

CHAPTER II

THE MATHEMATICAL PRINCIPLES OF GOD'S DESIGN

“For God is known from his works.”¹

“In the preceding Books [I and II] I have laid down the principles of philosophy, principles not philosophical, but mathematical.” (*Principia*, p. 319.)

Newton was attempting to discover the original design of creation imprinted upon matter, for as he said, “God is known from his works.”² Two major routes were open to him in following up the mathematical principles of this original design. The first was the natural world; the second was the Bible (mainly the prophetic books) and the works of providence in the history of humanity. In both cases his working assumption was that a real design exists in nature and in human history, which the scientist and the interpreter of prophecy have a duty to uncover in order to provide human beings with practical guidelines for preserving and taking better care of the order of the design. Even prior to the events of the Glorious Revolution (1688-9), natural philosophers and divines of the Royal Society such as John Wilkins and Robert Boyle had emphasized the providential role of God in first ordering and then supervising the course of nature.³ In the context of the renewed political instability arising from the Glorious Revolution the providential Newtonian design argument was further popularized by scientists-theologians, such as Richard Bentley, Samuel Clarke and William Whiston in the Boyle Lectures, which were supervised by Newton himself. According to Westfall, these men along with Edmond Halley and Hopton Haines shared Newton's heretic Arianism which had a direct

¹ J.E. McGuire, “Newton on Place, Time, and God: An Unpublished Source,” *BJHS* vol. 11, (1978) p.119. See also: “We are, therefore, to acknowledge one God, infinite, eternal, omnipresent, omniscient, omnipotent, the Creator of all things, most wise, most just, most good, most holy. We must love him, fear him, honor him, give him thanks, praise him, hallow his name, obey his commandments, and set times apart for his service, as we are directed in the Third and Fourth Commandments.... And these things we must do not to any mediators between him and us, but to him alone... And this is the first and the principal part of religion. This always was and always will be the religion of all God's people, from the beginning to the end of the world.” Newton, “A Short Scheme on the True Religion,” Quoted in Brewster, *Memoirs of Sir Isaac Newton*, (Edinburgh, 1855), vol. 2, p. 348.

² J.E. McGuire, “Newton on Place, Time, and God: An Unpublished Source,” *The British Journal for History of Science*, vol. 11, (1978), p. 119.

³ For an account on the revealing of the providential design by members of the Royal Society, see: James Force, “Hume and the Relation of Science to Religion among Certain Members of the Royal Society,” *Journal of the History of Ideas*, vol. 45 (1984); idem, *Whiston*, pp. 90-95; Margaret C. Jacob, *The Newtonian in the English Revolution: 1689-1720*, (Ithaca, 1976).

saying on the design argument.⁴ Margaret C. Jacob points out that these Boyle Lectures were used to spread the design argument of Newtonian natural religion to the social needs of Restoration England.⁵ Indeed, Newton informs Richard Bentley before Bentley's first Boyle lecture that:

when I wrote my treatise about our Systeme I had an eye upon such Principles as might work with considering men for the believe of a Deity, and nothing can rejoice me more than to find it useful for that purpose.⁶

The idea of an original design that has mathematical and geometrical qualities is central in Newton's mind. In both his major scientific publications, the *Principia* and the *Opticks*, the "argument from design" provides the key theological metaphor of the world as a system of God's "most wise and excellent contrivances."⁷ Although by the seventeenth century the argument was serving as the conventional metaphysical means for demonstrating God's existence, Newton's endeavors to bring the metaphor it conveyed to bear directly on the philosophical study of nature and its underlying mathematical principles were not commonplace. Natural philosophers traditionally sought to explicate fundamental natural properties, that is, the simplest forms of nature underlying the phenomena. These explications provided the premises on the basis of which the phenomena could ideally be demonstrated. Thus, the method of "resolution" guided inquiry from evidence to basic premises, while the method of "composition" was followed in the attempt to investigate the consequences that followed the premises of inquiry.⁸ Although it was generally assumed that simple natures were created by God's omnipotence and omniscience, the logical structure of demonstrations did not pose the practical challenge of understanding a work of design. The latter would involve the examination of functional relations between the various parts that are

⁴ See: Westfall, *Never at Rest*, p. 651; Force, *Whiston*, p. 93.

⁵ Margaret C. Jacob, *The Newtonian in the English Revolution*, p. 270; See also: Force, *Whiston*, p. 63.

⁶ "Newton to Bentley, December 10, 1692", W. H. Turnbull, J.F. Scott, A. Rupert Hall and Laura Tilling (eds.), *The Correspondence of Isaac Newton* (Cambridge, 1959-77), vol. 3, p. 233.

⁷ Newton, *Isaac Newton, The Principia: Mathematical Principles of Natural Philosophy, a New Translation by I. Bernard Cohen and Anne Whitman, Assisted by Julia Budenz*. Cohen and Whitman (eds.), (Berkeley: University of California Press, 1999), p. 942. I wrote parts of this book throughout the years before this wonderful translation and edition was published, so I only cite from this edition (hereafter cited as *Isaac Newton, The Principia*) and not from Andrew Motte's translation when I find it necessary. Cohen also demonstrated that natural theology was explicit in all three editions of the *Principia*, see: I.B. Cohen, "Isaac Newton's *Principia*, the Scriptures, and the Divine Providence," Sidney Morgenbesser, et al. (ed.), *Philosophy, Science and Medicine* (New York, 1969), pp. 523-48.

⁸ See e.g.: A.C. Crombie, *Robert Grosseteste and the Origins of Experimental Science, 1100-1700* (Oxford, 1953), esp. pp. 290-319.

integrated by the order of the design into a particular synthesis that a logical inference cannot fully disclose or recover.⁹

It is important to keep in mind in this context the difference between grasping nature as God's *creation* and grasping the world as a work of God's *design*. Alluding to this distinction, Newton pointed out in his preface to the *Principia* that "[t]he ancients considered mechanics in a two-fold respect as rational, which proceeds accurately by demonstration; and practical."¹⁰ "Rational" mechanics sought to disclose the logical relations between specific magnitudes that a particular device must logically involve working. Artisans, on the other hand, faced the practical challenge of making a particular device, of learning the contingent constraints that it presented and the opportunities it offered in virtue of its special design. Rational mechanics did not provide the guidelines for accommodating the user's conduct to the designed system, while the user's practical experience fell short of demonstrative knowledge. As a philosopher, Newton was committed to the search for methodologically rigorous explanations; yet, because he construed the world as a work of design, he concluded that practical experience was the indispensable element in the acquisition of this knowledge. "Accurate practice" thus appeared to be the appropriate ideal: "he that works with less accuracy is an imperfect mechanic; and if any could work with perfect accuracy, he would be the most perfect mechanic of all."¹¹

In the 1710's, Samuel Clarke on behalf of Newton further developed the argument of design. In the famous correspondence between Leibniz and Clarke, Leibniz criticizes Newton's concept of design as follows:

According to [Newton's] doctrine, God Almighty wants [i.e. needs] to wind up his watch from time to time; otherwise it would cease to move. He had not it seems, sufficient foresight to make it a perpetual motion.... According to my opinion, the same force and vigor remains always in the world and passes from one part of matter to another, agreeably to the laws of nature and the beautiful pre-established order.¹²

Here Leibniz accuses Newton of detracting from the power and majesty of God by envisioning his creation as imperfect, whereas the Leibnizian God created from the beginning the most perfect design that develops according to determined laws of nature. In other words, while Newton's God has to intervene to keep the design of the world on track,

⁹ I owe these insights and the discussion in the following paragraph to Michael Ben-Chaim.

¹⁰ Isaac Newton, *The Principia: translated by Andrew Motte*, (New York, 1995), p. 3. Hereafter cited as *Principia*.

¹¹ Newton, *Principia*, p. 3.

¹² Leibniz's first reply, Loemker, Leroy E. (ed.), *G.W. Leibniz: Philosophical Papers and Letters* (Dordrecht, 1989), pp. 675-6.



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