Introduction

This book is a history of the emergence, flourishing, and eclipse of experimental philosophy in the early modern period. Experimental philosophy was one of the most significant developments in early modern philosophy. It arose as a movement among natural philosophers in England in the 1660s and quickly spread to English medicine. It was soon embraced in Italy and was taken up in the second decade of the eighteenth century in the Netherlands, and then in the 1730s in France. In the mid-eighteenth century, a number of Scots philosophers applied its methods to moral philosophy, and even to aesthetics and political philosophy. It had a significant impact in Germany in the mid-eighteenth century, and it features in histories of philosophy up until the early nineteenth century. In short, early modern experimental philosophy was a sustained, far-reaching, and complex historical phenomenon.

However, experimental philosophy hardly features at all in today's undergraduate courses on seventeenth- and eighteenth-century philosophy. There are a number of reasons for this omission, and some of them are discussed in Part III. Yet our primary aim here is not to explain why experimental philosophy has been overlooked, but to provide a general history of early modern experimental philosophy, a history that we hope will act as a springboard for further research and will impact on the way in which early modern philosophy is understood and taught in our universities.

Of course, this short history of experimental philosophy does not pretend to be comprehensive. What it attempts to do is to trace the rise and fall of experimental philosophy throughout the seventeenth and eighteenth centuries. The broad historical sweep of experimental philosophy is discussed and interpreted along three interlocking parameters: philosophical, disciplinary, and geographical. Thus, we discuss the emergence and development of experimental philosophy as a response to a cluster of philosophical problems concerning our knowledge of nature and ourselves within it. We discuss the spread of experimental philosophy from the discipline of natural philosophy to the discipline of medicine and other cognate fields, and then to moral philosophy. We treat of the different manifestations of experimental philosophy across various disciplines as they appeared in Britain and the Continent throughout

the period. And we trace the decline of experimental philosophy in late eighteenth-century Germany.

The history of experimental philosophy is patchy and uneven. It was not a movement that swept all before it or that manifested itself in a predictable chronological, disciplinary, or geographical sequence. It was a movement that had its allies and its enemies, its triumphs and failures, and there is, perhaps, no master narrative that enables us to capture every facet of its variegated nature. What we offer in this history, over and above the charting of the main points of its historical manifestation and the views of its major protagonists, is an account of the internal conceptual drivers that led to development and change within the movement. We have also attempted to isolate many of the context-specific factors that account for the idiosyncrasies of its manifestations in different countries, institutions, and protagonists.

The English term 'experimental philosophy' and the Latin equivalent *philosophia experimentalis* were occasionally used before the emergence of the movement in the 1660s. They are found, for instance, with a range of connotations in the Hartlib Papers and other correspondence.[1] The earliest known use of the term in English appears to be 1634 in Samuel Hartlib's *Ephemerides*.[2] It is normally associated with natural philosophy and often with the thought and writings of Francis Bacon.[3] Thus, in 1634 we find John Drury speaking of 'Philosophiae Experimentalis Verulamianus' (Bacon's experimental philosophy). By the early 1660s, however, the term was in regular use. Robert Boyle used it in *Spring of the Air*,[4] published in early 1660, and in the title of his *Of the Usefulness of Experimental Natural Philosophy* of 1663. From this period, the meaning of the term becomes fairly stable.

'Experimental philosophy' in its most general sense refers to a method for acquiring knowledge in the study of nature that gives priority to experiment and observation over theory and speculation. We will have much to say about each facet of this core claim of experimental philosophy in the ensuing chapters: its origins in natural philosophy, its prioritising of experiment and observation over theory, and the relation of experiment to theory. What is important here is that, while the disciplinary domain in which it was applied varied, and while there are a variety of context-specific meanings of the term, the kernel of experimental philosophy – its prioritising of experiment and observation over theory in acquiring knowledge of nature – remained constant. We ought also to point out here that many experimental philosophers

[1] See Feingold 2016.
[2] Hartlib Papers, 29/2/11A. Hartlib appears to be quoting the Cambridge scholar William Watts, though it may be Hartlib's own expression. See Feingold 2016, p. 3.
[3] See, for example, what Mordechai Feingold (2016, p. 4) claims is the earliest appearance of the term in print in the dedication of Gilbert Watts' edition of Bacon's *Advancement of Learning*, Bacon 1640, sig. ¶2^{v}.
[4] B 1 143.

did not draw a systematic distinction between experiment and observation but rather treated the expression 'observation and experiment' as a hendiadys.[5] So, in the chapters that follow, we shall use the expressions 'experimental evidence', 'observational evidence', and 'empirical evidence' as synonyms.

It is clear, then, that early modern experimental philosophy is quite a different phenomenon from contemporary experimental philosophy, or x-phi as it has come to be abbreviated. (We refer to contemporary experimental philosophy as x-phi and reserve 'experimental philosophy' for the early modern movement that is the focus of this book.) X-phi is often characterised, in a narrow sense, as the application of empirical methods from psychology and the social sciences to investigate people's intuitions and, in a broader sense, as the use of empirical methods to investigate philosophical questions.[6] Early modern experimental philosophers were not typically concerned with the empirical or experimental investigation of intuitions. However, like practitioners of x-phi in the broader sense, they did hold that observation and experimentation play a crucial role in philosophical inquiry – including both those branches of philosophical inquiry, like natural philosophy, that now belong to natural sciences and those branches, like ethics, that are still regarded as philosophical *stricto sensu*. Early modern experimental philosophy, then, is a distant relative of x-phi. Just how much continuity there is between the two should become clearer as the history of the earlier movement unfolds in the following chapters.[7]

Experimental philosophy should be also distinguished from the notion of empiricism that, along with rationalism, looms large in twentieth- and twenty-first-century histories of early modern philosophy. While the recent literature has witnessed the appearance of several alternative characterisations of empiricism,[8] along with distinctions between kinds of empiricism, many historians of early modern philosophy still adopt what we will argue is the original, Kantian characterisation of empiricism. This is the conjunction of two claims:

[E1] all human concepts derive from experience, and
[E2] all substantive human knowledge can only be proven to be true a posteriori.[9]

[5] For further discussion, see Daston 2011; Malik 2017.
[6] See Sytsma 2017.
[7] See also Anstey and Vanzo 2016, pp. 98–9; Sorell 2018.
[8] For unorthodox definitions of empiricism or rationalism, see, for example, Specht 1979, p. 15; S. Brown 1985, pp. 195, 198; Carruthers 1992, pp. 129–30; Garrett 1997, pp. 29–38; Ayers 2005. For further discussion of forms of empiricism, see the Conclusion, pp. 289–93.
[9] Several notions of empiricism can be found in Kant's writings. This notion of empiricism corresponds to the Kantian notion that we designate as 'history-empiricism' in Section 8.2. In support of the claim that this notion of empiricism originates in Kant's works, see the survey of pre-Kantian uses of empiricism in Vanzo 2014. Characterisations of empiricism in terms of [E1] and [E2] can be found, for instance, in S. Brown 1996b, p. 10 and Priest 2007, p. 5.

Empiricists deny that we have innate concepts or innate principles and that we can have any substantive a priori knowledge. By contrast, rationalists claim that we have innate concepts and that we can have some substantive a priori knowledge.

While some upholders of experimental philosophy, like Locke and Hume, endorsed [E1] and rejected concept innatism, others stressed the role of experience in the acquisition of knowledge while claiming that we have innate ideas. For instance, Robert Boyle endorsed concept innatism, and Lorenzo Magalotti endorsed the Platonic doctrine of recollection in a text strongly aligned with experimental philosophy, the proem of the Accademia del Cimento's *Saggi di naturali esperienze*.[10] Although Locke, who advocated experimental philosophy, famously criticised innate *ideas*, his main target in the first book of the *Essay* was innate *principles*.[11] And the Scots moral philosopher George Turnbull, a vocal proponent of the application of experimental philosophy to ethics, held that the idea of God is innate.[12]

As for [E2], the view that our substantive knowledge can only be proven to be true a posteriori provides a natural underpinning for experimental philosophers' emphasis on the priority of experiments and observations over theory and speculation. However, while [E2] reflects a concern with the *justification* of knowledge claims, experimental philosophers were primarily concerned with the method that we should follow in the *acquisition* of knowledge. Thus, while many experimental philosophers might perhaps be said to be empiricists in a generic, loose sense of the term, the notion of empiricism has a different meaning and reflects different concerns than the notion of experimental philosophy. As we will argue in Chapter 8, these were distinctively Kantian concerns (reflecting his interest in the origin of the categories and synthetic a priori judgements) which post-Kantian authors used as a prism through which to chart the development of early modern philosophy. And whereas early modern empiricists are routinely contrasted with rationalists, there was no homogeneous grouping of speculative philosophers – to use experimental philosophers' preferred designation of their opponents – who provided a counterpoint to the experimental philosophy movement. The notion of speculative philosophy functioned primarily as a rhetorical and argumentative foil for experimental philosophers, and the many critics of experimental philosophers or (more rarely) experimental philosophy as such held a variety of views and motivations.[13]

[10] See Robert Boyle, *The Christian Virtuoso, 1*, B 11 300–1; Magalotti 1667, sig. +1 2. Jean-Baptiste du Hamel, an early French advocate of experimental philosophy, accepted innate ideas. See du Hamel 1672, p. 348.

[11] See Anstey 2013b, p. 315.

[12] Turnbull 2005, pp. 230–5.

[13] Critics of experimental philosophy include, for instance, in England, Bampfield 1677a and 1677b; Hobbes, *Dialogus physicus* (London, 1661), translation in Shapin and Schaffer

Terms have referents, cognates, and semantic fields, and before long the term 'experimental philosophy' referred not simply to a method of knowledge acquisition, but to a movement. When we speak of it as a movement, we mean, following the OED, that it was 'a course or series of actions and endeavours on the part of a group of people working towards a shared goal'.[14] Experimental philosophy was a movement with its central tenets and epistemic values, its leaders, followers, promoters, and opponents; a movement with its own jargon and rhetoric, and eventually its own institutional niches and material culture, and above all its shared goal of practising and promoting a distinctive shared methodological approach in natural philosophy. So, for example, in 1707, Roger Cotes, who later edited the second edition of Newton's *Principia* (1713), was appointed the Plumian Professor of Astronomy and Experimental Philosophy in Cambridge. By the time of Cotes' appointment, courses in experimental philosophy were being taught and 'demonstrated' in Oxford, Cambridge, London, and St Andrews, and the term now connoted the content of these courses. As a result, especially in pedagogical contexts, one could find disciplinary rather than methodological uses of the expression 'experimental philosophy'.[15] Thus, early modern experimental philosophy became a social phenomenon with literary and material outputs and institutional cachet.

All of these facets of early modern experimental philosophy are fascinating and worthy of detailed study in their own right. However, our focus in this history is on, for want of a better word, philosophical aspects of experimental philosophy. It is not that we ignore the institutional, linguistic, and material strands of its history, but this study is centred on experimental philosophy as a phenomenon within early modern philosophy, rather than on its place in the history of science or early modern social history.

1985, pp. 345–91; Cavendish 2001 [1666/8]; Casaubon 1669 (see Spiller 1980); Stubbe 1670a, 1670b, 1670c (see Heyd 1995, chapter 5); Sergeant 1696, esp. sigs. d5^{r}–d6^{r}; and in Italy, Aletino 1694, pp. 189–254 and Barbieri 1752, pp. 1–18. Aletino referred to experimental philosophers interchangeably as 'atomists' and 'experimentalists', as did, among others, one of the Spanish critics of both corpuscularism and experimental philosophy, Juan Martin de Lessaca (1717, p. 7).

[14] OED, meaning 8a.

[15] See Baglivi 1696, part 1, chapter 5, §5. A number of the authors who advocated a *via media* between experimental and speculative philosophy also sometimes used these expressions in a disciplinary sense, to indicate branches of, or approaches to, philosophy that can co-exist or could be combined. See, for example, Cavendish 2001 [1666/8], p. 242 in England and Bartoli 1677, pp. 305–7 in Italy; and in Germany, Wolff's and Tetens' attempts to combine experimental and speculative philosophy, discussed in Chapter 7. In eighteenth-century Germany in the Berlin Academy, experimental and speculative philosophy happily co-existed as separate classes within the institution (see Section 7.4). Later in the century, supporters of experimental philosophy (e.g., Feder 1788, p. 43) as well as others (e.g., Wezel 1784, p. 24) sometimes used 'speculative philosophy' in a non-derogatory way as a synonym of 'theoretical philosophy'.

To that end, it is important at the outset to set out some of the basic distinctions and the broad contours of the philosophical context within which experimental philosophy emerged. As we have established, experimental philosophy involved a method for acquiring knowledge in the study of nature. Its salient feature was that it gave epistemic priority to experiment and observation; however, it was also set within a broader approach to knowledge deriving ultimately from Aristotle's *Posterior Analytics*, what one of us elsewhere has called the neo-Aristotelian theory of knowledge acquisition.[16]

This neo-Aristotelian theory of the acquisition of knowledge held that each science or *scientia*, including natural philosophy, is derived from first principles that take the form of propositions. The question arose then as to how we gain knowledge of the principles of a science. Experimental philosophers insisted that in this process we must give epistemic priority to experiment and observation over and above speculation and theorising. As a result, they set themselves against what they called speculative philosophy, which, in their view, established principles using primarily hypotheses and a priori reasoning, without relying systematically on experiment and observation. A concomitant of this prioritising of observation and experiment was that many experimental philosophers spoke of a two-step approach to developing a science of nature. According to them, it is only after the initial process of gathering experimental and observational evidence is well under way that we can firmly commit to principles and theories, and theorising begins with the attempt to determine the true principles of a science.

The second structural feature of the neo-Aristotelian theory of knowledge that pertains to the history of experimental philosophy is that it divided knowledge into two distinct forms, practical knowledge and speculative knowledge. This feature is crucial for understanding the origins of the distinction between experimental and speculative philosophy, a distinction that characterises early modern experimental philosophy from its beginnings (see Chapter 1). It is conceivable that early modern experimental philosophy could have arisen without defining itself against speculative philosophy. In other words, there could have been experimental philosophy without the experimental/speculative distinction (hereafter ESD). However, this is not

[16] See Anstey 2020. For early modern theories of principles, see Blundeville 1617, Pascal 1995 [1670], Arnauld and Nicole 1996 [1683], Mariotte 1678, Barrow 1734 [1683], and d'Alembert and Chapelle 1755. If we take Newton as an exemplar: for his general principles, see his 'Principles of Philosophy' in McGuire 1970, pp. 182–4 and commentary in K. Walsh 2017; for his deployment of principles in hydrostatics, see the manuscript known as *De gravitatione* in Newton 2014, pp. 50–8 and commentary in Chalmers 2017, chapter 9; for his deployment of principles in optics, see Newton 1979 [1730], and for analysis, see Worrall 2000.

how things worked out, and the ESD remained a central feature of experimental philosophy and a key polemical driver of the movement until the end of the eighteenth century.

In fact, this distinction became one of the standard terms of reference in early modern natural philosophy and philosophy more generally. It had a long prehistory insofar as the distinction between experimental and speculative is a descendant of the distinction between practical and speculative knowledge found as far back as Aristotle. In its early modern form, however, the distinction is primarily methodological:[17] experimental philosophy emphasised the priority of observation and experiment over theory and speculation. By contrast, speculative philosophy began with principles and hypotheses from which systems of knowledge were constructed, and – in the eyes of experimental philosophers – it only paid lip service to observation and experiment. We have set out this philosophical context in Figure 1.1 which shows in a simplified way the manner in which core features of experimental philosophy arose out of the Aristotelian theory of knowledge.

There is another aspect of early modern experimental philosophy that, like the ESD, was non-essential but features prominently in the practice of experimental philosophers in its first four decades. This is their

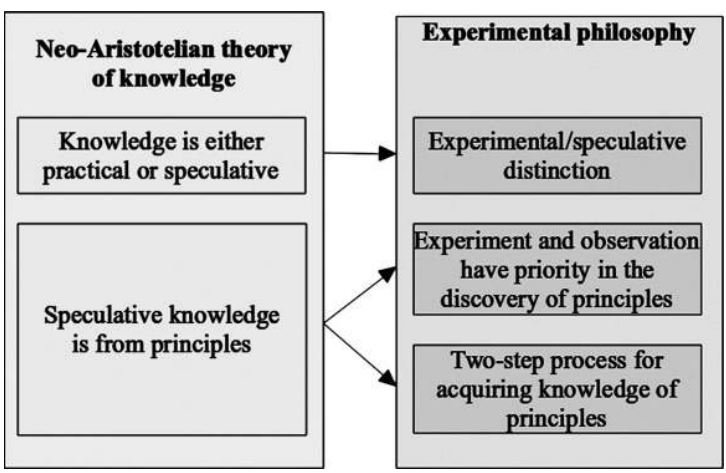

Figure 1.1 Experimental philosophy and its relation to the neo-Aristotelian theory of knowledge

[17] However, see note 15 above on disciplinary uses of the distinction.

commitment to Francis Bacon's architectonic vision for a natural philosophy founded upon natural histories, which was the main inspiration for the practice of and theorising about experimental philosophy. This need not have been the case, and, in fact, the Baconian approach to natural history moved well into the background in the theory and practice of experimental philosophy from the end of the seventeenth century (see Chapter 3). We regard the strong emphasis on natural history among the first generations of experimental philosophers as deriving in large part from the philosophy of Bacon himself, and a concomitant Baconian legacy was the philosophy of experiment that we find in the writings of Robert Boyle and Robert Hooke. Again, this is a contingent feature of early modern experimental philosophy: the movement could well have progressed in the absence of a carefully articulated philosophy of experiment. Nevertheless, as things transpired, a philosophy of experiment did form part of the theoretical background to the movement as it developed in the latter decades of the seventeenth century (see Chapter 3).[18]

The ESD provides a kind of entry point into a number of philosophical problems around which we have shaped this book. It is, in a sense, the popular framing of a clutch of deeper philosophical issues that beset early modern thought in general and which became the conceptual drivers in the emergence and development of experimental philosophy. Each of these problems has to do with understanding the inner nature, structure, and behaviour of things in the world. As such, they are both metaphysical and epistemological problems. They were not new problems, but experimental philosophers, we will argue, tackled them in new ways. The first has to do with the nature of things themselves. It is the problem of inner natures or essences. Many philosophers believed that particular substances such as gold, or qualities such as heat, have an essential nature, something in virtue of which it is what it is. Furthermore, they believed that these essences are the same for all tokens of the same type, and that knowledge of these essences will lead to an understanding of the behaviour of that type of thing and their relations with other types of thing: all gold has the same essence and interacts with other substances in the same ways. The problem was to get epistemic access to the essences. Can this be gained through the senses, through reason, or through a combination of both?

Experimental philosophers claimed not just that knowledge of inner natures ought to be obtained via the senses, but that the acquisition of this knowledge required more than this: it required structured experiment and observation. They also claimed that experiment and observation had temporal and epistemic priority over speculation in the search for essences. In their view, anyone who denied this and claimed that reasoning from speculative theories

[18] See also Anstey 2014a.

and hypotheses was the place to start in the discovery of the inner natures of things was a speculative philosopher.

Once those essences were known, there was then a second problem as to how to construct a body of knowledge concerning them, their behaviour, and their relations with other things. As we have argued, at the turn of the seventeenth century there was a well-established theory as to how to go about this deriving from Aristotle's *Posterior Analytics*. While there were variants of the theory, the general view was as follows. In order to generate a science, we need to start with principles: both the common propositional principles that pertain to all sciences and those certain propositions about the essences of things pertaining to the science at hand. Once the principles are established, we then proceed, using a method of demonstration such as the Aristotelian syllogistic, from these common and proper principles to produce a systematic body of knowledge.

Experimental philosophers were committed to this neo-Aristotelian theory of knowledge acquisition and yet were aware of its limitations. In addition to the problem of knowing the essences of things, there is a difficulty in determining what the principles are, and, furthermore, there are various issues with the process and outcomes of developing a demonstrative science. Many experimental philosophers opposed the foundational role of a priori principles and harshly criticised the leading examples of this sort of demonstrative science. Aristotelian natural philosophy and Cartesianism were two of the most criticised speculative philosophies.[19]

This leads us to the third and closely related philosophical problem that experimental philosophers sought to address, namely, establishing the precise relation between observation and experiment on the one hand, and theorising using principles and hypotheses on the other. For, even if we come to know the essence of a particular substance or quality, the question remains: in the process of constructing the relevant science, how should we relate observations and experiments to theory? On the whole, experimental philosophers decried the use of hypotheses and premature theorising on the basis of principles, especially when these were used without sustained recourse to observation or experiment.

It is one thing to say that natural philosophers ought to carry out observations and perform experiments rather than merely spinning theories out of their own minds; it is far more difficult actually to specify what the standards of

[19] There were, however, some attempts by early supporters of experimental philosophy to recruit Descartes among the predecessors of or contributors to experimental philosophy. See, for example, Glanvill 1665, p. 72; Accademia dei Fisiocritici 1691, §31; and Conti 1832, p. 76 (Conti also acknowledges Descartes' contributions to speculative philosophy, pp. 88–90). It is worth noting the irony in the fact that many experimental philosophers were working with the neo-Aristotelian theory of knowledge acquisition in order to establish an anti-Aristotelian natural philosophy.

adequacy for observation and experiment are, either in general or with respect to any particular natural philosophical theory or principle. Experimental philosophers were quick to criticise the method of speculation insofar as it lacked adequate recourse to observation and experiment, but what quantity and kinds of experimental evidence are sufficient for establishing theories?

In addressing this question, it is helpful to distinguish between the intrinsic and extrinsic epistemic value of observational and experimental evidence. The intrinsic epistemic value of some determinate experimental evidence is the degree to which that evidence is reliable or can be trusted in its own right. The extrinsic epistemic value of some, say, experimental result depends on the evidential relation between the result and something else, such as a theory or proposition. In the case of the *intrinsic* epistemic value of empirical evidence, the early moderns attempted to establish reliability through repetition and replication of experiments, through methods of variation (see Section 2.4), and through testimony, especially the number and credibility of witnesses.[20] Each of these approaches finds parallels in contemporary science. However, with regard to the *extrinsic* value of observational and experimental evidence, there is an important difference between most early moderns and contemporary scientific practitioners.

There are many uses of observational and experimental evidence, including saving the phenomena; testing, developing, and calibrating instruments; exploratory experiments, and so on. However, in contemporary science the primary way in which the *extrinsic* epistemic value of observational and experimental evidence is gauged is the extent to which it *confirms or disconfirms scientific theories*. This was not the case in the early modern period. In the seventeenth and eighteenth centuries, the primary way in which the *extrinsic* epistemic value of observational and experimental evidence was assessed was the extent to which it facilitated the establishment of the *foundational principles* of a science. It was believed that once those principles were established – whether they be axioms, definitions, or laws of nature – one could proceed to develop the theory. To be sure, observational and experimental evidence were used for other purposes, such as testing and calibrating instruments and saving the phenomena. Moreover, there are examples of early modern experiments which with hindsight we can describe as confirming or disconfirming theories, testing hypotheses, or using experimental evidence in inferences to the best explanation. Yet it was the role of empirical evidence in establishing the

[20] For the repetition and replication of experiments in the early modern period, see Schickore 2010, 2011, 2017; Steinle 2016b. For Boyle on the utility of experimental replication, see Royal Society Boyle Papers, vol. 9, fol. 12^{r}; and for Boyle on experimental repetition and variation, see Sargent 1995, pp. 176–80. For an early reference to replication in Hooke that takes its inspiration from Bacon, see his 1661, p. 41. For testimony and witnessing of early modern experiments, see Shapin and Schaffer 1985; Shapin 1994; B. Shapiro 1999; Serjeantson 2006; and Hogarth and Witmore 2020.