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Chapter 1

Prospectus

1. Why Another Book on Empiricism?

The core idea of empiricism is that experience, and it alone, has the unique capacity to inform us of contingent truths of the world.[1] This simple but powerful idea is of immense importance both to science and to philosophy. What led me to write this book is that, with only a few exceptions, present writing about empiricism in philosophy and philosophy of science has failed to capture the proper import of this core idea in both areas.

Empiricism, as developed in the philosophical literature, is deeply skeptical and psychological. It is filled with old ideas and attitudes that belong in earlier centuries of empiricist thinking. Experience is narrowly confined to the excitations of human sense organs and their ensuing processing by mental activity. This anthropocentrism has long been surpassed by the practices of modern science. There, instrumental sensings and algorithmic processing routinely replace and greatly improve on human sensing and mental processing. The philosopher's empiricism is pessimistic about the power of experience to inform us and embraces a severe form of inductive skepticism. According to it, all we learn from experience is the content of the experience itself. Too much philosophical writing on empiricism struggles to explain away the immense success enjoyed by science in its discovery of many foundational truths of nature. A scientist's major discovery is to be discounted as merely a useful instrument for connecting possible experiences.

The empiricism advocated by scientists is, in contrast, more optimistic and more relaxed. Scientists have recognized that their enterprise has met with extraordinary successes only as long as it has remained empirical. They insist, quite correctly, that science must be empirical. The

[1] I thank Balazs Gyenis for helpful comments on an earlier draft of this chapter.

empiricism advocated by scientists silently overlooks the excesses and aberrations of philosophical writing. It knows nothing of the philosophical empiricist's skepticism and employs a more expansive notion experience that is not rigidly limited to the stimulations of human sense organs. The emphasis is on the part of empiricism that has served science well: the unique capacity of experience to inform us.

The conceit of too many philosophers is that scientists are naïve about the reach of experience and that they have failed to recognize the limits to their ambitions uncovered by philosophy. My view is different. It is we, the philosophers, who are failing. We are too quick to mount artful theses that deny the reach of experience and dispute the plainly visible achievements of science. In so far as we adhere to these artful theses, we are unable to account for the enormous successes of science. We need to try harder. The optimistic empiricism of the scientists is the better view.

Where science has embraced empiricism as essential to its project, philosophy itself has drifted away from empiricism, to its detriment. When philosophers now try to discover foundational, contingent truths of the world, they commonly abandon the powerful idea that we can only learn such truths through experience. This idea has now been lost under a flourishing of work in non-empirical metaphysics. According to it, we are supposed to arrive at foundational truths about the world merely by introspecting deeply; or by interrogating how ordinary folk speak; or, worse, by interrogating how ordinary folk speak, when they are confronted with fanciful scenarios contrived by philosophers to manipulate and corrupt ordinary thinking.

What has resulted is a literature that appears to me little different from the creations of works of fiction. To enter into debates over its questions, adepts must learn and conform with strict rules. It is akin to a challenging and well-structured game whose players come to believe that their fictional world is real.

The project of this book is to develop an optimistic version of empiricism that is well-adapted to modern science and to revive its importance to philosophy itself. It is to reaffirm the central tenet of empiricism, the unique privilege of experience, while discarding the skepticism too often associated with philosophical writing in empiricism. It will be founded on an expanded conception of experience, modeled on the successes of modern science, and will be sufficiently rich to vindicate those successes. My hope is to revive the idea amongst non-empirical metaphysicians that they must look to experience if they are to recover contingent, foundational

truths about the traditional topics of metaphysics: space, time, matter, causality, possibility and the like; and to accept that modern science has enjoyed remarkable success in this project.

2. A Précis of small-e empiricism

The following are the basic elements of the version of empiricism to be developed here:

Small-e, not Big-E

Two components are common in many versions of empiricism. The first grants experience the unique capacity to inform us of contingent facts. The second insists that the factual content of experience is the totality of what experience informs us of the world. Everything else has an instrumental or fictional character whose sole function is to connect experiences with experiences. Big-E Empiricism endorses both components. It is a deeply pessimistic and skeptical doctrine quite at variance with the idea that science actually makes discoveries that go beyond mere associations among experience. Small-e empiricism endorses only the first component. According to it, experience informs us of contingent truths that go well beyond the content of experience itself. It is optimistic in crediting our best science with true discoveries.

Liberation from psychology

The modern tradition in empiricism was founded in the seventeenth century by Hobbes and Locke with the idea that experience consists of what human sense organs deliver to the mind and that its processing is carried out by the mental operations of thought. They wrote before present sciences were developed. The analysis of the operation of our sense organs is now best left to neuroscience and physiology; and how the mind processes ideas is now best left to empirical psychology. Their analysis is not the responsibility of small-e empiricism. Whatever its source, experience enters small-e empiricism once it has been given a communicable, propositional form, such as when it is described in scientific publications.

Experience generalized

The notion of experience must be generalized to include instrumental sensings in which human sense organs play no part; and the processing of the instrumental sensings must include those executed outside the human mind. For much of the major discoveries of recent science comes from instrumental detection and their subsequent mechanized processing in which human mental processes play no role.

Experience as a process

The authority of experience does not reside in any special power of human sense organs. Its authority derives from its constitution as a continuous physical process that connects with the system of interest in the world. The continuity of these processes precludes a strict division between experience and the results derived from it, such as is required by Big-E Empiricism. We can only make relative judgments. This stage is closer in the experiential process to the system of interest and that stage is farther from it.

Inductive structure

Experiential processes are structured by relations of inductive support among the propositions that describe the stages of the processes. A proposition describing one stage provides inductive support for propositions describing those closer to the system of interest. For example, propositions describing patches of light and dark in an astronomical photograph inductively support a proposition asserting the location of a light source in the sky. These supported propositions then also provide inductive support for more general propositions beyond the direct scope of the experiential process. Propositions concerning the location of the light sources in the sky over time provide inductive support for the proposition that these light sources are illuminated masses moving under an inverse square law of gravity.

Inductive optimism

Empiricism accords experience the *unique* capacity to inform us of contingent facts. This capacity is realized in the relations of inductive support that structure experiential processes and reach beyond them. Small-e empiricism takes inductive support for a proposition to be support for the truth of the proposition. Strong inductive support is strong support for truth and is the basis of the security of our mature sciences.[2] One is free not to accept this optimistic appraisal of inductive inference. However, to reject the import of inductive support is a poor choice. It is to be *irrational*, for rationality just consists in conforming to the dictates of reason and these dictates are codified in an inductive logic.

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[2] For some philosophers, suggestions of inductive success trigger the automatic response: "What about Hume's problem?!" Chapter 6 of Norton (2024) argues that the material theory of induction so alters the nature of inductive inference that standard forms of Hume's problem of induction can no longer be formulated and that efforts to recreate them in the material theory fail.

Inductive fallibility

Inductive support is, by definition, support for conclusions that are logically stronger than the premises employed. It follows that inductive support, no matter how strong, is fallible. This fallibility provides no basis for skepticism, such as the skepticism that controls Big-E Empiricism. In cases of very strong inductive support, a failure is very unlikely, for that is the meaning of very strong inductive support. A failure to accept this fallibility as benign has proved repeatedly to be troublesome in philosophy. On one extreme, it supports a blanket, unsustainable inductive skepticism. On the other, it leads to an unsuccessful search for infallible certainty.

Induction is material

Whereas any account of inductive inference could be employed in small-e empiricism, here I will treat inductive inference materially, in accord with the material theory of induction as developed in my Norton (2021, 2024). This account of inductive inference follows from an application of the ideas of small-e empiricism. Inductive inferences provide support for propositions that go beyond what is given in their premises. They are expanding our repertoire of contingent facts. Small-e empiricism asserts that such expansion can only be made on the basis of experience. Accordingly, inductive inferences in the material theory of induction are not warranted by universal rules that apply everywhere. They are warranted by contingent, material fact specific to the domain in which the specific inductive inferences proceed. In a mature science, these warranting facts in turn have inductive support that derives ultimately from experience.

3. Defending small-e empiricism

3.1 small-e empiricism Summarized

These last elements are combined to form the summary statement of small-e empiricism:

> *Science is empirical.* The propositions of experience provide inductive support for the truth of the contingent propositions of science; and the inductive support of experience is the only means of providing support for these contingent propositions.

That is, the only way we are informed of the contingent propositions of science is through their inductive support by experience. The case for small-e empiricism is based on the reconception of experience that is sketched above and is given in greater detail in Part II of the chapters that

follow. In brief, the case comes in two parts, corresponding to the two clauses of the summary statement above.

3.2 For the Adequacy of Experience

The first clause asserts that experience has the capacity to provide inductive support for the contingent propositions of science. This capacity is founded on the notion of experience as a continuous physical process that connects with the system of interest. Its processes form the channel through which we are informed inductively of the systems of interest. The results so discovered are then amplified beyond the scope of the experiential processes by further inductive inferences to results of greater generality. This much affirms the capacity of experience to inform us of contingent truths of the world that go well beyond experience. That these results embrace the totality of successful science can then be established by considering the sciences one by one and noting that in every case their foundation lies in experience.

The case for this first clause is enhanced by a resource derived from the inductive optimism of small-e empiricism, but denied to Big-E Empiricism. Experience itself provides strong inductive support for the reality of the physical processes that embody experience. On our best empirical evidence, there really are gravitational waves; and they really can inform us of the black hole coalescences that produced them. More generally, small-e empiricism supports the ordinary ontology of science which affirms the capacity of experiential processes to inform us of the world.

3.3 Against Other Modes

The second clause asserts the exclusive power of experience to inform us of contingent facts in the world. Making a case for it is more challenging since it must preclude existing modes that compete with it and perhaps even address the fanciful possibility of other as yet unknown modes.

That existing, competing modes fail is a matter of history. Part II below will categorize them under the headings of Platonic insight, innate or intuitive ideas and oracular revelation. A heading-by-heading survey will argue that none have succeeded. Their uniform failure may not be immediately apparent since each claims successes. These claims should be discounted since a single mode of failure afflicts all of them. Once empirical investigations have a result well-secured by experience, these modes can reproduce it. However, if these modes seek results not

already affirmed by experience, they fail, routinely and reliably. They are only wise after the fact.

Their failure is inevitable because they cannot draw on processes that can inform them of contingent propositions in the world, other than the experiential processes of empiricism. There is no clear articulation of the means through which Platonic insight can inform us or through which our minds can somehow intuit contingent facts in the world. This failure stands in contrast with the success of small-e empiricism, which finds its experiential processes in the ordinary ontology of science. We can learn empirically of contingent facts of the world through light waves, or X-rays, or infra-red waves, or radio waves, or sound waves, or the diffusions of molecules in chromatographic media. We can do so for the simple reason that they are all real processes.

This difference in turn gives small-e empiricism a unique capacity to reaffirm its results or to correct errors in them. For the processes it employs are themselves open to investigation and scrutiny. Whether faster-than-light neutrinos were really found in CERN in 2011 can be and was checked by reviewing step by step the physical processes that seemed to affirm the result. These other modes have no such capacity for affirmation and correction. We must just accept that they work when they do and that they fail when they do, without any deeper account of why they worked and failed when they did.

As to the possibility of other as yet undiscovered modes, as long as they remain undiscovered, they are irrelevant to any well-developed philosophy, since so little can be positively asserted of them. It is hard to harbor optimism for their discovery. Millennia of efforts to find such modes have failed. Every claim that one has been found eventually fails. That failure is precisely what empiricism has long expected.

4. Against Big-E Empiricism.

There is a quiet appeal in Big-E Empiricism. It asks us to adopt less in our positions and we are thereby exposed to fewer opportunities for error; and it asks us to limit acceptance to what it supposes is the most secure parts of our science, that which we directly experience.

This appeal should be resisted. The most important reason, in my view, is that it is needlessly skeptical. We can secure absolute security in the positions we adopt by the severe method of adopting none. Then we will never err. The cost, however, is that we will never be

right. We need to steer a middle course between complete skepticism and complete credulity. When it comes to being informed of contingent truths, we have one, and only one, resource to guide us: inductive inference from experience. We arrive at a conservative but still rich compromise between the two extremes by favoring propositions that are strongly supported inductively. We can thereby build a secure repertoire of propositions, such as populate our mature sciences. We are assured that each individually is unlikely to be wrong, for that is what strong inductive support means. To do otherwise, as I noted above, is possible, but it is irrational in the strict sense of refusing to accept the import of reason as codified in inductive logic.

This appeal of Big-E Empiricism faces two further problems of a more technical nature. First, the *totality* of experiences is privileged. However *individual* experience are fallible and more fragile. An empiricism has to provide a means of correcting them when they err. The general strategy of Big-E Empiricism is to draw on many other experiences to correct the one suspected of erring. If however we truly revere experience over all else and harbor an inductive skepticism, as does Big-E Empiricism, should we not just accept the anomalous experience as it is? It may not sit well inductively with these other experiences, but it will not contradict them.

Here, small-e empiricism has the advantage. It can provide a principled basis for doubting and correcting an anomalous experience in the more general facts it has secured inductively. Consider, for example someone's claim to have experienced a successful perpetual motion machine. A Big-E Empiricist might want to dispute the claim by recalling the failure very many other attempts. What is the force of this recollection? There is no logical contradiction between this being a perpetual motion machine, where those others were not. In contrast, small-e empiricism uses the failure of very many attempts at perpetual motion machines as strong inductive support for the conservation of energy, a general contingent fact. The novel claim of a successful perpetual motion machine is discounted for contradicting this inductively well supported fact.

The second problem facing Big-E Empiricism is that it has to suppose a clear distinction between experience and the results derived from it. Sustaining such a distinction has proved to be a long-standing problem for empiricisms that require it. Following the discussion above, experience is better represented as a continuous physical process that connects with the system of interest. We can make a relative judgment of which stages of the process are closer or farther

from the system of interest. There is no absolute stage which can be identified a "experience" *simpliciter*, such as Big-E Empiricism needs.

5. Applications of small-e empiricism

The first applications of small-e empiricism to be explored concern inductive inference itself. The distinctive feature of inductive inferences are that the go beyond what is compelled deductively by their premises. Whether any inductive inference succeeds depends essentially on further facts in the domain in which the inference is implemented. Most simply, we cannot generalize where some property applies, unless background facts in the domain sanction it as the sort of property that can be generalized. Since we can only learn of these background facts through experience, it follows that a determination of which inductive inferences apply in some domain is an empirical question. Accordingly, the material theory of induction treats inductive inferences empirically. Since the theory asserts that background facts determine fully which inductive inferences apply in any given domain, it treats the logic of inductive inference as something to be learned empirically from experience, domain by domain.

Inductive inference is fallible. At best it can tell us that some result is very likely. Once an inference assures us of its result, it has ceased to be inductive. It has become demonstrative or deductive. Since small-e empiricism asserts that inductive inferences are the only way we can learn of contingent propositions, it follows that the best we can affirm of a contingent proposition is the very great likelihood of its truth. An assurance of truth absolutely is beyond our reach.

There are many consequences of this fallibility. Definitions of knowledge that require truth become unattainable idealizations. We may believe a contingent proposition that is true, but we cannot assuredly affirm it. The safest course is to replace a concern for knowledge in our epistemology with one concerned with which contingent propositions are well-supported inductively by experience. A notable consequence is that Gettier problems cease to be a troublesome. Indeed, we shall see that Gettier-like cases in the history of science feature prominently in the progress of science. We also need to guard against misconstruals of inductive fallibilism. A pessimistic overreaction is a complete skepticism that refuses to accept the import of inductive inferences. An optimistic underestimation treats the fallibilism of inductive inference as a challenge to be overcome. It leads to futile efforts to secure an unattainable level of certainty.

[This section is to be completed after Part III of the book is written. Here I will review how small-e empiricism directs us to modify the way we treat a range of topics in philosophy of science and philosophy in general. The discussion will range over inductive inference itself, the need to recognize the import of its fallibilism, thought experiments, time, causation, possibility and realism.]

6. The Chapters

The chapters of this work develop at length the themes sketched above.

6.1 Part I. A Selective History of Empiricism

This first part provides a history of empiricist thinking, so that small-e empiricism can be located within the larger tradition. The most important conclusion to be drawn from the history is that, through its two millennia, the notion of empiricism has been malleable. There is no ancient, authoritative text to which all later versions must hold. It is quite unlike, say Platonism, Aristotelianism or even Euclidean geometry. For each, the writings of Plato, Aristotle and Euclid are authoritative. Accounts that differ from them are qualified as, as neo-Platonic, scholastic or non-Euclidean.

Empiricism persists through its history in a looser notion. It is that experience is privileged as the sole basis of our access to the contingent facts of the world. More precise versions of empiricism arise when this looser notion is implemented in larger accounts of how we come to learn facts of world. They fill in the details left open by looser notion. What are the elements of the account? Ideas? Propositions? What counts as experience? Excited sense organs? Observational or experimental reports? How are they processed? By mental operations? By an abstract logic? How much beyond experience can we learn from experience? Different versions answer these questions differently.

Chapter 2, 3 and 4 will sketch the development of empiricist thinking from antiquity to the later part of the twentieth century. It evolved from the doctrine of a sect of physicians who were roundly decried as cranks in the seventeenth century. The reputation of empiricism was then so poor that the "British empiricists" who founded the modern tradition in empiricism did not themselves use the term to describe their view. Through the course of the nineteenth century, the term was gradually rehabilitated as a doctrine free of medical specifics but centered on the

privileging of experience. In the first part of the twentieth century, the term had become so untainted that many leading philosophers casually identified themselves as empiricists, including notably those that worked in the logical positivist tradition.

A full chapter 4 is devoted to van Fraassen's constructive empiricism, since it has had a controlling influence on present conceptions of empiricism. It will be clear from my narrative that I regard his empiricism as a retrograde step. It is not so much an empiricism as a severe form of anti-inductive skepticism. In spite of their excesses, I have more sympathies for the versions of empiricism that developed in the twentieth century prior to van Fraassen's. To me, the most appealing of these earlier versions is Reichenbach's logical empiricism. It is distinctive in adopting a view that we we would now categorize as scientific realism. It renounces psychological processes in favor of logical relations. It is overtly fallibilist in using probabilistic relations as the primary relations among propositions.

Chapters 5, 6 and 7 develop specific element in the history that have a special connection with the details of small-e empiricism. Chapter 5 surveys briefly how the so-called "British empiricists" introduced a cognitive notion of experience that I believe should now be abandoned in philosophical writing. Chapter 6 reviews the emergence of the notion of "empirical science." It is looser than a fully developed empiricism in merely emphasizing the importance of empirical evidence as a foundation for science. It has become widespread among scientists and is even universally accepted by them. This looser conception is congenial to small-e empiricism for its emphasis on empirical foundations and for its lack of overt skepticism. Chapter 7 reviews mid-twentieth century formulations of principles of empiricism. They provide a background for comparison with the terse, summary statement of small-e empiricism provided in this work.

6.2 Part II. Small-e empiricism

This part contains the core material of this project. It articulates and defends the doctrine of small-e empiricism. The first four of its chapters establish the framework in which small-e empiricism is defined. They develop and generalize the notion of experience to one that conforms with the practice of present empirical science.

Chapter 8 argues that, to this end, we need to minimize the subjective elements in our notion of experience. We should abandon the still popular treatment in philosophical writing of experience as a cognitive state associated with our sense organs; and we should also abandon efforts to understand the import of these cognitive states by examining the mental operations that

they trigger. For the traditional methods of philosophical analysis, armchair introspection, are poorly suited to these tasks. They are now better handled by independently developed sciences such as empirical psychology.

More directly, problems that arise through the peculiarities of human sense organs and human mental processing are not problems specific to science. No scientific problem is solved by deciding whether Penzias and Wilson were mistaken in their perception that their microwave antenna walls were grey. What is a scientific problem is deciding whether the 7.35 cm microwaves their antenna detected was of a cosmic origin and sampled from a thermal cosmic microwave background.

To maintain a focus of problems specific to science, small-e empiricism begins its analysis of experience once experience has been given propositional form, such as in a publication; and the import of these experiences is found from an examination of relations of inductive support among propositions.

Chapter 9 argues that an empiricism well adapted to science must discard the anthropocentrism of traditional empiricisms and employ a concept of experience that allows for purely instrumental detections. For the authority of science does not derive from any special characteristic of human sense organs. Rather, that authority derives from its implementation of a physical process connected continuously to the system of interest.

Since instrumental sensings employ these same processes, they derive their authority in the same way as do human sensings. When there is an earthquake, both humans and seismographs are excited by vibrations passed to them in a continuous physical process from the hypocenter of the earthquake. Instrumental sensings, however, can deliver results far richer in content and with greater reliability. The inked trail left by the seismograph reading is a more sensitive, more enduring and objectively better interpretable representation of the event than is the human recollection. Many instrumental sensings do not compete with human sensings but vastly outstrip them. Consider LIGO, the Laser Interferometer Gravitational Wave *Observatory*. It *observes* black hole coalescences through a continuous physical process, gravitational waves, whose detection is completely precluded to direct human sense perception.

This general idea of the superiority of instrumental sensing has taken root in the sciences to great effect. The last century or so has seen a shift from human sensing to instrumental sensing

in almost every science. Chapter 9 reviews just a few illustrations of this transition from microscopy, chemistry, astronomy and biology.

Chapter 10 develops the further consequences of the reconception of experience as a continuous physical process that connects with the system of interest. The first consequence is immediate. There is no strict division between experience and the non-experiential results derived from it. Rather there is only a comparative relation among propositions describing the various stages or the experiential process. Some are closer to the system of interest and others are farther from it. These propositions stand in relations of inductive support: those farther from the systems of interest inductively support those closer to them. The chapter provides examples of these result that employ three different types of physical processes: Galileo's observation of mountains on the moon (electromagnetic processes); the reports of the 1883 Krakatoa volcanic eruption (acoustic processes); and forensic chains of custody (processes of physical transport of samples).

A further consequence of experience as a process is the provision of a definite means of affirming or correcting experiential reports that may be erroneous. This is the process of "winding back." It allows us not merely to suspect that some experiential report errs, but to reaffirm it or to diagnose how it came to err. Through it we wind back through the various stages of the experiential process towards the system of interest. In so doing we check the inductive support for propositions describing stages close to this system by those farther from it. Chapter 10 provides two detailed examples: Fermi's mistaken claim of the discovery of element 93 and Hubble's erroneous estimate of galactic distances in his 1929 report of the recession of the galaxies.

The prospects for winding back are limited, however, by the availability of records. Two examples illustrate the problem. Michelson's 1920s measurements of the speed of light were tainted by then unrecognized seismic disturbances corrupting their distance measurements. The steady stream of reports of mysterious unidentified flying objects or, as they are later called, unidentified anomalous phenomena, defy ready interpretation for a chronic lack of rich enough documentation.

Chapter 11 examines what I call the "terminal obsession." It is the idea that experiential processes terminate in some stage of pure experience. Such a stage would capture our experience of the condition of the system of interest, without any intrusion from our other theoretical ideas.

That there is such a stage is important for Big-E Empiricism since it posits a strict division between the experiential and non-experiential content of scientific theories; and it endows the cleanly demarcated experiential content with special epistemic powers.

This terminal obsession has been an enduring source of trouble for empiricism. Its proponents have struggled, repeatedly and unsuccessfully, to identify precisely this terminus. Advocates of various forms of the thesis of theory ladenness of observation have responded that no such terminus is identifiable because, they assert, experience and theory is indissolubly intertwined. Critics use the thesis to impugn empiricism.

Once the notion of experience as a continuous process is adopted, these problems evaporate. Because of the continuity of its connection with the system of interest, it has no closest stage that could serve as a terminus. Small-e empiricism has no need for such a terminus, since it has discarded the assumption of Big-E Empiricism of a strict division between the experiential and non-empirical content of science.

Skeptical theses concerning the theory ladenness of observation also fail. Much of the argumentation for them is poor in depending on tendentious analogies and metaphors. The positive difficulty is the treatment of "theory" as an undifferentiated mass that pervades experience. A better analysis considers individual theoretical terms as they appear in propositions describing the stages of the experiential process. The operation of winding back allows us to regress to a stage prior to the introduction of any specific theoretical term, so that the term is no longer involved in the associated theory choice. Since Einstein's discovery of special relativity is a favorite example of this literature, I show how a more careful treatment of the history of the discovery shows how easy it was to wind back and find expressions for key experimental results free of troublesome theoretical terms.

Chapter 12 draws together the elements of small-e empiricism from the earlier discussion of a revised notion of experience, formulates a summary statement of small-e empiricism and gives an extended argument for it. The principal content of this chapter has already been summarized above in Section 3, "Defending small-e empiricism."

The chapter adds further reflections. It reaffirms a traditional commitment of empiricism that restricts science to content that can be inductively supported by experience. This form of the commitment is modest. It renounces the severe form advocated by the logical positivists. They asserted, as meaningless, propositions whose truth cannot be tested against experience. Small-e

empiricism has no need to dismiss them all at a stroke as meaningless. Rather, that they cannot be tested against experience precludes them from empirical science.

The principal claims of small-e empiricism pertain to Reichenbach's context of justification. The content of science consists of those contingent propositions that are supported inductively by experience. Small-e empiricism does not presume a strict separation between Reichenbach's two contexts, discovery and justification. Rather, they are entangled. The actual processes of discovery in science consist of incremental steps whose directions are guided by small justifications of their correctness. Hence the inductive rationality central to small-e empiricism has an important role in scientific discovery.

Small-e empiricism is formulated in terms of inductive relations of support among propositions. The cognitive state of belief plays no essential role in these judgments.[3] However, the results of empirical analyses are relevant to our beliefs. Small-e empiricism does not include a well-developed theory of how these relations of inductive support are to be incorporated into the construction of a comprehensive cognitive system of beliefs. The chapter is limited to recalling Hume's maxim "A wise man, therefore, proportions his belief to the evidence."

The chapter concludes with a brief discussion of the traditional debate of great interest to the history of philosophy, the rationalism-empiricism debate.

Small-e empiricism implements a major shift in empiricist thinking in abandoning the epistemic pessimism of Big-E Empiricism in favor of an epistemic optimism. Because of the importance of the shift, Chapter 13 collects the reasons for the shift as given in fragmentary form in earlier chapters and expands on them as needed. There are four. First is the failure of Big-E Empiricism to identify a clean division between experiential and non-experiential content in science. Second is that an excessive deference to the authority of *individual* experiences neglects that each is corrigible and subject to correction by the greater authority of a well-developed and experientially well-supported science. Third, in denying the inductive import of experience for

[3] This inverts the approach of subjective Bayesians who first form a probabilistic representation of beliefs and from it derive confirmation relations. This inverted procedure is troublesome since it requires us first to develop a global theory of belief, before we form assessments of confirmation, where these latter are both easier to form and antecedent to rational belief formation.

results deeper in a science, Big-E Empiricism advocates inductive irrationality. Finally, through its inductive skepticism, Big-E Empiricism forgoes an ontology of science that is itself capable of vindicating the authority of experience.

6.3 Part III Applications of small-e empiricism

The idea of a modest empiricism like small-e empiricism is broadly, but not universally, accepted in philosophy and philosophy of science. However, the full import of this empiricism, it seems to me, has not been recognized. The goal of this third part of the text is to review how the consequences of adopting small-e empiricism extend through philosophy and philosophy of science.

Inductive inference and relations of inductive support lie at the heart of small-e empiricism. Inductive inferences allow us to use experience to inform us of contingent facts beyond experience. Small-e empiricism requires that this expansion must be founded ultimately on experience. It is argued in Chapter 14 that the material theory of induction is the only account of inductive inference that allows this expansion to be founded fully on experience. For according to it, each inductive inference or relation of inductive support must be warranted by background facts in the domain of the induction. Those background facts must in turn be supported inductively. A small-e empiricist can trace their inductive support back to experience.

The troublesome alternatives are rule-based accounts of inductive inference that do not trace the warrant for their rules back to experience. In so far as that warrant fails, such accounts introduce a priori elements into the analysis. For example, it is common to assume that inductive relations of support are *always* probabilistic relations without ensuring that their applicability to a particular case is warranted by background facts. When that warrant is lacking, there is a serious risk of introducing spurious results that are artefacts of a misapplication of probability theory. What results is a violation of the core idea of empiricism, that all we learn of the world comes from experience.

Chapter 14 offers a brief summary of further details of the material theory of induction. The earlier volumes on the theory investigated how the material theory accommodates known but limited rules of inductive inference (in Norton, 2021); and how the individual relations of inductive support authorized by the material theory fit together in the large-scale structure of inductive support (in Norton, 2024). This Chapter 14 now illustrates how the material theory allows for inductive support for contingent propositions without any evident mediation by rules

of inductive inference, even if of limited scope. The extended example is provided by the history of efforts to determine which are the chemical elements.

Chapter 15 explores the consequences of the fallibility of inductive inference. We can have contingent propositions well supported inductively by experience and even very strongly so supported. Since small-e empiricism asserts that inductive inferences are the only way that we can learn of these propositions, it follows that we can never go beyond very strong but fallible support and be certain of their truth. It is commonly required that a belief only rises to the level of knowledge if it is a belief in a truth, such as in the popular definition of knowledge as justified, true belief. Insisting on this requirement means that we define knowledge such that we can never affirm it positively of any of our beliefs. Truth is opaque. In place of knowledge, it is argued, we should just consider that for which we have strong inductive support from experience. There would be no loss to our informal understanding of scientific knowledge, since we have never been able to affirm the truth of contingent propositions beyond securing strong inductive support for them.

Once we discard the demand for truth, we have resolved the celebrated challenge posed by Gettier problems to knowledge as justified, true belief. Gettier cases become benign. There was some flaw in an apparently strong justification for a result, but, by unanticipated luck, the result turned out to be true after all. The chapter continues to look for Gettier cases in the history of science. The exact conditions of a Gettier case cannot be replicated in the history of science. In science, there is no omniscient narrator, familiar from the fictional narratives of Gettier cases, to declare what is the truth. The narrator is replaced by the judgments of later stages of a science that assess which in their view of the results of the earlier stages are true or false. Similarly, unanticipated luck is replaced by a success of an unreliable method by unanticipated means. It turns out that these Gettier-like cases are pervasive in the history of science and routinely consist of results that are celebrated successes. Gettier-like cases are no longer a threat to knowledge, but repeated successes of science.

[This section will be completed as the chapters of Part III are written]

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My goal in this volume is to restore the place in philosophy and philosophy of science of the core idea of empiricism, that experience is our sole means of accessing contingent facts of the world. I

seek to provide a version of empiricism that implements this core idea in a manner that is well adopted to modern science and affirms that modern science has been enormously successful in learning contingent facts from experience that extend well beyond it. My hope is that a revival of empiricist thinking will correct trends in philosophy of science and in philosophy that have drifted away from a respect for experience. I look forward to the day that the doctrine will cease to be treated warily as an idea to be tolerated and not acted upon, but as a useful ally in developing richer and stronger philosophical analyses.

References

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