

# A Very Principled Project

» PETER ANSTEY

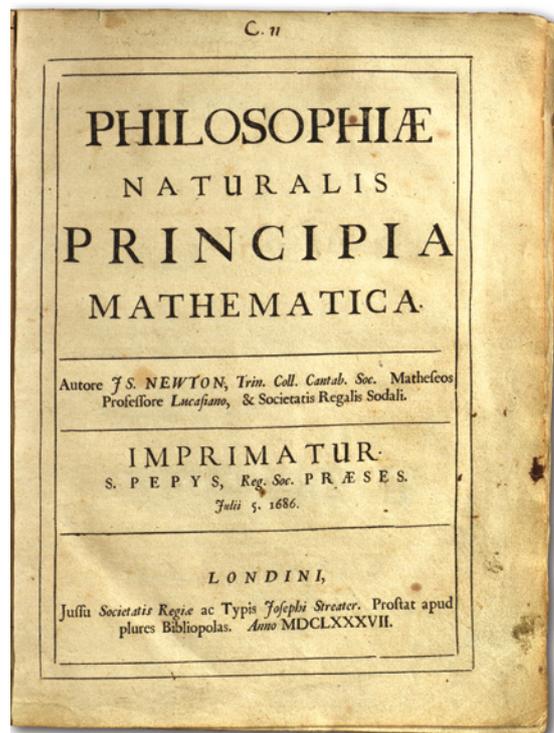
Sometimes it is the sheer ubiquity and ordinariness of a thing that prevents us from seeing it or appreciating its significance. Such is the case with the idea of principles in the early modern period, the age of the Scientific Revolution and the Enlightenment. Because almost everyone was talking about principles, arguing for them, arguing from them, assuming them, and using them, they have somehow slipped under the radar in intellectual history. Yet principles were important, very important.

Look at some of the titles of path-breaking books from this period: Isaac Newton's *Principia* (1687), René Descartes' *Principles of Philosophy* (1644), George Berkeley's *Principles of Human Knowledge* (1710), David Hume's *Enquiry Concerning the Principles of Morals* (1751). There is a recurring theme: principles feature in both the titles and the content of these works.

Principles were in the warp and weft of early modern thought. There are books about the principles of nature, principles of reason, principles of chemistry, principles of painting, principles of law and government, principles of morality, principles of theology, principles of navigation, of hunting, midwifery, taste, and writing. Principles were everywhere. Moreover, principles were central to the assessment of character: it really meant something to be a woman or a man of principle.

It is hardly surprising then, that once I started to look for principles in the thought and writings

of the seventeenth and eighteenth centuries, I soon found myself overwhelmed with materials to work on. This is a rich seam in the history of philosophy, the history of science, the history of religion and art that to date has never been mined. Thanks to the faith and generosity of the Australian Research Council and the support of the University of Sydney, I have spent the last four years as a Future Fellow surveying, setting up various mineshafts, and drilling down and extracting from this precious vein of ore.



(above)  
Montage using article figures.

(far right)  
The title page of a rare annotated first edition of Newton's *Principia*, 1687.

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And precious it is. There is a reason why the most valuable book in the Rare Books and Special Collections Library at the University of Sydney — indeed one of the most valuable books in Australia — is the annotated first edition of Isaac Newton's *Principia*. For this book introduced to the learned world a new set of principles, namely, the laws of motion and the law of gravitational attraction, which would transform the study of nature for centuries to come and which are still taught today in secondary schools the world over.

Yet for the historian of philosophy, the really interesting feature of Newton's *magnum opus* is the way in which his laws of nature came so quickly to be called principles. It may come as a surprise to learn that the notion of laws of nature as we know it today only emerged in the seventeenth century. The key figure here was the French philosopher and mathematician René Descartes (1596–1650). He effectively introduced the modern notion of laws of nature into natural philosophy (what we now call science), and he too regarded them as a kind of principle and argued that his two primary laws of nature derived from the immutability and simplicity of God.<sup>1</sup> This is because the idea of principles was at the very heart of the early modern view of how one acquires and builds a systematic body of knowledge.

The core idea was that to be a science, such as chemistry, optics, theology or morals, is to be a systematic body of knowledge founded on a small set of principles. Once the principles are in place, one then uses a method of demonstration — something like a set of knowledge generating procedures — to deduce all that can be known about the subject. The model, of course, was Euclidean geometry, which from a set of only five postulates generated an enormous number of theorems, many of which were entirely unexpected. It was as if the postulates or principles were so fertile, so fecund, that they contained within them all sorts of wonderful new truths.

To many in the early modern period, the newly discovered laws of nature seemed to function in the very same way: they seemed to enable one to generate knowledge. For example, Newton's laws were used to 'deduce' Kepler's laws of planetary motions. And it was not only in the

study of nature that principles had work to do. For some thinkers, such as the leading English philosopher John Locke (1632–1704), believed that it was possible to deduce a science of morality from a handful of principles, analogous to Euclidean geometry. Locke never undertook this task, but it was attempted by others.

Talk of moral principles brings to mind propositions like 'Love your neighbour as yourself' and 'One ought to keep one's promises'. These are normative principles that are concerned with what we ought to do. However, as one reads more and more moral philosophy from the period it becomes clear that, by the mid-eighteenth century, the discourse about moral principles undergoes a significant change. Instead of attempting to base morality on normative principles, philosophers, such as David Hume (1711–76) and Adam Smith (1723–90), argued that it is based on principles about human nature, and, in particular, human psychology. Thus, Hume had little interest in foundational normative claims. Instead he argued, on the basis of the observation of human nature, that 'morality is determined by sentiment'. Virtue, for Hume, is what gives the 'pleasing sentiment of approbation' and vice the opposite.<sup>2</sup> Nevertheless, Hume, like Locke before him, was committed to the standard view that to be a science is to be a structured body of knowledge based on principles: it is just that he disagreed with Locke about the nature of those principles.

With so much talk about principles in the air, it is hardly surprising that some scholars attempted to develop theories of principles. These theories were sometimes concerned with what qualifies a proposition to be a principle. Thus, the French logician Peter Ramus (1515–72) proposed three laws that principles had to conform to. They had to be universal, essential and convertible, as in 'All humans are rational animals'. It was also believed that there were different types of principles, such as common principles that pertained to all the sciences, and proper principles that were applicable only to one science. Some philosophers, such as some of the leading lights of the Berlin Academy in the 1740s and 1750s, argued that the ultimate principles of all the sciences were metaphysical, that is, principles about the nature of being itself.

(far right)

Portrait of Jean Le Rond d'Alembert by Maurice Quentin de La Tour, musée de Louvre.

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Indeed, some francophone philosophers claimed that, in fact, there is just one fundamental principle from which all other principles and ultimately all the sciences can be derived.

Jean le Rond d'Alembert (1717–83), Pierre-Louis Moreau de Maupertuis (1698–1759) and Étienne Bonnot de Condillac (1714–80) each claimed to have found such a principle, though ironically their principles all differ. In his article on the 'Elements of the Sciences' in the massive *Encyclopédie* project of the French *Philosophes*, d'Alembert claims:

if we were able to observe without interruption the invisible chain that links all the objects of our knowledge, the elements of all sciences could be reduced to *one unique principle*, whose consequences would be the elements of each particular science.<sup>3</sup>

D'Alembert believed that this single foundational principle can be found *a priori*, that is, without the use of observation and experiment. Experiment, however, was absolutely central to the early moderns' attempts to discover and establish principles. For example, in his *Enquiry Concerning the Principles of Morals* (1751), Hume claims 'we can only expect success, by following the experimental method'.<sup>4</sup> That experimental method was the method of a new movement in the study of nature called Experimental Philosophy, which first emerged in the nascent Royal Society of London in the 1660s. The impact of this new approach to science on the quest to establish principles was profound. And perhaps the best way to illustrate this is through the experimental philosopher *par excellence*, Robert Boyle (1627–91).

Boyle is known today as the father of chemistry, and that epithet provides a nice entrée into the centrality of principles to his thought. His most famous book *The Sceptical Chymist* (1661) is also something of a treasure — a first edition recently sold at auction for £362,500. In that work Boyle uses the term 'principle' 270 times. His purpose in the book is to argue against various theories of chemical principles in favour at the time, such as the Aristotelian four element theory and the Paracelsian *tria prima* of salt, sulphur and mercury. The second, 1680, edition of the book was published in



conjunction with a work that continues his polemical strategy. It is entitled 'Experiments and Notes about the Producibility of Chymicall Principles'. Boyle argued there that the chemists' principles were ultimately reducible to more fundamental principles, namely, the shape, size, motion and texture of the underlying tiny material bodies, or corpuscles. He called this his Corpuscular Philosophy and he attempted to back up his claim with appeals to numerous chemical experiments.

Experimental philosophers were adamant that, in order to understand the structure and behaviour of nature, we need to derive its principles from observation and experiment. Thus, they were opposed to those who eschewed experiment and began with untested principles and hypotheses. This is precisely what John Locke opposes in the opening book of his famous *Essay Concerning Human Understanding* (1690), which argues against the popular view that the mind at birth is furnished with innate principles. It is also what Newton opposed in his famous dictum *Hypotheses non fingo* — I feign no hypotheses.<sup>5</sup>

Now, it can hardly have escaped the reader's notice that the term 'principle' referred to a variety of things in the seventeenth and eighteenth centuries. Laws of nature are very different to chemical principles, which, in turn, do not have much in common with normative claims such as 'You should keep your promises'. Part of the challenge of understanding the idea of principles in this period is to make sense of the variety of uses or types of principles that were appealed to. It really does seem to be a family resemblance concept rather than something for which one can give a simple definition. Nevertheless, there is a fairly natural division between principles that are things in the world, such as chemical principles, and principles that are propositions, such as those we find in morals or logic or geometry.

A fascinating example of the use of principles in geometry is Brook Taylor's *New Principles of Linear Perspective*, which appeared in 1719. Taylor was the first to set out the principles of two-point perspective drawing. The work itself is technically demanding but its application is relatively intuitive and was already being applied by architectural artists. Perhaps the high-water mark of architectural painting in the eighteenth century is the work of the Venetian painter



(left)

Brass cast by Carl Reinhold Berch of an ivory medallion of Robert Boyle made by Jean Cavalier in 1690.

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Canaletto (1697–1768), who perfected two-point perspective painting in his marvelous scenes of Enlightenment Venice. In his painting of St Mark's Square below we can see the manner in which he has used two vanishing points to create a vista that cannot be seen in real life.

If there was a true man of principles in the early modern period, it would have to be G.W. Leibniz (1646–1716). This extraordinary polymath — co-inventor of the calculus, historian, philologist, diplomat, natural philosopher and metaphysician — was known above all for his Principle of Sufficient Reason. The principle claims '[T]here can be found no fact that is true or existent, or any true proposition, without there being a sufficient

(below)

*Piazza San Marco looking South and West*, by Canaletto, 1763.

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reason for its being so and not otherwise.<sup>6</sup> A second fundamental principle for Leibniz was the Law of Non-Contradiction, namely 'No proposition and its negation can be true at the same time'. Together these two principles for Leibniz were the basis of human reasoning.

The Principle of Sufficient Reason is an explanatory principle. It underlay Leibniz's view that this world is the best of all possible worlds. After the devastating Lisbon earthquake in 1755, the French *philosophe* Voltaire (1694–1778) famously took issue with Leibniz's claim, mocking it in his satirical novel *Candide*.

Terrified, confounded, thoroughly distraught, all bleeding and trembling, Candide reflected to himself: 'If this is the best of all possible worlds, then what must the others be like?'<sup>7</sup>

about his laws of nature and these laws were very quickly appropriated for other purposes. A case in point is the role that they came to play in natural religion. The view that there is a natural religion, constituted by principles, as distinct from revealed religion, emerged in the second half of the seventeenth century. It is found, for instance, in John Wilkins' *Of the Principles and Duties of Natural Religion* of 1675. The kernel of natural religion is a set of principles discoverable by human reason and available to everyone. These principles include such things as 'that there is a just and holy God, and a wise Providence, and a future State of Rewards and Punishments'.<sup>9</sup>

In the early eighteenth century, some mathematically competent theologians who understood Newton's achievement realised that his laws could be used as support for the

THUS, HUMANS SEEM TO HAVE FOUND A ROLE FOR PRINCIPLES IN AN ENORMOUS VARIETY OF DISCIPLINES IN THE SEVENTEENTH AND EIGHTEENTH CENTURIES.

Yet some of Leibniz's other explanatory principles fared much better. One extremely popular explanatory principle, that Descartes made famous and Leibniz promoted, was the view that all explanations of change in nature should be analogous to the functioning of machines: all explanations should only appeal to the shapes, sizes and motions of the parts of the objects involved. This was at the core of what was called the Mechanical Philosophy, an approach to nature that was enormously popular and highly controversial. It was largely on the basis of this explanatory principle, for example, that Descartes could claim that animals are merely very sophisticated machines, the doctrine of the *bête machine*.<sup>8</sup> This principle was also the primary motivation for Leibniz to reject Newton's claim about universal gravity. Gravity seemed to Leibniz and many others to be a violation of the fundamental mechanical nature of the natural world, a mysterious form of action at a distance. He regarded it as an occult quality that violates the principles of the mechanical philosophy.

Now, while some had doubts about the nature of Newtonian gravity, few had any reservations

principles of natural religion. William Whiston (1667–1752), for example, who succeeded Newton as Lucasian Professor of Mathematics at Cambridge — the chair recently held by Stephen Hawking — argued that the principles of natural religion were themselves derived from more fundamental principles, namely, Newton's laws of motion and gravitational attraction. The title of his book *The Astronomical Principles of Religion, Natural and Reveal'd* (1717) says it all: the principles of natural religion are founded on astronomical principles, namely, the principles discovered by Newton! Samuel Clarke (1675–1729) makes a similar claim in the famous Leibniz–Clarke correspondence, which was published in the same year as Whiston's book. Where Descartes had earlier based his laws on the immutability of God, Whiston and Clarke argued for the existence of God from the laws.

Thus, humans seem to have found a role for principles in an enormous variety of disciplines in the seventeenth and eighteenth centuries. They appear in everything from natural philosophy and its sub-disciplines, to theology and morals. And principles still have a central place in many disciplines today. For

some, the mark of a mature or developed science is the fact that it has clearly articulated and well-supported principles. Nevertheless, the quest for certain and necessary principles from which knowledge can be derived is no longer universal in the natural sciences. Inductive reasoning now has a very prominent and secure place in the way in which we generate knowledge. Moreover, the grip of the Euclidean model has significantly weakened. Looking back at the early modern period, I believe, there is a principled reason why we can say that that was the heyday of principles. ¶



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6. G.W. Leibniz, *Philosophical Papers and Letters*, 2nd edition, ed. by L.E. Loemker (Dordrecht: D. Reidel, 1969), p. 646.
7. Voltaire, *Candide*, in *Candide and Other Stories*, trans. by R. Pearson (Oxford: Oxford University Press, 1992), p. 15.
8. See Descartes, *Discourse on Method*, in *The Philosophical Writings of Descartes*, I, pp. 139–41.
9. Edward Stillingfleet, *A Discourse in Vindication of the Doctrine of the Trinity* (London: Printed by J.H. for Henry Mortlock, 1697), p. lvii.