

Anti-Newtonianism in the 18th century: the case of Scotland

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ABSTRACT

This study examines anti-Newtonianism within the context of Scotland in the 18th century, discussing its unique intellectual and cultural nuances. Admittedly Newtonianism and anti-Newtonianism were global phenomena, however this article concentrates on the Scottish context to uncover specific intellectual and cultural dynamics. By focusing on the reactions to Newton's ideas within Scotland, the article aims to reveal the diverse ways Scottish intellectuals engaged with and challenged Newtonian principles.

Introduction

The exploration of anti-Newtonianism, particularly in the Scottish context, offers insights into the intersection of science, philosophy, and theology during the Enlightenment period. While

Newton's ideas were broadly accepted across Europe, Scotland's unique intellectual and religious landscape fostered particular critiques. This article highlights the responses of key Scottish figures to Newtonian concepts, examining both scientific and theological objections. This study employs a historical-analytical approach to examine the unique Scottish responses to Newtonianism in the eighteenth century, with a focus on scientific and religious critiques. By analyzing primary texts from key Scottish figures, the paper situates anti-Newtonianism within Scotland's specific intellectual and cultural framework, addressing how local religious and philosophical traditions influenced these critiques.

To contextualize Scottish anti-Newtonianism, the study draws on comparative analysis. It contrasts Scottish responses with broader British and European reactions to Newtonianism, thereby identifying elements unique to Scotland. This comparison highlights the ways Scottish critics interpreted Newtonian concepts like gravity, void, and active matter through a lens influenced by local theological and philosophical values.

Newtonianism as a historical debate

The philosophical debate about the nature of Newtonianism is multidimensional. At the same time, in the period from the 1690s to the 1730s, when Newtonianism established itself as a full-fledged ideology or set of ideas in the scientific world, this way of thinking was the target of harsh criticism on British soil. As Snobelen (2004) rightly argues, the nature of Newton's own heterodoxy was not adequately studied until the 1980s. In the last three decades, much work has been published on the relationship between Newton's heterodox views and his understanding of science (Mandelbrote, 2004; Stewart, 2004).

Both scientists and theologians had difficulty accepting Newtonian concepts such as vacuum, remote interaction, gravity and active matter (Byrne MV, 1998; *Alternative Cosmologies in Early Eighteenth-Century England*. Unpublished Ph.D. dissertation, University of London). All this shook the traditionally accepted theory of mechanics. Many eighteenth-century thinkers found Newtonianism problematic, in particular because the Newtonian theory of the vacuum endowed matter with the ability to act on other matter in space.

Religious and scientific circles expressed a general reaction, both in terms of traditional Aristotelian mechanics and in terms

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of the religious implications of attributing to matter some kind of will and the ability to act independently, or spirit: according to this reaction, there was no remote interaction in the universe and to assume that matter was active would lead us to pantheism. Different versions of anti-Newtonianism emerged with various efforts to fill Newton's void with fluid elements; the 'fluid element' allowed for traditional mechanical motion and the principle that matter is passive and soulless. As Cantor (1983) notes, most of the circles of such thinking were fluid theorists, who focused on the relationships between light, heat, fire and fluids. Light was of particular importance to fluid theorists. Neo-Platonic and Hermetic writers of the Renaissance and the 17th century often spoke of light as a substance that emanated from God and spread throughout the universe (Cantor, 1983).

Approaches and reactions to Newtonianism came from both scientific and religious circles. Newtonian scientists such as John Woodward, William Whiston, Samuel Clarke and, of course, Newton himself were subjected to criticism from religious circles because their cosmology was incompatible with the biblical conception of the universe, and from scientific circles because they did not explain all natural phenomena with reference to fluids, air and/or void (Mandelbrot, 2002). From a purely theological point of view, the following claim has been made: in attempting to distinguish which writings were inspired and which were not, Newton "ventured into the dangerous waters of biblical criticism" (Manuel, 1963).

This makes it imperative for historians of the eighteenth century to consider not only Newton's cosmology but also the known religious implications associated with it. Margaret Jacob (2004) has pointed out that Newton's religious beliefs and his interest in theology should be treated as important building blocks of his scientific thought, which is illuminating in terms of the direction that research on Newton is taking today. With this in mind, the definition of Newtonianism here should include his advocacy of the New Science and Locke's theory of knowledge, as well as his reputation for rejecting certain dogmatic elements in religious matters. It is often difficult to clearly distinguish between religion and science, especially in the New Age; the historical prediction is that one's personal stance on religion determines one's views on science.

The main purpose of this article is to draw attention to the various reactions and approaches to Newtonianism from Scotland in the 18th century. Scotland is a good example to explain the various philosophical, scientific and religious reactions to Newton in the eighteenth century. Before moving on to the debates on this subject, I would like to touch a little bit on the historical background. It has often been said that all anti-Newtonians were conservatives. The debate about this has focused on the fact that Newtonian science succeeded in the 'triumph' of the Whig Constitution, so anti-Newtonians must also be anti-Whig. Emphasizing the relationship between the dynamics of the Revolution and the philosophical origins of modern science, Margaret Jacob argued that Anglican science, by which she meant religiously oriented science "could not overcome the radicalism of the English Revolution" (Jacob and Jacob, 1980; Jacob, 1981).

The Scottish context for anti-Newtonianism

Scotland presents a distinct case for studying anti-Newtonianism due to its intellectual environment, which blended scientific curiosity with theological conservatism. Prominent Scottish figures, such as Duncan Forbes, John Arbuthnot, and Henry

Home, expressed skepticism towards Newtonianism. These figures can be grouped based on whether their critiques stemmed primarily from scientific or religious concerns. The individuals we will consider here were not alone on Scottish soil in their opposition to Newtonianism and other possible heterodox speculations. Some of them were at the center of the intellectual agenda of eighteenth-century Scotland even apart from their previously ignored anti-Newtonian views. Scots skeptical of Newtonianism, such as Duncan Forbes of Culloden, John Arbuthnot, Henry Home, George Martine, Andrew Wilson, James Burnett and John Clerk of Penicuik, can be classified into two groups: those who questioned the validity of natural philosophy in general, and Newtonianism in particular, on scientific or religious grounds, and those who, while they supported work in natural philosophy, felt that Newtonianism contributed little either scientifically or religiously; both groups were influenced by different versions of anti-Newtonianism.

Duncan Forbes (1685-1747), a judge, was one of the founding members of the Philosophical Society, the first scientific society established in Edinburgh. Known for his anti-Newtonianism, Forbes published three works reflecting these views (Forbes, 1732, 1735, 1750). While it is true that he did not take kindly to Newtonian conceptions of the universe or religion, anti-Newtonianism was not Forbes' primary aim. In the minds of many thinkers, Newtonianism was a form of heterodoxy. Duncan Forbes thought that the same arguments that criticized all forms of deism could be made for Newtonianism. Forbes' criticism of the system known as Newtonianism targeted not Newton himself, but the consequences of this system and the philosophy that Newton's followers had formed. According to Forbes, this idea also contradicted the idea that the universe was truly mechanistic, since if the creator and the created were to be kept separate, there should be no intervention in the processes at work in the universe. Another problematic point, according to Forbes, was the qualities that Newton attributed to matter. According to Forbes, occult qualities were Newton's invention, such that in a rational universe it would be impossible to know the causes of such things. Forbes also found Newtonian void theory problematic and advocated fluid theory. The atmosphere, or as Forbes called it, the firmament, was a 'thin fluid' and Forbes claimed that this had been the case since the creation of the universe and in the forms of fire, light and air (Forbes, 1755). In another work, Forbes cites examples of air-pump experiments and states that these studies revealed various properties of air: 'The intelligence of the being is so admirable, that by its astonishing mechanism the fluid is tempered and adapted to support both the animal and vegetable kingdoms' (Forbes, 1750).

When we examine the anti-Newtonian arguments of the early eighteenth century, we see that Newtonianism received support from different political spectrums and criticism from different political circles (Guerrini, 1986; Friesen, 2003). Forbes of Culloden, a Presbyterian, played an important role in spreading anti-Newtonian views among his fellow Scots.

John Arbuthnot (1667-1735), a member of Duncan Forbes' circle, also had an ambivalent relationship with Newtonianism. As early as 1697, Arbuthnot, Queen Anne's physician, had argued against John Woodward, a professor of physics and a member of the Royal Society, who was an avowed Newtonian (Woodward, 1695; Woodward, 1729; Levine, 1977). The study of geology and the growing tide of skepticism were thought to have endangered religious narratives on the subject (Frei, 1974). A popular text in this context was the story of the Great Flood, but extra-biblical evidence from geological studies was problematic for the Church

(Young, 1987; Young, 1995). For non-Newtonian thinkers - including Arbuthnot (Catcott, 1761) - proving that the Flood had taken place was of fundamental importance. Another criticism was that Newtonianism had become increasingly scientifically dogmatic and deterministic in its view of the universe. Arbuthnot says: 'The compilers of theories should have more respect for the Revelation of Moses, which is superior in authority as well as in wisdom to all the explanations of philosophers' (Beattie, 1935; Olson, 1983; Shuttleton, 1985; Shoesmith, 1987). Newtonianism and the scientific attitude it brought was interpreted by Arbuthnot as blasphemy.

An example of a scientific criticism of this issue comes from Arbuthnot. At the beginning of his article on the effect of air on the human body, Arbuthnot provides a definition of air: 'Air is a thin fluid that envelops the Earth in which we move and breathe' (Arbuthnot, 1733). This void-fluid debate was at the center of the dispute between Newtonians and their opponents in the eighteenth century. Especially medical people who had problems in digesting some Newtonian concepts such as void expressed their reactions on this issue.

After studying medicine at the University of Edinburgh, Andrew Wilson (1718-1792), who received his master's degree as a doctor in 1749 with his thesis 'De Luce', worked in the field of philosophy as well as medicine. Wilson is a good example of natural philosophers who strongly opposed Newton. It was not unusual for medical practitioners in particular to have doubts about the Newtonian system, which claimed to explain the entire natural universe. There are many well-known examples of this in Europe, such as Stahl. Andrew Wilson received his license from the Royal College of Physicians in Edinburgh on August 7, 1764. Wilson participated in the debates on the Newtonian theory of the void and criticized the Newtonians for not abandoning this theory. Although Newton himself, in the light of the criticisms he faced, began to lean towards the theory of the ether filling the vacuum, Wilson opposed this theory as well: 'Is there or is there not a vacuum? If there is, let them present their proofs, or refute the proofs we shall put forward for the plenum' (Wilson, 1754). For anti-Newtonians, the Newtonian active matter moving non-mechanically in a vacuum unacceptably undermined traditional mechanics, and the active force was thought to have pantheistic implications because it was incorporeal and occult. For Wilson, the question of occult forces was part of a problem at the very center of Newtonian cosmology. In the first edition of the Principles of Philosophy, Wilson states: philosophers have failed or been incomplete in finding the natural and mechanical principles and causes of motion in concrete matter. Since locomotion is visible only in material elements, it can, in my opinion, only be brought about by material principles (Wilson, 1748). Wilson was unhappy with Newton's idea that God intervened in the course of natural events and argued that God must have created a perfect mechanism that could function on its own. This may not seem to contradict Newtonianism, but Newton and his followers sometimes attributed unexplained natural phenomena to occult forces in order to protect themselves from backlash, which, according to anti-Newtonians, contradicted the idea of a fully mechanistic universe (Wilson, 1764). Wilson also claimed that all natural phenomena, including the law of gravity, had to be explained purely mechanistically, and that atoms had no inertial power either to keep moving or to resist the action of another subject.

The Scottish physician (young) George Martine (1702-1741), after receiving his first medical education from Alexander Monro, became a student of Herman Boerhaave at Leyden University (McConnell, 2004). Known as an empiricist in medical circles,

Martine wrote an anti-Newtonian essay in 1740 when he was elected an honorary member of the Royal Academy of Edinburgh (Martine, 1740). Martine begins his argument with the premise that humans are sensory beings who believe in what they see, and that at first glance air is perceived as a void or empty space. The atmosphere, as Martine defined it, was both the air that people breathed in and inhaled and 'the space beyond the air', a claim that Martine attributed to Newtonianism.

Martine himself was a follower of the fluid theory influenced by the Dutch chemist Herman Boerhaave, which was fundamentally opposed to the Newtonian principle of vacuum theory: "We recklessly thought that the air that surrounds us was a vacuum, whereas now we realize that it is a material fluid" (Martine, 1740). It is also noteworthy that Martine was an active member of the Edinburgh Philosophical Society at the time of his publication, which was predominantly dominated by Newtonians (Tarbuck, 2021). Another member who also served as president of this society was the politician and antiquarian John Clerk of Penicuik (1676-1755). John Clerk, like Forbes, studied law at Leyden and, during his three years in the Netherlands, befriended Herman Boerhaave, an influential exponent of anti-Newtonian fluid mechanics. According to Cantor (1983), fluid theorists claimed that light was 'a substance' composed of "tiny particles of matter, usually emitted at high speed from a bright source". The crux of fluid theory was an 'etheric fluid', and fluid theorists focused on the relationship between light and other fluids, notably heat and fire (Cantor, 1983). In a letter to Forbes, Clerk said that waging war on the deists was a worthwhile endeavor (Warrand, 1735). Clerk was highly critical of Newtonian science: "modern mathematicians attribute much to the power of gravitation, but little to the power of the omnipotent God".

Often seen as a central figure in the Scottish Enlightenment, Henry Home, Lord Kames (1696-1782), a judge and writer as well as a member of the Edinburgh Philosophical Society, made his concerns about Newtonian cosmology explicit in his writings. In his biography of Kames, Ian Simpson Ross said that he represented "thinkers who had to find ways of dealing with the processes of modernization and secularization that were undermining the traditional religious orientation of their societies" (Ross, 1972). This view is an attempt to concretize these processes and to bring their philosophical debates in the eighteenth century to the agenda, which constitutes one of the aims of this article.

In the third volume of the Acts of the Philosophical Society of Edinburgh, published between 1754 and 1771 under the title «Essays and Observations, Physical and Literary», there is a three-page article by Lord Kames on 'Evaporation'. In this article, Kames examines the circulation of moisture and its possible causes, arguing that Newtonian theories based on the motion of gravity, such as Halley's bubble theory, are not valid. Kames' anti-Newtonian arguments overlapped with examples from outside the UK, such as the work of scientists at the French Academy who challenged the concept of gravity. In addition, in the first volume of the Activities, Kames published a 90-page critique of Newtonian physics, On the Laws of Motion, in which he questioned the validity of the concepts of gravity, remote interaction and vacuum (Home, 1771). In the first sentences of his essay, Henry Home clearly expresses his dissatisfaction with the mathematical systematization that was so fashionable at the time; according to Home, the longing for all-governing systems such as Newtonianism goes beyond the view of experimental method (Home, 1771). Theory becomes a source of error if we become too familiar with it, or if we become attached to it beyond what the facts and experiments can justify. In short, theory unsupported by experiments

is hollow, and experiments are best understood only when they are applied to theory (Home, 1771). Kames clearly saw the Philosophical Society as a platform for debating the assumed authority of empirical natural science (Home, 1771). Kames insisted that “natural philosophy... lacks the maturity necessary to be a sound and enduring theory” (Home, 1771). Kames criticized natural philosophy for its emphasis on theory rather than fact. Kames also challenged Newton’s claim that matter was active. Kames represents a strand of Scottish thinkers who were uncomfortable with the relentless theorizing that sought to develop a ‘theory of everything’ - which he himself found unconvincing and impulsive.

James Burnett, Lord Monboddo (1714-1799), a Scottish judge, also wrote a critique of the Newtonian system. The first volume of his *Metaphysics in Antiquity*, published in 1799, included a *Treatise on the Principles of Newtonian Philosophy*, which criticized the Newtonian system at length. Lord Monboddo claimed that Newton’s philosophical system posed ‘a danger to the true theistic system’. Theism as Monboddo perceived it was a system based on revealed religion and seeing God as an ever-active being in the world. Monboddo’s framework was explicitly theological and in no way compromising when it came to the defense of revealed religion, and he interpreted Newtonian philosophy as deistic: “when I examined some of their works, I was astonished to find that these authors and Isaac Newton conceived of the motion of the planets from light or ether, spirit or air, as a machine in the heavens; the only thing they attributed to God was that He set the machine in motion first” (Burnett, 1799).

Conclusions

This study demonstrates that eighteenth-century Scottish anti-Newtonianism was rooted in both scientific skepticism and religious conservatism, highlighting a complex interplay between intellectual inquiry and theological commitment within Scotland’s unique cultural and intellectual landscape. Unlike other regions where Newtonianism gained broader acceptance, Scotland’s distinct religious and philosophical traditions fostered critiques that set its response apart from wider European reactions.

The perspectives of Scottish thinkers such as Duncan Forbes, John Arbuthnot, and Henry Home illustrate how local intellectual traditions shaped attitudes toward Newtonian science. These figures did not merely oppose Newton’s theories on scientific grounds; they saw Newtonianism as a challenge to theological doctrines, fearing that it led toward pantheism or determinism, in conflict with their religious beliefs.

By examining these critiques within a comparative framework, this paper reveals that Scottish anti-Newtonianism reflected a nuanced engagement with new scientific ideas rather than a straightforward rejection. The Scottish approach underscores the importance of considering regional variations in responses to Newtonianism, as well as the ways local traditions mediated these responses. Ultimately, the Scottish case invites a reassessment of anti-Newtonianism as a phenomenon that blended scientific skepticism with deeply rooted cultural and religious values.

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