

Newton and the Origin of Civilization, Jed Z. Buchwald and Mordechai Feingold. Princeton and Oxford: Princeton University Press, 2013. 544 pages.

The introduction of Newton's "Short Chronicle from the memory of the first things in Europe" concludes as follows:

I do not however pretend exactness which excludes all possibility of my being mistaken: There may be some errors of 5 or 10 years, and sometimes of 20; but I think none of a larger Extent.

This statement is remarkable due to both its author and its subject matter. Newton's chronology places events from Greek, Persian, Jewish, and Assyrian mythology and history on a timeline extending from the origins of civilization – placed at 1125 B.C.E. – to Alexander's conquests. This shortened the history of civilization by five to six centuries compared to rival chronologies, and the evidential reasoning supporting Newton's radical proposal was as strikingly idiosyncratic as the timeline itself. The "Short Chronicle" provoked rancorous debate following the publication of an unauthorized French translation in 1726, which was sustained by the posthumous appearance of the *Chronology of Ancient Kingdoms Amended* (1728). The controversy drew enough public interest that a publisher was willing to pay handsomely for rights to the book, a decision that was certainly not due to its engrossing prose.

Newton's research in chronology raises a number of questions as pressing now as they were for his contemporaries. How did Newton marshal evidence in favor of his account of the origin of civilization, and how strong was his case? How is the cautious natural philosopher of the *Principia* and the *Opticks* to be reconciled with the confident chronologer? What inspired Newton's efforts in chronology, and how does this work relate to the other inquiries he pursued? Twenty-first century scholars have some advantages compared to Newton's contemporaries in answering these questions. As with his research in other areas, lying behind the concise, sometimes cryptic published texts is a vast body of work. Newton's manuscripts related to chronology (and much else) were suppressed after his death, and it is only within the last 50 years that the full breadth of Newton's work has been opened to careful scrutiny. Yet there are significant challenges to reconstructing Newton's thought. Grafton has aptly called chronology a "lost continent of erudition," making it difficult to chart Newton's course through this intellectual terrain and estimate the altitude of the peaks he scaled. Few modern scholars have sufficient expertise in the various disciplines Newton and other technical chronologers drew on in their work. Manuel's *Isaac Newton, Historian*, for example, sets aside detailed assessment of Newton's astronomical arguments.

It is with these challenges in mind that the magnitude of Buchwald and Feingold's achievement becomes clear. This is, simply put, the definitive account of Newton's chronological research. But it is more than that, as the authors develop novel insights into Newton's methods and worldview based on his chronological research. They have arduously reconstructed Newton's concerns and insights from the manuscript sources, leading to a compelling overall account that integrates chronology with Newton's other pursuits. Furthermore, this is a history of a discipline and not a single scholar. The authors map the lost continent of chronology, characterizing the discipline leading up to Newton's immersion in it and as his own contributions shaped it decades later. This approach makes it possible to see

how and why Newton's views departed from the earlier tradition, and to assess his impact. The controversy incited by Newton's radical view helped to erode the status of chronology as a discipline. After all, many skeptics asked, who could be expected to bring order and certainty where Newton had failed? Later historians largely abandoned the chronologists' project, trusting instead in the emerging disciplines of archaeology and anthropology as the basis for understanding the ancient world.

Buchwald and Feingold's main theme is that Newton employed the same innovative style of evidential reasoning in chronology and natural philosophy. The first two chapters introduce the distinctive ways with evidence Newton developed in his early research, with a focus primarily on optics. Following the demise of scholastic accounts of perception, the connection between a perceiver and the object of perception was treated in mechanical terms. But then the eye, or any other sense organ, would be subject to the same imperfections and errors as mechanical instruments, rendering perception inherently unreliable. Other mechanical philosophers responded to the unreliability of instruments and perception by carefully selecting the "best" result of a measurement or observation, with the choice regarded as a display of skill and judgment. The young Newton was sufficiently intrigued by the effect of mechanical disturbances on perception to squeeze his own eyeball with a bodkin (brass plate) inserted between his eye and the bone. He developed a deep skepticism regarding perceptual judgments, along with a number of truly innovative ways of extracting experimental and observational results despite the unreliability of the senses. Newton was extremely sensitive to sources of error, which he overcame through ingenious experimental design and averaging the results of repeated observations. Newton's sophistication in handling measurement is a familiar theme, and the authors draw in particular on George Smith's recent work regarding Newton's methodology in the *Principia*. This is a rewarding discussion nonetheless, and in particular these two chapters draw a clear contrast between Newton and various contemporaries. But this is simply the first part of the book's argument, introducing Newton's ways of handling evidence in natural philosophy to facilitate comparison with the strikingly similar practices he adopted in his chronological work.

Newton's interest in chronology stemmed from his intense study of Biblical prophecies and the history of religion (discussed in Chapter 4). His manuscripts regarding the books of Daniel and Revelations display great confidence that he had developed an interpretative scheme to extract the true meaning from these obscure texts. Newton's confidence stemmed in large part from his ability to match his interpretations of prophecy with independent historical sources. Newton also held that the history of religion consisted of periodic restorations of true religion, followed by corruption and decline. He identified precedents for atomism and heliocentric cosmology in the original true religion, traced back to the Egyptians and Phoenicians, and nearly included these claims as a defense of his natural philosophy in the *Principia*. During the 1690s Newton worked intensively on establishing the natural philosophy of the true religion, which was to be incorporated into the argument for universal gravity in a thoroughly revised second edition of the *Principia*. The account of the corruption of the true religion depended, like his work on the prophecies, on establishing ties between Scripture and other mythological sources.

As he developed an account of the early history of mankind, Newton recognized various deep problems with the resulting timeline. The authors identify one issue as particularly troubling: Newton's initial history placed a battle involving one army more than a million

strong merely 150 years after the Deluge. This would require Noah's offspring to not only be unbelievably fruitful, but to scatter over the globe as if carried by the wind, with kingdoms developing immediately. As Chapter 5 describes, Newton was not alone in recognizing the demographic challenge of reconciling the Deluge (and other parts of Genesis) with the dispersion of mankind recorded in other ancient histories. This problem was particularly pressing for those, like Newton, who accepted the shorter timeline based on the Hebrew Masoretic text rather than the Septuagint. These challenges led Newton to abandon the views he had developed in the 1680s and focus his efforts on chronology. Like his response to Cartesianism, Newton deemed the existing systematic thought of his contemporaries to be thoroughly flawed and in need of radical reform. He developed new ways of handling evidence, used to address sharply formulated problems regarding the dispersion of mankind and development of early civilizations.

Chapters 6-8 trace the development Newton's mature, innovative chronology. As in his earliest work on the prophecies, Newton attempted to synchronize Scripture with pagan myths from a variety of texts. The authors find in Newton's manuscripts a shift, however, from local synchronization to overall synchronizations between timelines that are internally consistent — e.g., fitting Greek and Assyrian histories spanning several centuries together, rather than simply trying to identify a single battle in both sources. The authors treat this as analogous to other cases in which Newton is able to extract evidence despite the inherent unreliability of individual sources. Furthermore, Newton developed an account of the development of human civilizations, leading inevitably from towns to kingdoms through several distinct stages, with advanced learning and culture appearing only in the final stage. The mature chronology is required to be compatible with the “course of nature” in this sense. Newton also differed from his contemporaries in using an average regnal length in calculating the total duration of a sequence of monarchs.

Newton used astronomical evidence to pinpoint specific events described within the Greek mythic tradition. Chapter 8 laboriously reconstructs the efforts Newton devoted to extracting a precise astronomical description from Hipparchus' *Commentary* (on Aratus' *Phaenomena*), which he could then use to calculate the date when the observations were taken based on precession of the equinoxes. He took Hipparchus to describe the observations made by Chiron (the centaur) in preparation for the Argonaut's expedition. But to utilize this source, Newton had to convert Hipparchus's descriptions in terms of constellations (e.g., a line passing “through the middle of the *great Bear*” and etc.) into precise curves on the celestial sphere. Newton's reading of this passage has been memorialized on a celestial globe in his tomb at Westminster Abbey, which displays the colures he used in this calculation.¹ This calculation was supported by other cases in which Newton found specific astronomical observations described in texts regarding ancient Greece, and he also used astronomical evidence (described briefly in Chapter 13) to constrain dates in Egyptian chronology.

The authors' skill and apparent pleasure in reconstructing Newton's line of thought is particularly evident here. Throughout the book they provide the calculations and arguments underlying claims by Newton and others, frequently noting errors and omissions, or identifying implicit assumptions and context based on manuscripts. The treatment of the astronomical arguments is thorough, including a self-contained (albeit quite challenging)

¹Colures are two great circles on the celestial sphere, one passing through the celestial poles and the solstices and the other through the poles and the equinoctial points.

treatment of the relevant astronomy and spherical trigonometry, and manuscript excerpts with commentary (in appendices).

This detailed reconstruction of Newton's thought and its development is bracketed by chapters regarding the discipline of chronology. Chapter 3 sets the stage with a discussion of the standing of chronology in England leading up to Newton's arrival at Cambridge, and Chapters 9 - 12 describe the convoluted publication history of Newton's work, critical reactions in England and France, and the role of Newton's work in the decline of chronology as a discipline. These chapters recount the unfolding debate blow-by-blow, with capsule summaries of the contributions of seemingly all the participants and descriptions of the unfolding intellectual and political context. Many of the polemics against Newton's *Chronology* reveal more about the ignorance of the author, and the criticisms of the astronomical arguments by the likes of Whiston and Souciet fall short. Yet the calculations ultimately rested on a flawed linguistic foundation; scholars such as Hardouin and Quirini rejected Newton's attempts to extract astronomical information from classical sources. Quirini, for example, argued that Newton attributed to knowledge of practical astronomy to Nausicca (related to the discussion of the Argonauts) based on misreading the word for "ball" as a reference to the celestial sphere. Newton's work ironically convinced many of his contemporaries that, to paraphrase Viscount Bolingbroke, chronology was built atop loose sand rather than firm foundations (quoted on p. 316).

The resulting portrait of Newton *qua* historian is far more nuanced than that provided by Manuel's book, the only comparable scholarly study. Newton the chronologer exhibits an idiosyncratic combination of tradition and innovation, as in his other pursuits. Newton's conviction that laws governed the development of civilizations presaged more theoretical approaches to history. He deployed a variety of innovative techniques for extracting evidence from his sources, such as the use of averages in the computation of regnal lengths. Yet the entire approach was constrained, and compromised, by Newton's reliance on ancient texts as the primary evidential source and acceptance of Biblical chronology.

This is a book of quite ambitious scope, and brevity is not among its virtues. The authors note that the chronologers' devotion to obsessively comparing ancient sources often led to "stupefyingly tedious" prose, which only devoted readers could have any hope of wading through. Thankfully the same cannot be said of their own prose as they map out this lost continent. Yet they too rarely provide a global perspective to orient the reader amidst the onrush of detail, and often the motivation for including particular details is not clear. Many of the scholars involved in the early 18th century debate, for example, do not seem to be among the leading lights of the age, and their inclusion is not explicitly justified based on their perspicacity or influence.

Returning now to the main theme, the authors highlight fascinating parallels in Newton's use of evidence in chronology and natural philosophy. The discussion of these parallels raise a number of questions that the authors do not pursue in detail. It is not clear that the parallels reflect more than a fairly general, even if historically distinctive, approach to handling evidence, with challenges to evidential reasoning reflecting domain specific details. Philosophers of science have drawn inspiration from Newton's methodology in the *Principia* given that the problems Newton faced are (arguably) relevantly similar to the challenges that arise in contemporary physics, and perhaps in other areas of science. Yet it seems quite implausible that the specific challenges Newton faced in his project of mining ancient texts

for chronological evidence will have parallels with contemporary pursuits. Hence the main contribution of a more thorough account of Newton's method in this area is to understand further Newton's distinctive, ingenious ways of minimizing error.

In sum, Buchwald and Feingold have produced a magisterial account of Newton's chronological research. It makes a substantial contribution to our understanding of Newton, and more broadly to the evolution of the forgotten discipline of chronology.