Ructions over Fluxions: Maclaurin's Draft, *The Analyst* Controversy and Berkeley's Anti-Mathematical Philosophy

Following the publication of Berkeley's caustic critique of calculus, *The Analyst* (1734), numerous figures in the scientific world responded to the text's allegations of rigour violations and a culture of mathematics-laced heresy. Maclaurin's *Treatise on Fluxions* (1742) shaped the reception of Berkeley's mathematical views. The published version of the *Treatise* focused on securing the foundations of Newton's fluxions against Berkeley's claims that they were unrigorous. However, an earlier draft has a different, ideological focus, and engaging with this text sheds new light on both Maclaurin and Berkeley. I will argue that Maclaurin was concerned with much more than simply mathematical foundations and rigour and that his initial response helps us to understand Berkeley's hostilities to mathematics in their proper context. The ultimate aim of this paper is to demonstrate that what was at stake were issues of mathematical rhetoric and reputation, and questions about the morality of mathematicians in an emerging culture of mathematical authority.

1. Introduction

Berkeley is usually understood as having earned his place in the history of mathematics as a petulant critic of the logic underlying calculus and as an early and vociferous proponent of mathematical finitism. Maclaurin's *Treatise on Fluxions* (1742)[1] represented a long-awaited response to Berkeley's criticism on behalf of all admirers of Newtonian calculus. His singular focus on rigour issues supports a reading of *The Analyst* as primarily mathematical criticism. Interestingly, an earlier draft of the

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[1] Hereafter "*Treatise*".

Treatise focuses on ideological aspects of Berkeley's work that did not survive in the published version, likely because Maclaurin sought to minimise attention to these fraught issues in his new presentation of Newton's mathematics. Close attention to this draft reveals that, for Maclaurin, *The Analyst* was concerned with much more than foundations and rigour. Further, though *The Analyst* restricts its focus to issues in calculus, Maclaurin's response shows that he regarded mathematical practice in general to be under fire. The aim of this paper is to demonstrate that what was at stake to the main parties in the Analyst Controversy[2] were issues of mathematical rhetoric and reputation, and questions about the morality of mathematicians in an emerging culture of mathematical authority. The typical historical reading has seen Berkeley's metaphysical and mathematical criticism of infinitesimals as the fundamental project of *The Analyst*. This paper argues that ideological issues were paramount, and that Maclaurin's responses to Berkeley's commentary on mathematical infidelity and his explicit connection of *The Analyst* to *Alciphron* (Berkeley's main work of apologetics) demonstrate that the contemporary understanding of the nature of the debate was much more nuanced than the history has acknowledged. Maclaurin clearly understood that Berkeley's main objective was not merely to offer a corrective to calculus methodology.

Section 2 of this paper provides the relevant background on Maclaurin and *The Analyst*. In Section 3, I introduce and explain Maclaurin's *Treatise* draft and use additional material from his correspondence to demonstrate Maclaurin's extensive engagement with Berkeley's thought. In Section 4, I give an account of Berkeley's anti-mathematical anxieties grounded in his worries about (4.1) the over-zealous application of mathematics to non-mathematical disciplines, and (4.2) increasing devotion to mathematical authority. I also discuss Berkeley's association of mathematics with secularism and his worries about the reputation and perceived neutrality of mathematics in light of similar presentations in popular treatments of religion today. Section 5 is the conclusion.

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[2] I follow Wisdom (1942) in referring to the publication of *The Analyst* and the responses from Newtonians and mathematicians of later eras as the "Analyst Controversy".

2. Background

Berkeley published *The Analyst* in 1734.[3] It contains a critique of the foundations of calculus—infinitesimal and fluxionary, whose distinguishing features are collapsed—on two grounds. One ground is metaphysical and the other is rooted in concerns we would now ascribe to mathematical logic.[4] The text also has a crucial theological agenda. Berkeley presents the rigour issues of calculus within the comparative framework provided by contemporary critiques of Christian theology. By revealing structural similarities between the logical issues in calculus and criticisms made against theological rigour, Berkeley sought to demonstrate hypocrisy in those who revered the supreme rationality of mathematics while denigrating theology and its allegedly looser logic.[5] Berkeley was certainly a vociferous pundit, but he was not alone in criticising early calculus. Criticisms of Leibniz's calculus appear in work (predating Berkeley's) by Bernard Nieuwentyt, Dethleff Clüver and Michel Rolle.[6] There are important differences between Leibnizian calculus and Newtonian fluxions that Berkeley disregards; in *The Analyst*, both theories must bottom out in some metaphysically and logically dubious entity. Berkeley's refusal to acknowledge any steadier ground beneath the fluxionists' feet means that *The Analyst* presents both theories as though they are vulnerable to the same objections, even where the arguments might make more sense against an (explicitly) infinitesimal calculus. Equally, Leibniz's metaphysical system is subtler than Berkeley allows.[7]

The Analyst provoked responses from numerous Newtonians in subsequent years. The most substantial—Maclaurin's (published) *Treatise*—contributes to a traditional understanding of Berkeley's text according to which (i) Berkeley's primary target is calculus methodology, (ii) the

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[3] With two exceptions, citations to Berkeley's works are from *The Works of George Berkeley Bishop of Cloyne* (1948-1957). In-text citations give title (sometimes shortened), year and page number in the relevant volume. Berkeley's two mathematical treatises from 1707 are not translated in the Luce-Jessop edition of Berkeley's works, so citations to those texts give title and page number in volume 2 of Wright's edition. The synoptic contents which precede *The Analyst* are also absent from the Luce-Jessop, so references are to Jesseph's edition. (Berkeley 1992).

[4] For Berkeley's mathematical arguments, see Jesseph (1993, 178–231) and Sherry (1987).

[5] For the religious elements of *The Analyst,* see Reid (2002) and Cantor (1984).

[6] See Mancosu (1996, p. 117). Berkeley had read Nieuwentyt and refers to him in 'Of Infinites' (1707), *The Principles of Human Knowledge* (1710), and *Siris* (1744).

[7] See Katz, et al. (2021) for ontological options available in interpreting Leibniz's fictions.

religious elements are of minor importance to its interpretation, and (iii) *The Analyst* is simply another manifestation of Berkeley's empiricist concerns about the infinite. Jasper Reid frames this nicely:

> Some of these accounts have, in passing, mentioned the fact that Berkeley's declared motive in writing the book was a theological one, but they have then swiftly shifted away from theology to examine the mathematics in isolation from it. G. J. Warnock, for instance, dismisses Berkeley's 'ostensible' motive in writing the book as being 'hardly a serious point'.[8] It is true, of course, that the theological issue which concerned Berkeley—the intelligibility of Christian mysteries—tends not to animate many philosophers any more, and mathematicians still less so, which is why there is a tendency for many commentators on *The Analyst* to place this issue on a high shelf, with a little embarrassment, so that they can then get to work more seriously on the 'real' message and the 'important' achievements of that book. (Reid 2002, 1)

My aim is to show how Maclaurin's draft introduction to the *Treatise* supports a reading of *The Analyst* as a work of anti-mathematical rhetoric in a specific theological context. Though the domain of *The Analyst* is calculus, the scope of its rhetorical conclusions is much broader, having consequences for mathematical reputation generally and raising questions about the morality of mathematicians in an emerging culture of mathematical authority.[9] For Berkeley, the important arguments of *The Analyst* are: (i) that mathematicians (and those who revere mathematics) are inconsistent on matters of rigour, on the one hand deriding the use of mysteries in religion and on the other ignoring its presence in recent mathematics; and (ii) that the authority of mathematics is increasingly being held up as a rival against religious authority and plays a role in infidelity. Arguing that the logical rigour of calculus is insecure and requires faith is a means to the above ends.

Colin Maclaurin has a unique position in debates about *The Analyst*. His engagement with Berkeley's philosophy was considerable. Evidence suggests he had read most of Berkeley's published work, probably initially as a member of the Rankenian club.[10] Surveying Maclaurin's references to Berkeley in his *Account of Sir Isaac Newton's Philosophical Discoveries* (hereafter "*Account*"), Stewart summarises things as follows:

> Maclaurin criticizes Berkeley's semantic theory of ideas (…), his view of the relativity of what is perceived to the perceiver (…), his argument from *minima sensibilia* to the impossibility of infinite division (…), and his denial of absolute motion (…). There is no real

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[8] Warnock (1953, 212).

[9] For discussion of anti-mathematicism in 18th century philosophy, see Schliesser (2017), (2011) and Demeter and Schliesser (2018).

[10] See Stewart (M. A. Stewart 1985, 38–39).

grasp of the serious questions Berkeley posed for the uncritical dualism which Maclaurin and his contemporaries complacently took over from Locke and Newton and which they fallaciously equated with a robust sense of reality, and a total failure to appreciate the distinction between a particular scientific cosmology and the metaphysics of science, between Newtonian theory and the ontological interpretation of the theory. (M. A. Stewart, 1985, p. 38)

Schliesser (2018) regards Maclaurin's criticism of Berkeley's idealism and theory of vision (in the *Account)* as emblematic of 'The Mathematical-Experimental Method' of post-Newtonian empirical enquiry:

Maclaurin's core methodology commitment is not hard to discern: he claims that not just in astronomy but "in natural philosophy" generally "truth is to be discovered by experiment and observation, with the aid of geometry, only" (…) [I]t is "by the principles of geometry and mechanics" that one performs a so-called "analysis from the phenomena to the powers and causes that produce them." (Schliesser, 2018, p. 19)

Maclaurin's correspondence reveals that many in the mathematical world and beyond (James Stirling, Robert Simson, Francis Hutcheson and Alexander Cuming) looked to him to respond to Berkeley and cheered him on in the undertaking (see Section 3). Given this position and his independent interest in Berkeley's thought, it is natural to believe Maclaurin was particularly strongly motivated to understand the nature of Berkeley's criticisms in their proper context. He was also unusually sensitive to considerations bridging the worlds of mathematics and theology. Speaking about the dissertation (*De Gravitate, aliisque viribus Naturalibus*) Maclaurin defended at age 15, Sageng argued that it was illustrative of "the way in which Maclaurin's ideas about the role of mathematics in religion and natural philosophy developed at the very beginning of his career" and "shows that Maclaurin was not only familiar with Newton's [*Principia*], but was able to apply his arguments forcefully in service to natural religion." (Sageng, 1989, p. 8)

Finally, Maclaurin initially intended to write a public response to *The Analyst* and reconsidered, preferring the 750-page scholarly effort encapsulated in the *Treatise.* However, as this paper shows, he drafted much of that initial response and it appears that he had intended to use it as a more ideological introduction to an as-yet unwritten text on fluxions.[11] As "Newton's most successful follower" (Grabiner, 2004, p. 841) his interpretation of Berkeley's motivations in the draft are illuminating,

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[11] On the draft's penultimate page, a paragraph opens 'In the following treatise (…)'. See Maclaurin (1982, 434).

shedding new philosophical light on the contemporary reception of Berkeley's mathematical incursions.[12]

3. The Draft and Correspondences

The introduction to Maclaurin's published *Treatise* tells us that the project was provoked by *The Analyst* and Maclaurin's shock that someone of Berkeley's learning could not appreciate Newton's achievement:

> A letter published in the year 1734, under the title of *The Analyst,* first gave occasion to the ensuing Treatise; and several reasons concurred to induce me to write on this Subject at so great a length. The Author of that Piece had represented the Method of Fluxions as founded on false Reasoning, and full of Mysteries. His Objections seemed to have been occasioned, in a great measure, by the concise manner in which the Elements of this Method have been usually described; and their having been so much misunderstood by a person of his abilities, appeared to me a sufficient proof that a fuller Account of the Grounds of them was requisite. (Maclaurin, 1742, p. xii)

Maclaurin delivered on his promise of a fulsome response and the *Treatise* was published in 1742. In November of 1734 (the year *The Analyst* was published) he wrote to mathematician James Stirling about his early reaction to it:

> Upon more consideration I did not think it best to write an Answer to Dean Berkeley but to write a treatise of fluxions which might answer the purpose and be useful to my scholars. (Maclaurin, 1982, p. 250)

Robert Simson, among others, encouraged Maclaurin in the project, replying 'I much want to see the first wherein yow take off the B-p of Cloynes objections (…)'. (Maclaurin, 1982, p. 255) Simson is of interest to this discussion because his mathematical brilliance and easy character are taken as exemplary of the mathematician in Adam Smith's discussion of the different dependencies of various branches of learning on public approval and the consequences for practitioners' sensibilities. Unlike poets, whose conceptions of themselves and their work are often tormented by negative coverage or neglect, mathematicians "may have the most perfect assurance, both of the truth and of the importance of their discoveries." (Smith, 1759, p. 181) For Smith, Simson is a kind of mathematical paragon.

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[12] This text is wholly absent from the philosophical literature; the only previous references to the document are brief treatments in the PhD dissertations of Erik Lars Sageng (1989) and Bruneau (2005).

They are almost always men of the most amiable simplicity of manners, who live in good harmony with one another, are the friends of one another's reputation, enter into no intrigue in order to secure the public applause, but are pleased when their works are approved of, without being either much vexed or very angry when they are neglected. (Smith, 1759, p. 182)[13]

Berkeley's recognition of this attitude toward mathematicians and the apparent calm truth of their ideas is a central motivating force in *The Analyst*.[14]

Though the *Treatise of Fluxions* is initially conceived of as a brief undertaking, it took Maclaurin eight years to finish, and was eagerly awaited by Royal Society members and those offended by the disdain Berkeley had shown towards mathematics in *The Analyst*. Francis Hutcheson, whose desire for a moral calculus was a natural target for Berkeley's anti-speculative agenda in *Alciphron* (1732), also wrote to Maclaurin encouraging him to hurry up for the following colourful reasons:

I have constant accounts of the Impatience of our Virtuosi in Dublin about your Fluxions. Your Friends are angry at the Delay & Bp Berkeleys are triumphing already. If he should have some silly answer ready before yours be well published, I think you deserve it for your excessive complaisance to a man bursting almost with vanity long ago. (Maclaurin, 1982, p. 274)[15]

The Hutcheson letter and others suggest that Maclaurin had become a point of contact for those interested in defending Newtonian fluxions.[16]

Even after the *Treatise*, Maclaurin received strange correspondence identifying him as a target for those sympathetic to Berkeley's case. One such letter came in a scrawling hand from Sir Alex Cuming in 1744, while he was reportedly 'confined within the limits of Fleet Prison for bankruptcy charges'. (Godwin, 1919) It reads: 'The following Problem is proposed to all the Writers on Fluxion's [sic] who have engaged on either side of the debate since the publication of the Analyst, in order to determine whether he or they are in the right?'. (Maclaurin, 1982, p. 412) Cuming even cautioned Maclaurin over the independence of his response 'No first rate mathematician is not (*sic*) to advise with any other about

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[13] See Tweddle (1998) for an account of Maclaurin as a "prickly genius" that challenges this stereotype.
[14] This idea also motivates Berkeley's appeal in *Siris* for readers not to give the philosophical opinions of mathematicians more credit that they are due, since, in contrast with the reputation Smith alludes to, according to Berkeley they are "like other men, […] misled by prejudice" and they "embrace obscure notions and uncertain opinions, and are puzzled about them, contradicting each other". (Siris, 1744, 119 & 127)
[15] I am grateful to Roderick Gow whose discussion of this quotation first directed me to these correspondences.
[16] John Conduitt (Royal Society fellow and husband of Newton's niece) also wrote Maclaurin in 1734 to say 'The Analyst has been met with universal contempt, I am glad you have undertaken him'. (Maclaurin 1982, 58)

the Answer he is to give; but every man is to give his own solution'. (Maclaurin, 1982, p. 412) He demanded Maclaurin's answers be returned by first post to Slaughter's Coffee House in London.

The framing suggested by Maclaurin's published *Treatise* points to a traditional reading of *The Analyst*—whereby Berkeley was frustrated by a mathematical development that seemed to him to include definitional equivocations and logical deficiencies. On this reading, Berkeley criticised calculus in order to improve it and to put it on the same logical footing as classical mathematics. That would explain a response where the only recourse offered is a detailed account of the proper foundations and methodology of fluxions. And yet, Maclaurin's draft reveals a considerably different intention—one that clearly supports an understanding of *The Analyst* as an attack on mathematical reputation, the morality of mathematicians, the quality of contemporary mathematical proof and the mathematical direction inherent in much Newtonian natural philosophy. It reveals that Maclaurin read *The Analyst* as about much more than simply rigour and foundations. This initial reaction displays consternation at the ideological content of *The Analyst* and Maclaurin reacts via a presentation of evidence against what he clearly understood as an association of mathematics and infidelity. In Mills' *Collected Letters of Colin Maclaurin,* a letter in the final section 'Scientific Letters – Undated' to a 'recipient not stated' is obviously Maclaurin's attempt at a public response:

> *The Analyst* appeared in 1734 and MacLaurin's first reaction was to write to Berkeley (…); but, on reflection, he changed his mind and wrote the *Treatise of Fluxions* instead. This MS. may be a draft of MacLaurin's proposed reply to Berkeley which would date this MS/ late in 1734 or early 1735. (Maclaurin, 1982, p. 425)

The scope of the present undertaking forbids discussion of the purely formal elements of Maclaurin's draft. Happily, the same ground is covered in the scholarship on Maclaurin's *Treatise* and *Account of Sir Isaac Newton's Philosophical Discoveries*.[17] Bruneau also gives a summary of the mathematical sections. (2005, pp. 273–278) The following precis is merely to give a sense of the distribution of the draft's content. The mathematical content is primarily a promissory note on the viability of Book One of the *Treatise*. He contends that any imprecision in the foundations can be avoided by showing that Newton's methods can be translated into 'Demonstrations of the Ancients' (as instances of *reductio ad*

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[17] For what Grabiner terms 'the standard picture', see Boyer (1959), Cajori (1917), and Kline, (1972). For a modification, see Grabiner (1997). See also Schliesser (2018) for a characterization of Maclaurin's philosophical tendencies.

absurdum) and works a few examples. (Maclaurin, 1982, pp. 428–431). He notes that Newton 'tells expressly that it was to shun the tedious demonstrations of this kind after the manner of the Ancients' that made him present things as he did and that Berkeley's worries over last proportions of increments are addressed in §1 of the Scholium to Newton's *Mathematical Principles of Natural Philosophy,* from which Maclaurin quotes over 17 lines of text. (Maclaurin, 1982, pp. 428–429).

Maclaurin's draft text is just over ten pages long and incomplete. It opens as follows:

Sir,

As you know me to be a sincere wellwisher to Religion and that at the same time the Mathematicks are my favourite and particular Study, you will easily believe that I must consider the Analyst as a performance of a very extraordinary nature. What this writer advances against the foundations of the methods of Fluxions serves only to shew that he has not considered or understood what its great Author said in their defence when he first published them;[18] for if he had, he would have found the most material of his objections prevented & answered there. But it must appear very surprising to see him represent Mathematicians as generally Enemies to Religion & abusing the Authority they may have acquired by their Mathematical knowledge, by misleading unwary persons in the greatest moment. (Maclaurin, 1982, p. 425)

The remarks about mathematicians misleading unwary persons respond to the opening sentence of *The Analyst* which is addressed to an infidel mathematician and, according to Berkeley, the many more like him:

Though I am a Stranger to your Person, yet I am not, Sir, a Stranger to the Reputation you have acquired, in that branch of Learning which hath been your peculiar Study; nor to the Authority that you therefore assume in things foreign to your Profession, nor to the Abuse that you, and too many more of the like Character, are known to make of such undue Authority, to the misleading of unwary Persons in matters of the highest Concernment, and whereof your mathematical Knowledge can by no means qualify you to be a competent Judge. (*The Analyst*, p. 65)

Maclaurin perceives Berkeley's ideological claims—which are often regarded as merely a polemical preface—as of central importance, and proceeds on that basis. Berkeley is certainly ambitiously general in his opening claims and one can understand Maclaurin's responding as though Berkeley has made a universal claim equating working on mathematics with misleading people in religious matters. Perhaps unsurprisingly then, Maclaurin begins by producing counterexamples—pious mathematicians. Indeed, he claims mathematics is the most hallowed discipline of all:

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[18] Footnote: 'Scholium at the end of section I Princip. Math. Newtoni'. (Maclaurin 1982, 425)

He might with better reason have attacked Physick, Law or ev'n Divinity itself; for I believe it will easily be granted by all who are acquainted with the History of Learning that there is not any order or Class of Learned Men that has produced fewer writers on the side of Infidelity, or fewer adversarys to natural or revealed Religion than that of the Mathematicians. (Maclaurin, 1982, p. 426)

Not only are mathematicians the practitioners of a theologically venerable discipline, but, according to Maclaurin, the particular subfield that Berkeley attacks (in concentrating on analysis) boasts the holiest mathematicians of all:

The greatest Men among them have distinguished themselves as firm in the belief, and ornaments to the practise of Christianity, and particularly these men who invented or promoted the parts which this Author has so warmly attack'd; Dr Wallis, Dr Barrow & Sir Isaac Newton have excelled in these very parts, and I believe it will be hard to find three Divines whose Christian faith & practice is less equivocal that theirs was. (Maclaurin, 1982, p. 426)

Maclaurin then produces a renowned opponent of mathematics with unorthodox religious views:

Mr Hobbes from being a very bad Mathematician became a professed Enemy to the whole order, and because the truth and evidence of Geometry could not yield and conform to his gross blunders, he took a ridiculous revenge by writing against the pride, as he called it, of Geometers. (Maclaurin, 1982, p. 426)[19]

Maclaurin then demonstrates familiarity with the targets of Berkeley's recent anti-freethinking philosophy in *Alciphron* (1732),[20] naming the most significant figures, and—seemingly grappling with the generality of Berkeley's opening remarks in *The* Analyst—muses that not one is a particularly able mathematician:

I have not hear'd that Mr Collins, the Author of the fable of the bees, or of Christianity as old as Creation were esteemed Mathematicians, and it is evident that Mr Toland was very unskilful in that way. (Maclaurin, 1982, p. 426)[21]

Next, Maclaurin engages with one of the elements of the contemporary intellectual climate that motivates Berkeley's anti-mathematical tendencies: the intellectual authority of mathematics.

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[19] Maclaurin refers to the 1655 incidence of Hobbes claiming he had solved the ancient challenge of 'squaring the circle'. John Wallis, one of Maclaurin's pious mathematicians, wrote a caustic rejoinder and so began another of mathematics' historic feuds.
[20] Maclaurin's recognition that the arguments of *The Analyst* are importantly related to *Alciphron* is itself significant. See Moriarty (2018) for discussion of the relationship between those texts.
[21] Mills suggests that Newton's friend John Collins (1625-1683) is intended, but 'Mr Collins' is surely Anthony Collins, author of *A Discourse of Freethinking*. Bernard de Mandeville is 'the Author of the fable of the bees', Matthew Tindall wrote 'Christianity as old as the Creation', and 'Mr Toland' is John Toland of *Christianity Not Mysterious* and *Letters to Serena* notoriety. While *Christianity Not Mysterious* is a particular target of Berkeley's in *Alciphron* (see Berman, 1981), *Letters to Serena* is likely the more significant text for Maclaurin, given Toland's selective use of passages from Definition III of the *Principia* to bolster his arguments on the inherent activity of matter. See Stewart (1981) for an account of the relationship between Newtonian metaphysics (especially that of Samuel Clarke) and scepticism over the Trinity.

Increasingly, in this period, mathematics is regarded as supreme above all disciplines in its rationality and infallibility. This precise idea opens *The Analyst:* "§1. *Mathematicians considered to be the great Masters of Reason. Hence an undue deference to their decisions where they have no right to decide. This one Cause of Infidelity.*" (Berkeley, 1992, p. 159) The same spirit sees Maclaurin caution Berkeley against the promotion of anything like a 'religion versus mathematics' framework, and *for religion's sake*, since such a presentation 'may unhappily confirm the prejudices of others against the cause of Religion when they see it and mathematical knowledge sett in a sort of opposition'. (Maclaurin, 1982, p. 426) Thus, if Berkeley's desire is the promotion of religion and a faithful society then Maclaurin thinks he is unwise indeed in his choice of disciplinary contrast:

> [It] never can be pleasing to the real wellwishers of Religion, to see one of its advocates give such advantages against himself, & so much misled by his Zeal as to consider it as Service to Religion to weaken that Science which has been ever the strongest bulwark against the Scepticks. These may possible be in some measures the fruits of his labours as for the Mathematicks every body knows how vain all attempts against them have always proved. (Maclaurin, 1982, p. 427)

Maclaurin proclaims that he has always seen the 'interests of true Science and Religion [as] united' and that those who present them as 'opposite in any measure' do a real disservice to all. (Maclaurin, 1982, p. 427)

Among the most important aspects of this draft is its demonstration of how seriously Maclaurin took the hostility towards mathematics revealed in *The Analyst.* Even two years after the publication of the *Treatise* (ten years after *The Analyst),* Maclaurin was privately corresponding with mathematician Martin Folkes about his sensitivity to the same sentiment in Berkeley's latest work:

> I should be glad to know what you think of Dobb's Answer to Middleton, and of Siris[22] the extraordinary piece by the Bishop of Cloynes. It seems to be ingenious but in many parts profoundly mystic, The old prejudice against Mathematicians continues deeply rooted, and the mechanical philosophy and experiments are treated with an Air of great Contempt. (Maclaurin, 1982, p. 410)

Though Edmund Halley is the probable addressee of *The Analyst,*[23] Martin Folkes (1690-1754) would have made an equally good target for Berkeley, and since the rhetoric in *The Analyst* points to a culture

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[22] For 'Siris', Mills has mistakenly transcribed 'Sins'.
[23] This thinking originates in Stock (1776) and is partially supported by the lack of any disagreement in Anne Berkeley's heavily annotated copy of Stock, where she frequently disputes claims made about Berkeley's philosophical motivations and

of mathematical infidelity ("the many more like you") rather than one lone rogue, perhaps Folkes was a supporting case. In Folkes, the personae of mathematician and 'heretic' were both apparently well developed. In the memoirs of the antiquarian William Stukeley, we find the following claims about Folkes and his administration of an 'Infidel Club' in Bloomsbury:

> In matters of religion an errant infidel & loud scoffer. Professes himself a godfather to all monkeys, believes nothing of a future state, of the Scriptures, of revelation. (…) When I lived in Ormond Street in 1720, he set up an infidel Club at his house on Sunday evenings, where Will Jones,[24] the mathematician, & others of the heathen stamp assembled. (…) From that time he has been propagating the infidel System with great assiduity, & made it even fashionable in the Royal Society, so that when any mention is made of Moses, of the deluge, of religion, Scriptures, &c., it generally is received with a loud laugh. (Stukeley, 1882, p. 100)

Roos confirms Folkes' infidelity and discovers a fascinating link between Folkes' atheism and the particular freethinking texts Berkeley worried about: "Folkes simply did not identify with the vindication of religion, natural and revealed, admitting to his friend John Byrom that he was 'a heretic about the book of Daniel'. Folkes also remarked to Byrom that his heretical beliefs stemmed from reading radical deist (and frequent subject of Berkeleyan ire) Anthony Collins's *Discourse of the Grounds and Reasons of the Christian Religion* (1724)." (Roos, 2021, p. 125)

Returning to the draft, Maclaurin also engages Berkeley on *The Analyst's* claim that the apparent uniformity in mathematical opinion (and related failure to observe and extirpate calculus's logical issues) is best explained by something like blind faith in mathematical experts and mindless navel-gazing in practitioners (a point Berkeley is sensitive to, given the association between religiosity and a lack of critical facility, as found in Toland's work):

> He treats Mathematicians as men that do not really reflect or think, that obtrude obscure Mysteries as objects of Science, that are deluded by their own Signs or Symbols, accustomed rather to compute than to think, earnest rather to go on fast & far than solicitous to sett out warily & see their way distinctly, that admit Suppositions & reject them at pleasure &c. (Maclaurin, 1982, p. 427)

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personal relationships. Anne was living with Berkeley in Cloyne for the duration of the Analyst Controversy and would likely have reported if Halley was not the intended target. Additionally, see Albury (1978) on Halley's suitability for the accusation, on the basis of his perceived danger to religion, his "Epicurean interpretation of the *Principia*" and the "susceptibility of scientific knowledge to conflicting ideological deformations, even in the hands of scientists themselves." (1978, p. 43)

[24] Another mathematician to publish on fluxions and infinite series, Jones was a friend and collaborator of Halley and Newton.

Maclaurin denies these claims, noting the pains mathematicians go to in setting foundations out clearly, with the caveat that once this is done well initially it is an unfair expectation that mathematicians constantly *explicitly* anchor every advanced inference and conclusion back to foundational axioms.

The theme of the obligations of mathematicians to pay closer attention to the reference of their terminology returns six pages later. Maclaurin encourages mathematicians to turn their alleged 'nice and intricate notions' towards the risks inherent in the dangers of (Berkeley's) setting religion as opposed to mathematics and Newtonian natural philosophy:

> Every discovery [Newton] has made displays a neu beauty in the fabrick of the Universe, sets in a neu Light the infinite Skill & contrivance of its Author & Governour and points out to us his influences. (…) Had the Analyst taken the least Notice of the services of this nature which Sir Isaac Newton & other Mathematicians have done to Religion his partiality against them had not appeared in so strong a light. If he indeed holds any particular Scheme which obliges him to reject those Arguments from Philosophy which in so sensible & satisfying a manner establish our belief of a Deity & raise our Veneration for him, it appears very Natural to inquire whither such a Scheme may not be of more dangerous consequence to Religion than the undue Authority of the infidel Mathematician or two in opposition to the judgment of those of the first rank that have been amongst them. (Maclaurin, 1982, p. 432)

While Berkeley was anxious about the prospects for a version of religion guided by mathematical science, Maclaurin's enthusiasm for applying the *Principia* methodology to the broadest reaches of human endeavour was almost unlimited.[25]

Maclaurin's correspondences reveal him to have been a figure with markedly permissive views on religion and demonstrate a sincerity and practical concern in his own faith. There is a potent contrast here with Berkeley's doctrinal orthodoxy. Writing to Hutcheson in 1728, Maclaurin laments the uncertainty inherent in much thinking about the afterlife, describing disagreements that emerge in that domain as 'the greatest Evil of this state'. (Maclaurin, 1982, p. 26) The ensuing remarks incapsulate the good-natured tendency of his spiritual thinking, even towards those who don't toe the doctrinal line:[26]

> I sometimes please myself with thinking how agreeably some good men I know who do not believe in a future state will be surprized to find themselves live after Death. The pleasure of finding ourselves exist after Death and the Wonderful manner of it will be an admirable Introduction into a new state. (Maclaurin, 1982, p. 26)

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[25] See Grabiner (2004)

[26] For contrast, we might consider Berkeley's *Word to the Wise* (1749).

Maclaurin's engagement with Berkeley's rhetoric on comparative rigour standards in theology and mathematics demonstrate his desire to have the two presented as companion disciplines, both involved in the search for truth about different but associated kinds of perfection. Some of the closing thoughts in the draft discuss Maclaurin's view of the temperaments of good mathematicians:

> It is inclination & Genius not interest or Ambition that leads men to a particular application to this science. It is the Love of Truth of order harmony & proportion that is the foundation of the exquisite delight which this study affords almost the only satisfaction they can propose to obtain from it. (…) The zealous, the ambitious and interested may pursue their aims & leave the Mathematicians (if they reject their services) to their meditations in an unenvied quiet. The Squaring a curve, summing up a Series, tracing an orbit, settling the place of a star or the progress of a ray of Light need give no offence or disturbance to any body. (Maclaurin, 1982, pp. 433–434)

The final paragraphs more obviously resemble the introduction to an unwritten *Treatise.* Maclaurin explains that he will 'justify the Method of Fluxions in the first place and its celebrated Author in the next upon such principles as I think the Analyst himself will allou'. (Maclaurin, 1982, p. 434) Bruneau conjectures that he soon realised that "what he had done in his first reply was not sufficient, and that another subsequent draft was required. This is how he decided not merely to do a simple reply to Berkeley, but a true treatise which would be useful to him for his teaching and as such essential for his students."[27] Perhaps this draft would have been followed by a briefer treatment and Maclaurin's reason for scrapping the draft was, as Bruneau suggests, the recognition of a need for a grander project. However, given the significant shift in focus between the draft and the published introduction, it is likely that Maclaurin's change of mind reflects a strategic decision not to condone Berkeley's anti-mathematical rhetoric by repeating it and increasing its readership. By restricting himself to the mathematics of *The Analyst,* Maclaurin retrieves the discourse from the purported association between mathematics and infidelity—Berkeley's "great contempt" and "old prejudice against Mathematicians", as he later puts it. (Maclaurin, 1982, p. 410)

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[27] "Macluarin se rend compte très tôt (…) que ce qu'il a fait dans cette première réponse n'est pas suffisant et qu'un autre projet doit le supplanter. C'est ainsi qui'il decide de ne pas faire une simple repose à Berkeley mais un veritable traité qui lui sera aussi utile pour son ensignement et donc qui sera aussi essential pour ses étudiants." (Bruneau 2005, 277–78)

4. Berkeley's Anti-Mathematical Anxieties

In hopes of illuminating the detail of the foregoing ideas from Maclaurin, some account of the special features of Berkeley's mathematical animus is necessary. And indeed, Maclaurin's draft and correspondences interestingly supplement that understanding. Characterising Berkeley's attitudes to mathematics is made difficult by exegetical issues. The first is that Berkeley's (published) views on mathematics changed over his career. His little-read first publications treated mathematical subjects exclusively. In his (1707) *Mathematical Miscellanies* and *Arithmetic Demonstrated without Euclid or Algebra,* Berkeley presents himself as a mathematics promoter. The subtitle of *Mathematical Miscellanies* terminates in the promise of "persuasives to the study of mathematics, especially algebra." (*Miscellanies* 1707, p. 59) His instructions for an algebraical game designed to help students train their minds in mathematical inference includes the following rumination:

> But perhaps some one may say, that he cares neither for mathematics, nor for anything treated mathematically. Be it so; let us so far indulge the desire, the ignorance of persons; for I venture to maintain that this contempt proceeds from ignorance of the most exalted pursuits, and "which distinguish us from barbarians". But is there anyone who thinks slightingly of a capacious intellect, a sagacious genius, a sound judgment? If there be anyone so devoid of reason, let him then disregard mathematics, the great importance of which, for forming all the best habits of the mind, is allowed by all. (*Miscellanies* 1843, p. 74)

That these should be the early words of the author of *The Analyst* (especially its 'Queries' section) is striking:

> Query 38: Whether tedious calculations in algebra and fluxions be the likeliest method to improve the mind? And whether men's being accustomed to reason altogether about mathematical signs and figures doth not make them at a loss how to reason without them? (*Analyst*, 1948, p. 99)

However, even in that early enthusiastic writing, there are moments of caution over the promotion and teaching of mathematics. *Arithmetic* opens "I perceive and regret, that most votaries of mathematical science are blindfolded on the very threshold." (*Arithmetic*, 1707a, p. 31) Perhaps these more laudatory early publications are something of a special case, published to secure a fellowship for Berkeley and alleviate worries that he was hostile to mathematics and the Newtonian spirit of the "new philosophy".

After all, his scepticism about mathematics is abundantly clear in plenty of writings from the same period.[28]

Further to the exegetical complexity, Berkeley's inflammatory rhetoric towards his mathematical critics makes things more challenging still.[29] Even in nuanced moments where he explains that mathematics, so long as it is practice-guiding and applied for the benefit of societies, is fine,[30] whereas mathematics that remains firmly in the realm of abstract speculation is not, we lack a sophisticated account of the relationship between pure and applied mathematics. Pure mathematics is clearly an important driver of mathematical progress that makes possible many pragmatically useful innovations downstream, and Berkeley owes us an account of how the practical end flourishes without the speculative.

Complications aside, two themes of anti-mathematical worry emerge consistently in Berkeley's work that illuminate Maclaurin's draft and the implied reception of *The Analyst.*

4.1 Over-Zealous Application of Mathematics to Non-Mathematical Domains

The "mathematization of nature" was a significant feature of modern thought, beginning as early as the late sixteenth century. Galileo described a universe written in a mathematical language, and following successes garnered by the mathematization of branches of the physical sciences—notably astronomy, mechanics and optics—a program of mathematization was naturally seen by many as a promising strategy in other disciplines. Following this lead, we see many philosophers of the period exploring the formalisation and mathematization of natural and social disciplines.

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[28] For evidence, see Berkeley's notebooks (Jesseph estimates that almost a third of the entries address mathematics (Jesseph 1993, 45), 'Of Infinites', and the mathematical scepticism in his *New Theory of Vision* (1709) and *Principles* (1710: see particularly §118-132).
[29] See Moriarty (2021).
[30] See Dialogue Seven of *Alciphron* for these ideas.

This tendency is appreciable in myriad fields of late seventeenth- and eighteenth-century thought. In theology, *John Craige's mathematical principles of Christian Theology* (1699) and Pascal's marshalling of the nascent probability theory in securing prudential reasons for religious belief in his 'Wager' (1670) are conspicuous. In social philosophy, William Petty's *Political Arithmetick* (1690) and Francis Hutcheson's *Inquiry* (1725) demonstrate a new enthusiasm for calculating political and ethical success.[31] Later, much of Condorcet's philosophical project might be regarded as a wholesale attempt at the mathematical modelling of law, politics and sociology.

Berkeley decries the use of mathematical approaches to virtue in *Alciphron*. To take one—perhaps unfortunate—example, he summarises what he takes to be Mandeville's recommendation of mathematically motivated vice in *The Fable of the Bees*. Mandeville's *Fable* was a complex piece of public writing and Berkeley does little justice to it in reproducing some of its ideas as though they were straightforwardly (im)moral recommendations.[32] Equally, it is unusual that Berkeley sees Mandeville as exemplary of mathematics-devoted decision-making given that Mandeville was one of the most salient voices in critiquing this excessive mathematizing in other domains.[33]

Berkeley understands Mandeville's and Hutcheson's use of mathematics as cases of "barren speculation", a phrase he uses in his later philosophy to signal formalism for its own sake (and not in service of practical goods). His use of "barren" in this sense is reminiscent of Bacon's usage in *The Great Instauration,* where he laments the philosophy received from Ancient Greece as "fruitful in controversies, but barren of effects" and describes the "present condition of knowledge" as exhibiting "the countenance and expression of a virgin, while barking monsters encircled her womb". (Bacon, 1901, pp. 11–12)[34]

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[31] The subtitle to the first edition of Hutcheson's *Inquiry* closed with the line: "With an Attempt to introduce a Mathematical Calculation in Subjects of Morality." (Hutcheson 1725) See also: Bailie (2021).
[32] Mandeville's *Letter to Dion* is illuminating on this misrepresentation. (Mandeville 1732) For a contemporary account of Berkeley's unfair representations of his freethinking targets, see Hervey (1732).
[33] Wolfe (2019).
[34] Bacon is an important influence for Berkeley, and he cites *The Advancement of Learning* in his *Miscellanies* when he makes the early claim that algebraic reasoning has particular efficacy in "rearing the intellectual powers". (Berkeley 1707b, 74)

An important revelation that emerges from consideration of Maclaurin as a central character in understanding the Analyst Controversy is that, though Hutcheson is likely Berkeley's target when thinking about attempts at mathematising moral matters (as one of the earlier promoters of a felicific-calculus), Maclaurin, Hutcheson's friend and correspondent, had written a very early thesis that sought to do exactly that:

> A sort of trial run of the Newtonian style was Maclaurin's youthful attempt—he was sixteen—to build a calculus-based mathematical model for ethics. (…) In "On the Good-Seeking Forces of Mind," Maclaurin postulated that the "forces with which our minds are carried towards different good things are, other things being equal, proportional to the quantity of good in these good things." (…) He said that one could find the maximum and minimum intensities of any good or evil using Newtonian calculus. Maclaurin graphed the total attraction of a good under various assumptions about how the intensity varies over time, and, by integration, derived equations for the total good. (Grabiner, 2004, p. 843)[35]

Grabiner discusses this as an early instance of Maclaurin's devotion to "the Newtonian style" and his ambitious sense of the scope for its application. (Grabiner, 2004, pp. 841–844) Schliesser discusses a related concept "Newton's Challenge" as roughly the view that 'in the wake of the success of the *Principia,* the authority of science should be used to settle debates in philosophy' (Schliesser, 2011, p. 104) Schliesser discusses this Newtonian zeal as a key motivation for eighteenth-century anti-mathematicism. Schliesser's focus is on reservations about the application of and regard for mathematical approaches to broader disciplines. He categorises numerous relevant thinkers (Smith, Locke, Buffon, Mandeville) as adopting a "containment strategy" in response.[36] Schliesser also reads Berkeley as exemplifying the containment strategy with respect to mathematics. His treatment of Berkeley's hostility to mathematical methodology is primarily drawn from *De Motu* (1721b) and the explanations of his philosophy of science to Samuel Johnson (the American educator rather than the

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[35] Berkeley's reservations about this kind of project are an interesting precursor to numerous contemporary debates about the neutrality of formalisms when applied to processes with social outcomes. For example, the perception of algorithms as essentially ideologically neutral has often been raised in response to complaints about (for example) racial bias in certain artificial intelligence. See Birhane (2021). Berkeley shares a concern that the perceived neutrality and logical perfection of mathematics might mean that any projects that utilise it are in some sense neutral themselves. For a light-hearted approach to a similar theme, see Kofi Bright's satirical essay 'Logic versus Social Justice Activists.' (Kofi Bright 2021)

[36] Elsewhere, Schliesser suggests that Berkeley's worry-raising over the infinite may have played a role in Smith's anti-mathematical reservations, because the troubled state of infinitesimal and transfinite mathematics in the wake of *The Analyst* may have caused pessimism over the possibility of any serious mapping between mathematics and (potentially) infinitely complex domains. (Schliesser 2017, 318)

stone-kicking English lexicographer). This focus is natural, since the context for the treatment is his

discussion of 'Newton's Challenge' and of Berkeley's as one of a number of reactions to it (though he

thinks Berkeley's reaction is better directed at Cartesian accounts of matter).

> Berkeley's particular target is what I have elsewhere called the "pre-Newton mechanical philosophy," namely, one that tries to explain [things] in terms of (rational reconstructions of) collision of small particles; in the wake of Descartes' rejection of final causes in physics, it is a science of reductionist and physicalist efficient causation. (Schliesser, 2011, p. 109)

The closing sections of *De Motu* encapsulate much of the spirit of Schliesser's analysis, where

Berkeley is seen as applying a kind of hierarchical model to the kinds of natural knowledge:

> In physics sense and experience which reach only to apparent effects hold sway; in mechanics the abstract notions of mathematicians are admitted. In first philosophy or metaphysics we are concerned with incorporeal things, with causes, truth, and the existence of things. (*De Motu*, 1721, p. 51)

> Only by meditation and reasoning can truly active causes be rescued from the surrounding darkness and be to some extent known. To deal with them is the business of first philosophy or metaphysics. Allot to each science its own province; assign its bounds; accurately distinguish the principles and objects belonging to each. Thus it will be possible to treat them with greater ease and clarity. (De Motu, 1721b, p. 52)

Berkeley, Schliesser notes, believes in the distinguishing of different kinds of description of our

experience into their proper categories. He clarifies this, with respect to Newtonian natural philosophy,

later in a letter to Johnson:

> The true use and end of natural philosophy is to explain the phenomena of nature, which is done by discovering the laws of nature, and reducing particular appearances to them. This is Sir Isaac Newton's method; and such method or design is not in the least inconsistent with the principles I lay down. This mechanical philosophy doth not assign or suppose any one natural efficient cause in the strict and proper sense. (Berkeley, 2012, p. 302)

So, on Schliesser's view, Berkeley's position is that Newtonian, mathematical natural philosophy does

away with the important sense of cause: final causes. The application of mathematics is useful for

instrumentalist descriptions of regularities in natural phenomena, but this project should not be seen to

rival proper metaphysics. This is very much contrary to the understanding of those promoting

Newtonian-type mathematical models of the world (again, Maclaurin is an exemplar), many of whom

see the project as providing the long-awaited translation of Gallileo's mathematical language. I agree

with this analysis of Berkeley's aversion to mathematical treatments of natural philosophy but believe

the hostility to mathematics runs deeper and is rooted in more sociological and theological phenomena

than this account reveals.[37] For this reason, I speak of "anti-mathematical" tendencies in addition to "anti-mathematicist" ones and regard my account as an extension of Schliesser's analysis with a different emphasis.

Consider this remark from early in the first dialogue of Berkeley's *Alciphron*, where pragmatist Euphranor responds to Alciphron's claim that he has much left to prove:

> O *Alciphron*! I do not doubt your faculty of proving. But before I put you to the trouble of any farther proofs, I should be glad to know whether the notions of your minute philosophy are worth proving. I mean, whether they are of use and service to mankind. (Alciphron, 1732, p. 60)[38]

Alciphron is a work of apologetics and Berkeley's approach to both the application of formal methods to religion and the contrasting of the rigour of theology with formal disciplines sheds light on his broader issue with the preoccupation with mathematization. The mathematical approach (like the "minute" approach of the titular freethinker Alciphron) is damaging to the elements Berkeley most prizes in religious life and invariably produces disagreements that distract from the true benefits of religion. Berkeley's re-use of "barren speculation" in his discussion of devotional matters is instructive.

> [W]hen Life and Immortality were brought to Light by the Gospel, there could remain no Dispute about the chief End and Felicity of Man, no more than there could about the Means of obtaining it, after the express Declaration of our Blessed Lord in the Words of my Text; *This is Life eternal, that they may know thee, the only true God, and Jesus Christ whom thou hast sent.* For the right understanding of which Words we must observe, that by the Knowledge of God, is not meant a barren Speculation, either of Philosophers or Scholastic Divines, nor any notional Tenets fitted to produce Disputes and Dissentions among Men; but, on the contrary, an holy practical Knowledge, which is the Source, the Root, or Principle of Peace and Union, of Faith, Hope, Charity, and universal Obedience.
>
> A Man may frame the most accurate Notions, and in one Sense attain the exactest Knowledge of God and Christ that human Faculties can reach, and yet, notwithstanding all this, be far from knowing them in that saving Sense. (Sermon, 1731, p. 116)

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[37] I have chosen to look at Schliesser's account, but one could also look to Jesseph for Berkeley's animosity towards mathematics. His analysis locates Berkeley's general disagreements with mathematics in his anti-abstractionism, and thus as an aspect of an epistemological mismatch between his own philosophical outlook and that assumed in contemporary mathematics. His analysis of *The Analyst* sees Berkeley's motivations as equally explained by mathematical and theological issues, but he sees the mathematical issues as capable of standing alone. See Jesseph (1993).

[38] See also his framing of his philosophical opponents in his introduction to the *Dialogues:* "Though it seems the general opinion of the world, no less than the design of Nature and Providence, that the end of speculation be practice or the improvement and regulation of our lives and actions; yet those, who are most addicted to speculative studies, seem as generally of another mind." (Dialogues, 1713, 167)

Attempts to formalise and make precise transcendent concepts like those of religion will invariably lead to difficulty, disagreement and doubt. For Berkeley, this is a technical consequence of trying to force a sharpness onto concepts that are spiritual, practical and may legitimately appear differently to different people. Maclaurin sees nothing but potential in the immediate deployment of mathematical analysis in service of religious ends, but for Berkeley, there is much to be lost if religion moves in this direction.

4.2 Devotion to Mathematical Authority

Berkeley's conjecture that certain of his contemporaries were venerating mathematicians in a manner more appropriate to religious worship is particularly clear in the case of Halley's eulogising of Newton. Halley's ode to Newton appeared in Latin to match the text of the *Principia* (which Halley was preparing for publication)*, but little of the sense of worship is lost in the translation by Alexander Weinstein. Berkeley's sense that a sacred status is being attributed to mathematics emerges quite clearly in Halley's framing of Newton's mathematical talent as a new salvation:

> Cryptic questions that perplexed the mind of many an ancient sage,
> Riddles over whose solution fruitless controversies rage,
> We can read their answers plainly. Mathematics puts to rout
> All the error that oppressed us, and the darkness and the doubt;
> For the wisdom of a genius has enabled us to rise
> To the mansions of the mighty gods, to scale the lofty skies. (Weinstein, 1943, p. 70)

One can see how anyone anxious about idolatry might see reason for caution in Halley's words. Indeed, Halley never seems more faithful than when raising Newton up to the level of a God.

> You who take delight in nectar and in heaven's ambrosia fare,
> Sing with me the praise of him who laid the scheme of Nature bare—
> Newton, who unlocked the treasury where Truth lay hid from sight;
> Newton, loved of all the Muses; Newton, whom the god of light,
> Phoebus, fires with inspiration. No unworthy thought can win,
> No base passion at his bosom. There the god has entered in,
> And his holy presence fills the mind that sees the cosmos plain.
> Nearer to immortal godhead mortal man may not attain. (Weinstein, 1943, p. 70)

It is worth noting that Halley's ode was often "the first thing that people would encounter when reading the *Principia"* (Schliesser, 2013, p. 422) and thus, we have a common framing of the *Principia* as a kind of Epicurean venture:

> In Halley's rendition, God follows the (eternal?) laws of nature. Throughout the Ode, there is no sign that God the creator [Demiurge] needs to intervene in his own creation. More important, he uses the plural "Gods." I single out these lines because in 1691 they were used to create the charge against Halley "for asserting eternity of the world." (Schliesser, 2013, p. 423)

Coupled with this sense of increasing scholarly devotion to Newton is an anxiety over Newton's spiritual leanings.[39] The first edition of the *Principia* (to which Berkeley responds) is very light on the kind of theological grounding we expect from texts of the era. Despite the appetite for (selective) restriction of his writings to the phenomena—as epitomised in the "Hypothesis non fingo" addition to the second edition—it is surprising how little God features in the text. Much of the relevant evidence would have been unavailable to Berkeley, but from his "hatred (…) of the Doctrine of the Trinity" to his "belie[f] that he was one of the Elect, part of a chosen saintly remnant that would reign with Christ during the Millenium", Newton's religious ideas were unorthodox in a great many ways. (Iliffe, 2016, p. 485) Recalling that Berkeley thought unorthodox interpretations of Biblical content should be treated similarly to treason, we can understand the extent to which these ideas motivated his philosophical thinking.

> [W]hatever conduct common sense, as well as Christian charity, obligeth us to use towards those who differ from us in some points of religion, yet the public safety requireth that the avowed contemners of all religion should be severely chastised; and perhaps it may be no easy matter to assign a good reason why blasphemy against God should not be inquired into, and punished with the same rigour as treason against the king. (Preventing the Ruin of GB, 1721a, pp. 70–71)

In addition to concerns about an over-zealous affection for all things mathematical, Berkeley experienced derision over the perception that his metaphysical views did not sit well with contemporary mathematics. Andrew Baxter, whose *Enquiry into the Nature of the Human Soul* (1733) has a section entitled 'Dean Berkeley's Scheme Examin'd' in which he provides the following scathing characterisation of Berkeley's belief that immaterialism alleviates scepticism:

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[39] See Iliffe (2016) for a thorough summary.

[S]ince Dean *Berkeley's* argument demonstrates all substance out of existence, equally with material substance; what small reason he had to proclaim (…) his victory over *Atheists* and *Sceptics.* (…) This is, I think, as if one should advance, that the best way for a woman to silence those, who may attack her reputation, is to turn a common prostitute. (…) We might with equal reason affirm, I think, that putting out the eyes is *the best cure* for dimness of sight. (Baxter, 1733, pp. 284 & 286)

Closing his section on Berkeley, Baxter contrasts what he takes to be the intellectual (ir)respectability of Berkeley's philosophy with mathematics:

We may farther observe that it doth not great honour to his new scheme, (…) that it forces the author to suspect, that even Mathematicks may not be very sound knowledge at the bottom. (…) A man ought to have a vast deal of merit, and to have obliged the world with surprising discoveries, to justify his attacking these sciences at this rate; or rather no merit possible can warrant it. (Baxter, 1733, p. 298)

Thus, added to Berkeley's sense that reverence for mathematical authority was becoming excessive, there was a further concern that, increasingly, to criticize elements of mathematics (or just to present philosophical views that sit awkwardly alongside mathematics), was to risk automatically invalidating one's views. This is akin to the situation described by Huw Price (2015) as a "reputational trap", where, in his essay, those publicly considering or even attempting to engage the issue of "cold fusion" low energy nuclear reactions are professionally tainted by the historical sketchiness of that experimental field. Berkeley goes further still and alleges that the prestige of mathematics means that even bad arguments launched from something like the standpoint of that discipline achieve greater esteem (and less scrutiny) than they would without this positive association; we might call it a "reputational glow".

The combination of that esteem and absence of scrutiny means that those unwilling to examine theological issues themselves (the vast, busy majority) may simply defer to the position with the better reputational footing. Perhaps we can see an echo of Berkeley's worries in some contemporary representations of the spirit of atheism, where occasionally atheism is presented as a natural consequence of a strong commitment to logic or reason. Of course, one can take whatever position they might on the rigour and soundness of the various logical arguments available, but it cannot be denied that the history of theology has lacked logical treatments (consider, for example, Gödel's ontological proof). Thus, surely something more than logical devotion is required here. However, this idea that

"infidels" or religious reformers style themselves as neutral followers of logic is supported by many popular presentations of atheism,[40] and for Berkeley, this was a misleading and dangerous conflation.

5. Conclusion

The association between mathematics and infidelity in Berkeley's work is complex and an exhaustive account is beyond the ambitions of the present article. However, the association is convincingly echoed by Anne Forster Berkeley in her description of Berkeley's work ethic after his death. For her at least, the promotion of mathematics and atheism were always linked for Berkeley:

> [H]is Talents were great, & so are those of many others – but in his own Words: his Industry was greater; he struck a light at twelve to rise & study; & pray, for he was very Pious & his studies were not barren speculations – for he loved God & Man, silenced & confuted atheists disguised as Mathematicians & fine Gentlemen. (BL MS 39312, f.227r-v in Jones, 2021, p. 440)

The Analyst is among the most consequential interventions of a philosopher in the history of mathematics. The forgoing analysis and excerpts from Maclaurin throw new light on the reception of Berkeley's text and provide a novel interpretation of how one of the most important thinkers in the history of British mathematics regarded it.

Maclaurin originally intended to frame his response to *The Analyst* explicitly in terms of the religious and broader sociological concerns that motivated it. His draft reveals that he initially understood Berkeley's criticism of calculus as crucially directed at the comparative reputational circumstances of religion and mathematics and sought to answer it as such. His correspondences also illuminate various aspects of the relationship between these two giants of early modern thought, demonstrating Maclaurin's interest in Berkeley's anxieties about mathematics and the particulars of his anti-freethinking rhetoric. It also shows how seriously Maclaurin took these concerns and how he moved from a position of initially seeking to address them in detail to one of deciding they were better not given any further air.

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[40] For example, Harris (2006).

Acknowledgements

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