worksheet in the Appendix, and then I use two different sorts of "cases" to help them learn to use the framework. First, there are specific historical or recent cases of difficult contingencies requiring nuanced value judgments. These value judgments have actually been handled more or less well, meaning there was some reflection but perhaps also some failure of moral imagination where we can get into the nuances. The second kind of cases are hypothetical, of the sort that are actually

8. Cole and Engeström, "Cultural-Historical Approach to Distributed Cognition."
9. Fisher and Mahajan, "Midstream Modulation of Nanotechnology Research in an Academic Laboratory"; Fisher and Schuurbiers, "Socio-Technical Integration Research."

commonly faced by researchers, cases that lead RCR trainees to think in a more first-person way, relevant to their own work, about the kinds of decisions that they make. In both cases we use the moral imagination framework to think through the contingent decision and come to a better value judgment about how to best fulfill the task at hand.

In the first kind of example we might consider a topic like gain-of-function research, laboratory experiments where researchers take pathogens, typically viruses, and modify them to increase their function, for example, making them more transmissible or more virulent.[10] There are several contingent moments in such research that we could discuss; one that's pregnant with difficult issues is the dissemination of and communication about such research. In particular we might focus on whether and how to report the methods by which the viruses were modified. The most obvious element of the dilemma, the tension between the value of the free exchange of knowledge and of protecting public health, comes up quickly. Likewise it is easy for most researchers to see that the stakeholders are quite broad; potentially everyone could be affected by the decision in question, and their interests in their own health are clear. The trainees tend to start out more or less split on whether they find the health concerns or freedom of research more pressing, and thus whether they prefer leaving details out of the publication or publishing the results in full. Pushed to think of further relevant values and multiply options, trainees start to think about the risks to public health of *not* publishing all of the information,[11] as well as ways of more narrowly restricting publications so that the relevant parties, but not potential bioterrorists, get the information that they need.

In the second kind of example we might consider a more general, hypothetical case of the kind of decision researchers might regularly face. Suppose, for example, as part of a survey instrument, you need to include a question about the sex or gender of the research subject. How should you word such a question? The most obvious way, which tends to come up first in discussion, is simply the binary choice, "male or female." In this day and age, in my experience, at least one person will immediately ask something like, "What about nonbinary people, who don't identify as either male or female?" This opens up a discussion both of stakeholders (not only the research subjects themselves, but the men, women, nonbinary,

10. Douglas, "Moral Terrain of Science"; Davis et al., "Use of Highly Pathogenic Avian Influenza"; Selgelid, "Gain-of-Function Research."

11. Considerations that National Science Advisory Board on Biosecurity found decisive; compare Douglas, "Moral Terrain of Science."

intersex, or trans people who have an interest in the research results) as well as the values at stake (such as inclusiveness and respect). A variety of other options for how to ask might come up, such as including a third option (or more), as well as replacing a forced-choice answer with a free response (though this option has its own costs). It becomes clear that we really need to revisit the definition of the goal. Is it sex or gender that we're looking for, and why? If we're looking for some kind of biological sex, that can be problematized according to various definitions (assigned at birth? genital sex? chromosomal sex?) and requires some context-specific understanding of *why* that is of interest. Through applying the moral imagination framework, it becomes easy for researchers to see how the question cannot really be properly answered in general, in the abstract, or once and for all, as well as for them to see some of the relevant values and factors that need to be considered.

Further cases can help show other ways in which researchers need to think about values. Cases of disagreement in socially relevant science (such as disagreements between industry and nonindustry scientists in toxicological research)[12] can help researchers think about managing conflicts of interest. Another helpful type of example is one where the relevant social context changes in the middle of the research project, such as the shift in context for the Manhattan Project before and after V-E day (see "Introduction: The Need for Value Judgment," p. 57). It can also be helpful to frame the various cases in terms of different moments of inquiry, including "upstream" decisions in the planning phase, "downstream" decisions concerning dissemination and application, and the "midstream" decisions that arise in the course of inquiry itself (see "The Sociality and Collectivity of Science," p. 49).

The moral imagination framework provides a tool for these discussions that helps researchers keep track of the most important factors necessary to making good, responsible value judgments about scientific decisions. This style of representation, when its use is modeled in an interactive training session, can also help researchers iteratively refine their understanding of the relevant factors, their understanding of the task at hand, and their sense of the space of options. In general, the discussions in a short training session will not resolve to definitive answers, either because the cases are under-described or too abstract—necessities for brevity. But even recognizing those limitations teaches something important about the nature of value judgment in the lab.

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12. For example, the different ways of classifying tumors found in the dioxin case study in Douglas, "Inductive Risk and Values in Science."

Taking the Moral Imagination Framework Home to the Lab

The purpose of teaching the moral imagination framework to researchers in RCR training is ultimately to provide them a tool to take back to the lab for when they need to make complex value judgments in the course of their research. The simplicity of the worksheet for applying the moral imagination framework allows it to easily be reproduced in, say, a lab notebook. Simply draw a line down the middle of the page, horizontally and vertically, and label each quadrant appropriately, "Task," "Values," "Stakeholders," and "Options." Then the researchers can apply the same process to a decision that they are facing that they've already tried out in RCR training. Because they are in a genuine, concrete situation in the lab, unlike the RCR training, they can carry forward the value judgment to a satisfactory conclusion.

One difficulty researchers face in bringing the moral imagination framework into their own research is sensitivity to contingency. That is, researchers need to know when they face a decision that might have consequences or implications for ethical and social values and stakeholder interests. A major innovation of the STIR protocol was to embed researchers in the lab whose major purpose was to act as a sort of Socratic gadfly, and thus make strange those things that seem natural, to disrupt habitual behavior so that it could be subject to precisely the kind of scrutiny shown necessary by the ideal of moral imagination. Clearly, the best solution to this problem would be for every laboratory to employ philosophers of science (and other humanists) full-time for the express purpose of raising awareness about contingency.[13]

In lieu of that perhaps less-than-practical solution, there are several more modest steps that could help increase sensitivity to contingencies in the lab that a principle investigator could take. Primarily they could foster a culture of openness to questioning within the lab. Novices are regularly joining the typical research lab, whether they be undergraduate or graduate students with no, little, or less relevant laboratory experience, or postdoctoral research associates with lots of expertise from a lab where things were done differently. Novices should be encouraged to ask not only the common question, "How do I do this?" but also "Why do we do this this way?" and "How else could this be done?" And when such questions are posed by any member of the lab, they should be taken

13. It may seem to you that I have a conflict of interest in making this recommendation just because it would guarantee full employment for my PhD students. I'm sure that's not the case.

seriously and, where feasible, subject to deliberation according to the moral imagination framework.

Another stratagem for increasing sensitivity to contingency would be to make an explicit compendium of best practices, and to regularly subject those practices to review. Why is this our practice? What task does it serve? What other options are there for completing this task? What differences do the options make? To whom? What interests and values are at stake? Et cetera. Last, it would be worthwhile when writing the "Methods" section of a paper to revisit the questions of why we did it the way we described it. Even if scientific papers, because of their formulaic style, cannot recount the decisions made to do it this way rather than that,[14] the members of the laboratory can do it themselves. All of these approaches might seem to threaten the pace of research productivity, but beside the fact that being morally responsible might require us to be less productive, in many cases the kind of divergent thinking required to exercise one's moral imagination appropriately can actually *improve* the quality and innovativeness of the science being done (see "The Positive Role of Values in Science," p. 202).

NEXT STEPS: FURTHER CONTEXTS FOR MORAL IMAGINATION

Throughout most of the book I have focused my attention on the role of value judgment in *local* decision making, that is, decisions faced by individuals or small research teams in the course of research, as well as our after-the-fact evaluations of those decisions.[15] This focus has been both strategic and timely. It is strategic because it provides a more tractable ground for my argument that we need a new ideal for values in science founded on an adequate theory of values and value judgment, while abstracting away from very difficult issues about the interaction of science with larger social institutions. It is timely because this is the place where we most urgently need a new ideal to guide practice. Ordinary social-institutional processes like peer review cannot by themselves guard against bald-faced fabrication of results; such fabrication has been discovered instead through the extraordinary actions of whistle-blowers or major errors on the part of the fabricators, and even by the work of diligent nonscientists,

14. Though some have argued that a change in these norms is precisely what is needed. See Elliott and Resnik, "Science, Policy, and the Transparency of Values."

15. I was up front about this focus in "A Heuristic Focus on the Individual and Small Groups," p. 17.

such as Brian Deer's work on the Wakefield fraud.[16] Similarly, it is doubtful that social-level norms on their own can ensure that every significant decision throughout the research process has been made responsibly. Such processes depend on individuals, guided by norms of responsible conduct, more or less trying their best.

Nevertheless, this focus leads the ideal of moral imagination to appear less comprehensive that it might be. A number of avenues of development of the ideal of moral imagination remain open for future work. Of course the application of the ideal of moral imagination to any aspect of the research process could be explored in far more detail than I've done here. We also need to develop the ideal of moral imagination in application to questions beyond the research process itself.

First, there is more to be said about what I've called the "credibility process"[17] than I have had space to say here. There are a host of contingencies peculiar to this process, different from the research process itself: criteria and standards for publication, editorial practices, referee evaluations, publication decisions, decisions about how to respond or cite. These decisions, like any other, can be approached with the moral imagination framework. But this raises a second limitation of my discussion so far, which is that the argument has so far focused on the research team as the largest social level of analysis ("primary collectivity," see "The Sociality and Collectivity of Science," p. 49). In the decisions faced in the credibility process (instances of "secondary collectivity"), the subject making the judgment is sometimes more difficult to identify than the individual researcher or research team. Perhaps decisions faced by an editor or peer reviewer are no more difficult to account for, but when it comes to field-wide conventions or large-scale certification of public knowledge, we're dealing with social systems and institutional structures of science, and we need better ways of accounting for these.

Likewise, many questions concerning the application and dissemination of science, as well as the relationship of the scientific community at large to the public, concern large-group sociality at a level that makes the application of the ideal of moral imagination uncertain. The question to be answered is: How can moral imagination guide larger or more diffuse groups? The question moves us from considering an ethical ideal for scientific practice on the basis of moral imagination, to the realm of political philosophy, to the consideration of a

16. Deer, "How the Case against the MMR Vaccine Was Fixed."
17. See "Inquiry, Credibility, and Certification," p. 38.

political ideal (or a nonideal political theory, perhaps) of scientific institutions. Among the promising starting points to think about these ideas are *adaptive management* theory,[18] Biddle's "nonideal system design,"[19] and the moral and political philosophy of Mary Parker Follett.[20]

I have argued that science is deeply value-laden and that values are, at their best, the product of inquiry that is both informed by evidence and scientific knowledge and also similar in structure to scientific inquiry itself. I have articulated a broadly pragmatist theory of inquiry that makes this structural parallel between science and value judgment perspicuous. I have synthesized the main philosophical arguments against the ideal of value-free science into a novel overarching argument, the contingency argument. I have argued that philosophers and scientists need to take value judgment more seriously, not as a source of inevitable bias and a threat to the objectivity and integrity of science, but rather as a source of reasoned judgments that can support and improve scientific inquiry. On this basis I have articulated and defended a new way of thinking about the responsibilities of scientists and what counts as good science: the ideal of moral imagination. As we have seen in this Conclusion, that ideal has fairly radical implications for the Responsible Conduct of Research and the practice of science generally. As discussed above, there is much work for philosophers to do in developing this ideal and its implications further. There is also important work for science educators and science communicators to do in educating both scientists and the public about the proper role of values in science and the responsibilities of scientists to values and to society. Finally, there is important work for scientists to do in learning to exercise their moral imagination throughout the research process. As I have said before, the proof of the pudding is in the eating. The value of the work pursued in this book will be seen in whether its framework can successfully be employed by scientists to improve their research both ethically and epistemically, in whether it can help members of the public understand the relationship of science to their values, in whether it is fruitful for further work in philosophy of science that attempts to normatively theorize the role of values in science and in analyses of cases of values in science within the history and philosophy of science. My hope is that this work adds depth and flavor to these many important conversations about values in science.

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18. See Norton, "Pragmatist Epistemology for Adaptive Management"; Mitchell, *Unsimple Truths*.
19. Biddle, "Can Patents Prohibit Research?"
20. Follett, *New State*; Follett, *Creative Experience*.

GLOSSARY OF KEY TERMS

COGNITIVE STATUS

Truth aptness, meaning, warrant, or credibility. To deny that something has cognitive status is to deny that it has truth conditions, that it is meaningful, that it can be warranted, or that it can have credibility. To say that one thing has less or lower cognitive status than the other is to say that the thing is less warranted, less credible, has a lower grade of truth or reality, or is less meaningful. Views of cognitive status tend to apply to whole categories of judgment rather than specific cases in context.

COGNITIVISM

The view that value judgments have truth values, are truth-apt, or can have credibility. *See* noncognitivism.

CONTINGENCIES

Steps in the process of inquiry that reasonably could go in multiple directions. Retrospectively, they reasonably could have been done differently. They are *decision points* that could potentially be made the subject of reflective choices.

THE CONTINGENCY ARGUMENT

An argument that demonstrates the pervasive value-ladenness of science based on the role of contingency and choice in the scientific process. According to this argument, scientific inquiry has contingent moments, and thus scientists in principle have multiple options among which they must make a decision. Since these decisions may have

implications and consequences for things of value, scientists must make value judgments in the course of scientific inquiry. The canonical form of the argument appears in "The Contingency Argument," p. 63.

CONTINUUM OF MEANS AND ENDS

The continuity of and connections between human lives and activities require that means (resources) constrain ends (goals and outcomes), and ensures that one ends at one moment becomes the means to future ends. The distinction between means and ends is therefore not absolute, but one of emphasis. *See* end-in-view.

CREDIBILITY, THE CREDIBILITY PROCESS

The process by which the scientific community subjects research claims to scrutiny, typically starting with peer review, to publications and conference talks by the researchers, through ever-widening consideration until, in some cases, the result becomes a "textbook fact." *Compare* discovery.

DEFERRED DECISION RESPONSE

An argument in defense of the value-free ideal that admits the relevance of value judgments to the contingencies in science, but proposes to defer those value judgments until a later moment. For instance, although values are relevant to where we set the standards of evidence for hypothesis acceptance, the deferred decision response proposes that scientists not make the decision about whether to accept the hypothesis, and instead provides the relevant statistical information to decision makers. See "These Decisions Cannot Be Deferred," p. 70.

DEGENERATE EXPERIMENTS

They play the same functional role as any experimental tests, but they diverge from prototypical experiments in various respects. Natural experiments, novel observations, thought experiments, and simulations are all examples of degenerate experiments. *Degenerate* here is used in the technical sense of lacking a specific element or structure usually seen in experiments; degenerate experiments need not always be an undesirable substitute.

THE DEMOCRATIC OBJECTION TO VALUES IN SCIENCE

Because science has a special epistemic authority in democratic societies, the inclusion of (potentially partisan) value judgments in science creates a crisis of democratic legitimacy. Science should remain impartial by remaining value-free according to this objection. See "These Decisions Cannot Be Deferred," p. 70.

DISCOVERY

The research process itself, where a scientist or scientific research team attempts to resolve a scientific problem. *See* inquiry. *Compare* credibility.

DRAMATIC REHEARSAL

Rehearsal in imagination of a proposed course of action, to determine the implications and consequences, as far as they can be anticipated. A thought experiment. Especially relevant to practical decisions and value judgments, where the function is to determine whether the implications and consequences of the course of action are acceptable or preferable.

END-IN-VIEW

The current end (goal or aim) of an activity, but not an *absolute* end. In other contexts or from other perspectives, the end-in-view is merely a means to further ends. *See* continuum of means and ends.

EPISTEMIC FACTORS

Any considerations in judgment that refer only to the features of a part of inquiry that make it good for producing knowledge.
See epistemic standards, epistemic values, or scientific standards.

EPISTEMIC PRIORITY THESIS

The view according to which science must prioritize satisfaction of epistemic standards over considerations of values.

EPISTEMIC STANDARDS, EPISTEMIC VALUES, OR SCIENTIFIC STANDARDS

Factors in decisions about contingencies in science that go beyond basic evidence and logic, that characterize the decision as *scientifically* good or good in the way of producing knowledge. These might be characteristics of theories (such as simplicity), characteristics of experimental designs (such as careful controls), or characteristics of theory-evidence relations, such as accuracy or precision. For clarity's sake, I typically refrain from referring to these as "values," reserving that term for what others sometimes call "non-epistemic values."

EVALUATION

The activity of making a judgment or determining the worth of something.

EVIDENCE

A collection of facts of the case and experimental results that have been ordered by systematic reasoning in a way that makes clear the ways that they relate to the hypothesis, statement of the problem, and goals and epistemic standards of inquiry, especially for presentation in a final judgment.

EXPERIMENTAL RESULTS

The data produced by experimental testing, as opposed to observation. These represent the results of applying the hypothesis to the situation in a limited fashion. They contribute to the body of evidence that support the final judgment. *See* facts of the case.

EXPERIMENTAL TESTING OR EXPERIMENTATION

The process of trying out a hypothesis as a potential problem solution in limited circumstances.

FACTS OF THE CASE

Representation of the fixed features of the problematic situation that are both limitations on and resources for hypothetical problem solutions. The facts of the case help fix the statement of the problem and can help suggest hypotheses.

FUNCTIONAL FITNESS

An abstract goal of the criteria of all inquiry, namely, that the elements and processes of inquiry should come to functionally cohere, or fit together according to their different functions, in a way that is fit to resolve the problematic situation that occasioned inquiry. Neither functional coherence nor fitness is purely intellectual; they have to do with whether the relevant activities *work* together.

HYPOTHESIS

A representation of the possibilities inherent in the problematic situation that presents a possible solution to the problem. Hypotheses are forward looking and ultimately refer to courses of action. This reference is often masked by the generic way that hypotheses are posed, but this indicates only the relatively open-ended possibilities captured by the hypothesis, that is, its relative difference from situations of immediate need or enjoyment.

THE IDEAL OF MORAL IMAGINATION

Scientists should recognize contingencies in their work as unforced choices, discover morally and epistemically salient aspects of the situation they are deciding, empathetically recognize and understand the genuine stakeholders and their interests, imaginatively construct and explore possible options, and exercise fair and warranted value judgment in order to guide those decisions.

INDETERMINATE SITUATION

The situation in which a practice or activity has become disordered or incoherent, that is, where it is no longer determinate how the practice or activity should proceed given its circumstances. An indeterminate situation is not necessarily recognized by the practitioners or actors; they may muddle through rather than reflect upon the indeterminacy. *See* perplexity; problematic situation.

INQUIRY

A deliberate response to a perplexity that arises in a practice, which treats the perplexity as a problem to be understood and resolved through a process of investigation, inference, testing, and judgment.

JUDGMENT

A judgment in general is a careful decision, generally warranted by evidence, between two or more open options. The final judgment that brings inquiry to a close is such a decision, warranted by the whole process of inquiry that precedes it. Judgments are generally *not* private, mental acts, but assertions or discursive acts that transform the situation they are made in and directed toward.

LEXICAL PRIORITY OF EVIDENCE OVER VALUES

The strongest form of the epistemic priority thesis, according to which all evidential and epistemic factors are considered first, and values only play a role if some contingency remains. *Lexical* priority here means *strict* priority, in the same way that words starting with "a" have strict priority over words starting with "b" in an alphabetized list of English words.

MATTER OF PUBLIC INTEREST

Any matter that impacts those not actively or directly participating in it. In economic terms, a *negative externality*. Matters of public interest define publics that may come to consciousness and organize around the matter.

MEANS AND ENDS, CONTINUUM OF

See continuum of means and ends.

THE MORAL EXEMPTION RESPONSE

An argument in defense of the value-free ideal which claims that something special about the professional role of scientists exempts them from the ordinary moral responsibility to consider the consequences of their actions.

MORAL IMAGINATION

The role of imagination and creativity in the moral life.

NONCOGNITIVISM

The view that value judgments do not have truth values, that they are not truth-apt, that they cannot be warranted or credible. *See* cognitivism.

NORMATIVE

Concerning the way things ought to be or the evaluation of the quality or worth of things, as opposed to mere description of them. The theory laid out in this book is a normative theory, concerning what scientists ought to do and how their work should be evaluated, rather than merely describing what scientists do in fact currently do. The normative/descriptive distinction is shown in the book to be porous and problematic, and ultimately there are no purely normative or descriptive claims. However, it is useful and unproblematic in many contexts to draw a distinction between claims aimed at describing current practice and claims aimed at transforming practice.

NORMATIVE PRAGMATISM

The two-part view that (1) norms are ultimately practical in nature, and (2) pragmatism is the normatively best philosophical framework.

OBSERVATION

Acts of assessing the current situation to determine the facts of the case.

PERPLEXITY

The inchoate sense that something is wrong, that something is off about the current situation which occasions inquiry. The subjective or qualitative side of a problematic situation. *See* indeterminate situation.

THE PRACTICAL REASON ARGUMENT

An argument for values in science that since settling contingencies in science consists of setting on a course of action, and actions require or imply practical reasons (values), every such choice is value-laden.

PRACTICE

A complex activity or set of activities undertaken by a community of practitioners, formally or informally organized around the activity. A community of practice consists not only of individual people, but also of norms, expectations, shared objectives, tools, a division of labor, and a shared history. The activities that constitute a practice have objects or ends and are composed of actions, operations, tools, and rules or standards.

PRAGMATIC COHERENCE

A property of practices, actions, imperatives, and material means that can successfully work together.

PRAGMATIC PLURALISM

A pluralistic account of the nature of values according to which values: are inherently connected with action and practice; have many sources in human life and practice; have many different functions in life and inquiry; can be distinguished as unreflective valuings and reflective value judgments, where the latter is understood as a type of practical-empirical inquiry; come with evidential warrant.

PRAGMATISM

The view that all inquiry is practical inquiry, and all judgment is practical judgment, that is, concerning what is to be done.

PROBLEM

See statement of the problem; perplexity; problematic situation.

PROBLEM FRAMING

The process of coming up with a statement of the problem.

THE PROBLEM OF WISHFUL THINKING

The worry that wishful thinking will replace or mislead empirical inquiry through mistaking *the way we wish the world to be* for *the way the world really is*.

PROBLEM SOLUTION

See hypothesis.

PROBLEM STATEMENT

See statement of the problem.

PROBLEMATIC SITUATION

The recognition of an indeterminate situation *as* indeterminate, that is, as open to inquiry. The objective side of a perplexity.

PUBLIC

A group brought together around a shared issue or concern that affects them, that is, a matter of public interest. Society typically includes many publics.

REALPOLITIK

German term literally meaning "realistic politics." Realpolitik typically connotes cynical and amoral politics focused on immediate problems and interests. Realpolitik assumes most conditions and behaviors are fixed and is uninterested in ethical arguments that they should be otherwise.

REASONING

In its broad sense, another term for inquiry. In its narrow sense, the process of connecting a hypothesis to broader conceptual schemes and deducing specific, testable empirical correlates, as well as collecting and ordering evidence.

THE SCIENTIFIC METHOD

A recipe, algorithm, inference structure, attitude, or process of inquiry characteristic of science. Often capitalized as if it is the proper name of the one true such recipe. Many work with a cookie-cutter, step-by-step recipe notion of the scientific method that does serious violence to the actual practice of science. Thinking of science instead as a method or pattern of inquiry can better mesh with the practice of science. There is a serious risk of reifying a particular approach to science (say, the approach used in particle physics or biomedical research) when discussing the scientific method that we must avoid.

SCIENTIFIC STANDARDS

See epistemic standards, epistemic values, and scientific standards.

SITUATION

A situation is everything that forms the content and context of a practice or activity. This includes organisms and their environment, agents, tools, objects, and context. Situations are marked by continuity among their elements and a kind of pervasive qualitative character of the relations and interactions among those elements. That character is experienced by those within the situation, though they might reflectively characterize it in different ways. A situation is bounded by relevance to the practice or activity, though its boundaries might not be sharp. A situation is in a sense a "world," though not in the sense of the entire universe, but rather as we might say "the world of professional baseball" or "the fashion world." *See* indeterminate situation; problematic situation.

STANDARDS

See epistemic standards, epistemic values, and scientific standards.

STATEMENT OF THE PROBLEM

A representation of what is problematic about the situation of inquiry.

SUGGESTION

A nascent hypothesis, typically occurring to the inquirer along with the initial understanding of the problem and typically requiring significant revision to become a hypothesis as such.

TECHNICAL SWEETNESS

A term describing the pleasurable experience of expert puzzle solving, where the activity is engaging and challenging, pushing technical skills to the limit, where a functional and elegant solution falls into place. Scientists and engineers are often highly motivated by such experiences. The reckless pursuit of technical sweetness, without consideration of the larger consequences of the work, is commonly pointed to as an engine of irresponsible science and innovation The term is due to J. Robert Oppenheimer: "However, it is my judgment in these things that when you see something that is technically sweet, you go ahead and do it and you argue about what to do about it only after you have had your technical success. That is the way it was with the atomic bomb. I do not think anybody opposed making it; there were some debates about what to do with it after it was made."[1]

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1. *J. Robert Oppenheimer Personnel Hearings Transcripts*, 2:95.

THICK ETHICAL CONCEPTS

Concepts that include both descriptive (factual) and normative (value) contents in such a way that while those sides of the concept may be analytically separable to some extent, this cannot be done without losing something of the integrity of the concept, for example, health, poverty, violence, courage. This distinguishes them from purely evaluative concepts like "good" or "right" that lack any specific descriptive content, as well as purely descriptive concepts like "having atomic number 79" that might have value judgments attached to it extrinsically. Given the pervasiveness of values in science, purely descriptive concepts might turn out to be quite rare.

THE VALUE-FREE IDEAL

The normative account of values in science according to which values should play no role in the internal processes of science.

VALUE JUDGMENT

Judgments of value or evaluations. The reflective endorsement of some attitude, preference, prohibition, desire, goal, aim, or ideal. Also the judgment that some thing has some valued feature or property. Value judgments are a form of empirical, practical inquiry.

VALUES

Things we care about, broadly construed. A double-barreled word that includes both the attitudes (preferences, desires, goals) and the features of the things (objects, events, traits, persons) toward whom we develop those attitudes. Value attitudes include both pre-reflective valuings and reflectively endorsed evaluations or value judgments.

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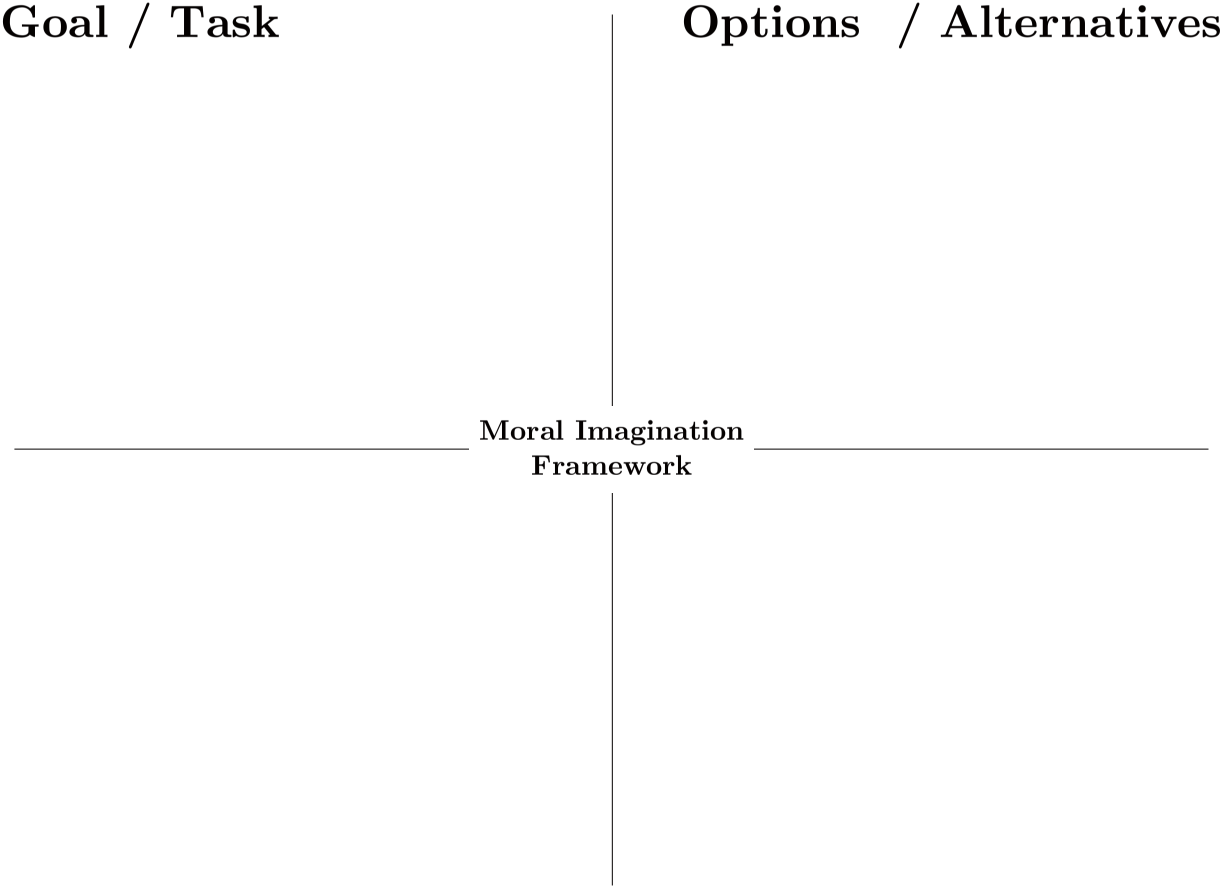
APPENDIX

The worksheet on the following page can be copied and used in the context of making value judgments in scientific practice.


Goal / Task
Options / Alternatives
Moral Imagination Framework
Values
Stakeholders