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DEPARTMENT OF PHILOSOPHY

**A PRAGMATIC BISHOP: GEORGE
BERKELEY'S THEORY OF CAUSATION IN
*DE MOTU***

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בְּשִׁבּוּל בִּישׁוּף בְּרִקְלִי



Declaration

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Summary

In this doctoral thesis, I will argue that in his *De motu* (1721, ‘On motion’), Bishop George Berkeley (c.1684–1753) develops a pragmatist theory of causation regarding mechanical theories outlined previously with Newtonianism. I place chief emphasis on the importance of logic and mathematics in Berkeley’s scientific approach, on which the other levels of semantics, epistemology, and mechanics build up. On my rendering, Berkeley’s pragmatic method to *conceive* or mathematically imagine causation makes sense in *terms* of mechanical causes or ‘mathematical hypotheses’. For the mechanist maintains the usefulness and truthfulness of causation by the following definition.

DEFINITION. A pragmatist theory of causation is one which holds that:

- ① Causal terms are indispensable in scientific deliberation for their usefulness; they cannot be eliminated [*contra* reductionism].
- ② What a cause is is defined by one’s temporal deliberative practices, independent of atemporal structure that theories hold [*contra* structuralism].
- ③ Causal laws (theories formulated in causal terms) are genuinely true, not fictitious, when one confirms and deduces them [*contra* instrumentalism].

By justifying this definition, I will object to three rival readings—reductionism, structuralism, and instrumentalism—to my reading of Berkeley as a pragmatist about causation.

In particular, my pragmatist reading criticises the most popular instrumentalist reading because, according to the latter, talk of causal terms like forces can be false or merely fictitious inasmuch as one can hold the utility of theories in mechanical practices. The instrumentalist reading is then compatible with mathematical formalism, according to which it is not truth or meaning that counts as formal manipulation or game of meaningless symbols, thereby eschewing a platonist attitude towards mathematical objects. However, I rebut the formalistic instrumentalism from Berkeley’s logical and realist standpoint, maintaining the irreducibility of occult qualities that mathematical objects have in their formulation from hypotheses to propositions. Light shall be shed on the tenet I propose that law-propositions formulated in hypothetical, causal terms must be true, neither false nor fictitious, when we (1) frame, (2) confirm, and (3) express them to the extent of our discursive thinking (in three steps).

[339 words]

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Abbreviations

Works by George Berkeley (1684/5–1753, in chronological order)

This list is not exhaustive. References are usually: α , ω , where α means the *Works* volume and ω means the page number of the Luce and Jessop edition (1948–57, 9 vols). The symbol ‘§’ refers to (chapter and) section in a book: e.g. *DM* §33 refers to section/paragraph 33 of *De motu*.

- Arithmetica* *Arithmetica absque algebra aut Euclide demonstrata. Cui accesserunt, cogitata nonnulla de radicibus surdis, de æstu aeris, de ludo algebraico, &c.* (London: A. & J. Churchill; Dublin: Jeremy Pepyat); 1843 II (tr. Wright); *Works* IV 1948–57 (ed. Luce, not tr.) 1707
- Miscellanea* *Miscellanea mathematica: sive cogitata nonnulla de radicibus surdis, de æstu aeris, de cono æquilatero & cylindro eidem sphaeræ circumscriptis, de ludo algebraico; & parenetica quedam ad studium matheseos, præsertim algebrae* (published together with *Arithmetica*); 1843 II (tr. Wright); *Works* IV 1948–57 (ed. Luce) 1707
- Notebooks* ‘Notebooks’, also known as ‘Commonplace Book’ and ‘Philosophical Commentaries’; *Works* I 1948–57; 1976 (ed. Thomas) 1707–08
- MI* ‘Manuscript Introduction’, also known as ‘First Draft of the Introduction to the Principles’; *Works* II 1948–57; 1986 (ed. Belfrage) 1708
- NTV* *An Essay towards a New Theory of Vision*, 2nd ed. (Dublin: Jeremy Pepyat); 3rd ed. in *Alciphron*, vol. 2; *Works* I 1948–57 1709; 1732
- Principles* *A Treatise Concerning the Principles of Human Knowledge*, Part I (Dublin: Jeremy Pepyat); revised 2nd ed. (London: Jacob Tonson); *Works* II 1948–57 1710; 1734
- Dialogues* *Three Dialogues between Hylas and Philonous* (London: Henry Clements); revised 2nd ed. (London: Tonson); *Works* II 1948–57 1713; 1734
- DM* *De motu; sive, de motus principio & natura, et de causa communicationis motuum* (London: Jacob Tonson); later with slight modification included in *A Miscellany* (London/Dublin); 1843 II (tr. Wright); 1901 I (ed. Fraser); 1951 IV (tr. Luce); 1952 (tr. Jessop); 1969 (tr. Breidert); 1987 (tr. Berlioz-Letellier et Beyssade); 1992 (tr. Jesseph); 2008 (tr. Clarke); 2009 (tr. Fimiani); forthcoming (tr. Belfrage), etc. 1721; 1752

<i>Correspond.</i>	‘Philosophical Correspondence between Berkeley and Samuel Johnson’; <i>Works</i> II 1948–57; 2003 (ed. Hight)	1729–30
<i>Alciphron</i>	<i>Alciphron: or, The Minute Philosopher</i> , 2nd ed., 2 vols. (London: J. Tonson); revised 3rd ed. (London: Tonson & Draper); <i>Works</i> III 1948–57; 2010 (ed. Jaffro, Brykman, and Schwartz)	1732; 1752
<i>TVV</i>	<i>The Theory of Vision, or Visual Language, Shewing the Immediate Presence and Providence of a Deity, Vindicated and Explained</i> (London: Jacob Tonson); <i>Works</i> I 1948–57	1733
<i>Analyst</i>	<i>The Analyst; or, a Discourse Addressed to an Infidel Mathematician</i> (London: J. Tonson); <i>Works</i> IV 1948–57	1734
<i>Defence</i>	<i>A Defence of Free-Thinking in Mathematics: in answer to a pamphlet of Philalethes Cantabrigiensis</i> (London: Tonson); <i>Works</i> IV 1948–57	1735
<i>Siris</i>	<i>Siris: A Chain of Philosophical Reflexions and Inquiries Concerning the Virtues of Tar Water, and divers other Subjects connected together and arising one from another</i> , 2nd ed. (Dublin: R. Gunne, 1744); <i>Works</i> V 1948–57	1744
<i>Miscellany</i>	<i>A Miscellany, Containing Several Tracts on Various Subjects</i> (London: Tonson & Draper; Dublin: George Faulkner)	1752

Works by other early moderns

<i>AT</i>	René Descartes, <i>Œuvres</i> 1964–76 (ed. Adam et Tannery)	1641 etc.
<i>CSM(K)</i>	Descartes, <i>Philosophical Writings</i> 1984–91 (tr. Cottingham et al.)	
<i>Ethica</i>	Baruch Spinoza, <i>Ethica, ordine geometrico demonstrata</i> (posthumous work); 2002	1677
<i>GP</i>	Gottfried Leibniz, <i>Philosophische Schriften</i> 1875–90 (ed. Gerhardt); 1969 (tr. Loemker); 1989 (tr. Ariew and Garber); 2016 (tr. Rey)	1686 etc.
<i>GM</i>	Leibniz, <i>Mathematische Schriften</i> 1849–63 (ed. Gerhardt)	1695
<i>Principia</i>	Isaac Newton, <i>Philosophiæ naturalis principia mathematica</i> (London: Joseph Streater); 1962 (tr. Motte, ed. Cajori); 1999 (tr. Cohen and Whitman)	1687 etc.
<i>Essay</i>	John Locke, <i>An Essay Concerning Human Understanding</i> (London: Tho. Basset); 1975 (ed. Nidditch)	1690; 1694
<i>CNM</i>	John Toland, <i>Christianity not Mysterious: or a treatise shewing, that there is nothing in the Gospel contrary to Reason, nor above it: and that no Christian doctrine can be properly call’d a mystery</i> (London: Sam. Buckley); 1997 (ed. McGuinness et al.)	1696
<i>Serena</i>	Toland, <i>Letters to Serena</i> (London: Bernard Lintot); 2013 (ed. Leask)	1704

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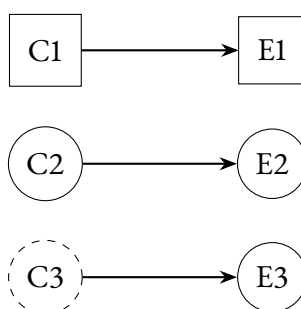
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‘And the darkest hour is just before dawn’ 

Introduction

BISHOP George Berkeley (c.1684–1753)¹ left us with a very short treatise, *De motu* (‘On motion’, hereafter *DM*), consisting of 72 sections/passages. It was first published in 1721 in London and later included in *A Miscellany* in 1752 (London/Dublin). Even if the bishop were thinking in English whilst writing this Latin treatise, the translations in English would be a serious matter of interpretation, let alone those in other languages. However, the greatest matter in my thesis is a new, viable, pragmatist interpretation of his theory of causation in *DM*.

In the first place, causation is taken to be a relation or relations—relating two *objects*, the cause and the effect.² In my rendition of *DM*, there are three models of causation:



¹ George Berkeley, D.D., Bishop of Cloyne, was born at Kilcrin near Thomastown, in south-east Ireland, County Kilkenny in the province of Leinster, in 1684 (according to Joseph Stock 1776, 2, the first biographer of Berkeley, though nowadays believed to be 1685). Along with many siblings (at least five brothers, according to Tom Jones 2021, ch. 2, the latest biographer), George’s childhood was spent in an extended house of Dysart Castle at Kilcrin, lower on the River Nore. Kilcrin (‘church in the woods’ in Irish) is associated with a hermit’s dwelling place called ‘Colman of the pigs’ (*Leabhar Breac*, ‘the Speckled Book’ 1872–76; Leahy, email correspondence, 2021), where the church was to the rear of Dysart Castle. The castle was originally built as a medieval Priory of Kells, where his father William Berkeley probably took refuge from the collectorship of Belfast (the year of his arrival in Ireland is unknown). The Belfast post was a reward for his service to Charles I and II (i.e. his loyalty and expending his fortune) when he was in England. The reason for Berkeley’s father to reside in a secret sanctum, deep in the forest valley of Kilkenny, might have been to hide his Stuart loyalist identity in the turbulent times of late seventeenth-century England. On a visit to Kilcrin, I thank Ramie Leahy, current owner of the castle ruins and vast fields. See Berman 1994; Bartlett 2010, ch. 3; Attis 2014, §2.5.

² In this definition, for which I thank Alison Fernandes, the relation is the *third* object or entity. It is clear that Berkeley posits three kinds of entities or ‘object[s] of human knowledge’: (i) ‘minds’ (‘spirits’), (ii) ‘ideas’ (mental representations), and (iii) ‘relations’ between ideas or ‘things’ (*Principles* §89; see the passage in §1.1.1.2). For him, *stricto sensu*, the first objects ‘minds’ and the third ‘relations’ are called ‘notions’, distinct from the second ‘ideas’ perceived. On my reading, the *perceiving* minds are causes, and the *perceived* ideas are effects thereof, whereas causal relations exist *unperceived* in connecting the ideas in human knowledge in which we, finite minds, are also understood. This ‘firm system of sound and real knowledge’ was meant to be ‘proof against the assaults of *scepticism*’ (*Principles* §89). Thus, epistemology underlies the ontological objectivity of metaphysical causation in Berkeley. On the other hand, I will distinguish this metaphysical system from his other system of mathematical, mechanical causation. The latter is the subject matter of this thesis.

Where C and E stand for a cause and its effect, respectively, the first model (C1 implying E1) is metaphysical causation,³ whereas the second (C2 implying E2) and the third (C3 implying E3) are two types of mechanical causation.⁴ The second model concerns mechanical causes *qua* objectionable *empirical* hypotheses with reference to existing objects, which have ‘mass’, ‘figure’, and the like. On the contrary, in the third model, mechanical causes *qua* mathematical hypotheses, such as ‘gravity’ and ‘force’, refer to no observable objects or entities *per se*. What I mean by ‘pragmatic’ causation rigidly applies to this third model, in which law-propositions or nomological statements about motion (by ‘the theorems of the mutual attraction’, for example, *DM* §28) are truly confirmed for the utility of mathematical framing and conception. My reformulation as such is overall a realist, not anti-realist,⁵ rendition of the irreducibility of unobjectionable causes called ‘mathematical hypotheses’ with reference to occult qualities. This is because such causes in abstract terms are independent of our understanding—unintelligible—but inasmuch as useful in scientific discourse, they are formulable, confirmable, and expressible as true (or false) theories ‘in the pursuit of truth’ (*DM* §1).

To this end, the Introduction lays out three matters: the background of *DM*, the context of it, and the aims of this thesis. §0.1 sheds light on the background between science and religion and the importance of unintelligibility of occult qualities, thereby illuminating the three models of causation. §0.2 explains the influence of several precursors on Berkeley, as well as the relationship between his other writings and *DM*. Finally, §0.3 spells out the aims of this thesis on the bishop’s pragmatist theory of causation in *DM*, detailing the five main chapters. Not only is my completion of the thesis dedicated to the bishop, but also to the approximately tercentenary celebration of the publication of the treatise towards our new understanding of pragmatism.⁶

³ Model 1 is a fundamental level under the higher-levels of mechanical causation. Contemporary philosophy of causation does not necessarily deny the objectivity of causation in the metaphysics of science. See Fernandes 2018. However, slightly differing from the sense of analytic metaphysics, I take model 1 causation to be the notion of ‘necessary connection’ for the anti-sceptic Berkeley. To this extent, incorporating the notation of a modal operator (‘it is necessary that’), the boxes (squares) of C1 and E1 denote necessity in the implication of causal relations, particularly efficient and final causation in *DM*. In modal system K, axiom A1 of *distribution* applies to my postulate of model 1, where C1 and E1 are formulated into propositions ϕ and ψ , respectively: $\vdash \Box(\phi \supset \psi) \supset (\Box\phi \supset \Box\psi)$. See also Boolos 1999, 415; Divers 2018, 2.

⁴ This thesis does not distinguish between two English terms, ‘causation’ and ‘causality’ (more archaic), for two reasons. Firstly, to my knowledge, Berkeley deploys neither of the terms in his text including the Latin treatise *De motu* (in which no ‘*causalitas*’), whence the deployment of ‘causation’ is my reformulation. Secondly, in the non-English manner of speaking, there is no equivalent semantic distinction between ‘causation’ and ‘causality’ in the other languages. For instance, what is the counterpart of ‘causalité’ in French? Probably, there is only one sufficient definition of ‘causalité’ *comme* ‘relation(s) causale(s)’. I suppose thus, such a distinction in English does not matter to many translations in the other languages, nor does it to my reformulation. On a late eighteenth-century use of ‘causation’, not ‘causality’, see Beattie 1770, 319 (with a quotation from Cicero’s *De fato*): ‘Causation implies more than priority and contiguity of the cause to the effect. This relation cannot be conceived at all, without a supposition of power or energy in the cause.’ See also Immerwahr 1974; Winkler 1989, 106–117; Blackburn 2008; Downing 2014, 199.

⁵ In Berkeley scholarship regarding mathematics and mechanics, anti-realist interpretations, *viz.* instrumentalism, fictionalism, and formalism, have been popular. My realist, pragmatist reading is a modest disagreement with them.

⁶ On Berkeley’s ‘pragmatic bent’ in his social philosophy, which my thesis on *DM* cannot cover, see Van Iten 2015, 84–86, drawing on the betterment of human life and welfare from *Siris* §§330–331, *Advice to the Tories* (*Works* VI, 53), etc. In particular, consider *Alciphron* §1.12, in the voice of Euphranor, Berkeley’s spokesman (emphasis added): ‘It is a true maxim that a man should think with the learned, and speak with the vulgar. [...] All our discoveries and

0.1 Science and religion up to the early eighteenth century

Why do I intend to concentrate on the bishop's specific treatise, *DM*? There is good reason to newly understand its relevance to our modern society on both macro and micro levels, thereby weaving the discussion of causation into historical, philosophical, and pragmatic consideration. I will start with the development of science together with religion on the macro level of human history, especially regarding manifest and occult qualities. On this basis, the micro level of *DM* is introduced in my analysis. That is, philosophical settings up to the early eighteenth century, in which *DM* situates itself, shall be established towards my reformulation of Berkeley's pragmatist theory of causation. On my reading of *DM*, both macro and micro levels concern the bishop's refined distinction between pragmatic mechanics and theological metaphysics.

0.1.1 Historical background of *De motu*—occult qualities

At the very beginning of *The Dawn of Everything*, ch. 1 'Farewell to Humanity's Childhood', David Graeber and David Wengrow set out (2021, emphasis added):

Most of human history is irreparably lost to us. Our species, *Homo sapiens*, has existed for at least 200,000 years, but for most of that time we have next to no idea what was happening. In northern Spain, for instance, at the cave of Altamira, paintings and engravings were created over a period of at least 10,000 years, between around 25,000 and 15,000 BC. Presumably, a lot of dramatic events occurred during this period. *We have no way of knowing what most of them were.*

Granted this paucity in our explanation of history, I put forward an account of Berkeley's theory of causation within the context of science and religion in early modern Europe. Truthfully, we have little way of knowing who Berkeley really was. From his writings and biographies, we continue to interpret his philosophy. My thesis is no exception. But this is always an indirect approach, separate from his own intention. From our present perspectives, with ideological boundaries and linguistic-epistemic biases, rarely is it possible to soundly argue real issues for the bishop's sake. However, I shall provide an overview of Berkeley's *DM* between science and religion, namely, between Newtonian mechanics and Christian theology.

On the macro level, following the study of Vyacheslav Stepin, it is worth considering why technogenic, i.e. technologically-oriented, societies emerged from traditional societies in Europe between the fifteenth and seventeenth centuries (2005, 1–4).⁷ Putting aside a deplorable post-

notions are in themselves true and certain; but they are at present known only to the better sort, and would sound strange and odd among the vulgar. But *this, it is to be hoped, will wear off with time.*' That true maxim '*loquendum est ut plures, sentiendum ut pauci*' (also in *Principles* §51), derived from medieval scholasticism (Roger Bacon et al.), may be called a pragmatic maxim in Berkeley. The maxim is found in Agostino Nifo's commentary on *Aristotelis De generatione et corruptione* (1506, Book I), also quoted by Francis Bacon in *De augmentis scientiarum* (1623, V.4), the Latin version of his *Advancement of Learning* (1605; 2000). See also *Works* II, editor Jessop's note in *Principles* §51.

⁷ For scholars who have non-Western education, a current Western Eurocentric supremacy since early modern times is a mere myth in *homo sapientic* history, which repeats prosperity and decline. On a celebrated typology of twenty-one

colonial distinction between the West and the East, it might be too coarse to describe how the technogenic civilisation has evolved from pre-modern civilisations in human history. However, in one of the interpretations—in the light of culturology—there are typically two types of culture: (1) cultures of technogenic societies in an external approach to objects in the activity of life, and (2) cultures of traditional societies internalising into one’s introspection and meditation.⁸ It appears that culturally, technogenic societies lean towards the former type, whereas traditional societies tend towards the latter. On this macro level, I view that Berkeley’s pragmatist theory of causation straddles the two types of culture. This is because it certainly treats the mechanistically technogenic development at the time, but it does elaborate on the meditation or geometrical reasoning about ‘causes’ within the human epistemic limits and manipulations.

Furthermore, intellectual history reconstructed from the two types of culture is essential to the science-religion distinction. One can see the contemporary developments of physics and mechanics from metaphysics, which was deeply theological in early eighteenth-century Europe. Especially in three scientific disciplines (i.e. physics, astronomy, and evolutionary biology), there are philosophical and theological implications, respectively. As Ian Barber argues, early modern Newtonian physics had been exceedingly disputed in the twentieth century, primarily because (i) it was *deterministic*, (ii) its epistemology was *realistic*, and (iii) its outlook was *reductionistic* (1990, 95–96). Nonetheless, if such modern criticisms began to stir, then it is the case that the current paradigm is no longer the same as the early modern. In this sense, Thomas Kuhn (2012 [1962]) famously featured Newtonian physics as a prime example of the paradigm shift or, if any, a scientific revolution at the time.⁹

In the early modern Newtonian paradigm of science,¹⁰ in which Berkeley’s *DM* is subsumed, theological issues were intertwined into the metaphysics of science. Certainly, the physicist Ernst Mach (1919, 455–457) remarks that ‘the notions of the constancy of the quantity of matter, of the constancy of the quantity of motion, of the indestructibility of work or energy, conceptions which completely dominate modern physics, all arose under the influence of theological ideas.’ Yet, as it was gradual, this development took well over two centuries from Copernicus (1473–1543) until Lagrange (1736–1813). As was the case with Descartes (*Principia philosophiæ*), early modern laws of nature and motion stems from the divine foundation. In fact, eighteenth-century mechanics (e.g. the views of Euler, MacLaurin, and Lagrange) was to become consciously reticent about theological accounts. However, this does not mean that the scientists suddenly jettisoned metaphysical

civilisations amongst more than 650 primitive societies, see Toynbee 1956, 35–47, table V.

⁸ For the second type of culture by semiotic autocommunication, see Lotman 1990, ch. 2; Stepin 2005, n. 1.

⁹ Whilst Kuhn did not systematise, there is a thesis called ‘Kuhn-loss’ in philosophy of science. In the shift from prior to posterior paradigms, there have been ‘losses’, such as aether and phlogiston, in terms of the ‘relinquishment’ of explanatory power (Hoyningen-Huene 1993, 260–261). Newton and early moderns, including Berkeley (especially in *Siris*), believed the theoretical validity of aether, which has an occult quality in the name of ‘cause’. This ‘mathematical hypothesis’ does not refer to any objectionable entity, but at best a ‘pure aæthereal spirit, which ignites bodies, but is not itself the ignited body, being an instrument or medium’ (*Siris* §221). On a reappraisal of the scientific revolution as outlined previously with Newtonianism and the mechanical philosophy, see also Gabbey 1990; 2002; 2004; Schliesser 2021.

¹⁰ The Newtonian paradigm can better be labelled ‘Cartonian’, including the importance of Descartes and the Cartesians in late seventeenth-century Europe. See also McNiven Hine 1989.

deductions of phenomena from their purposes, i.e. final causality, as well as efficient causes of matter.¹¹

Is theology, then, a science at all? In other words, *utrum sacra doctrina sit scientia* ('whether sacred doctrine is a science')? Saint Thomas Aquinas (1224–74), on the very first pages of *Summa theologiae*, answered in the affirmative, putting theology at the apogee of knowledge (*scientia*).¹² As such, the Christian theology in the Middle Ages was broken down into two kinds: natural theology merging with metaphysics, and a revealed theology or sacred doctrine. Although Thomism was dominant in the thirteenth century, his natural theology, based on Aristotelianism through his mentor Albertus Magnus, was not established scientifically on observation and experiment.¹³ By contrast, in the same thirteenth century, the Franciscans of Oxford, e.g. Roger Bacon (c.1214–94), established the non-Aristotelian experimental science in optics, and also the Silesian Vitello (c.1220–75) developed a method in optics to measure angles of refraction based on the works of Ptolemy and Alhazen.¹⁴ Therefore, it may be argued that Saint Thomas epistemologically failed to make theology a science as we conceive nowadays, because revealed truth did not retain the scientific, or empirical, truth. Hence, from modern perspectives, the Thomist claim that theology should be a science might be contested disquietly, whereas one can justify that the nature of Aristotelian-Thomistic sciences is *not* empirical.¹⁵ The paradigm non-empirical science was geometry back then, before the Newtonian and post-Newtonian paradigms.

On the whole, can we ever articulate the point at which theology ends and science begins? In relation to the micro level of Berkeley's *DM*, I mention one obvious feature of the gradual detachment of science from theology or religion. This concerns a semantic reformulation of the distinction between 'manifest' (i.e. empirical) and 'occult' (e.g. alchemical and magical)¹⁶ qualities—or a naturalistic redefinition of the latter unobservables—since the fervent Renaissance period (Kearney 1971, ch. 4). According to John Henry (2008, 30–35), occult qualities came to

¹¹ Mach 1919, 466; Russell 1913; Kuhn 1971, etc.

¹² Aquinas 1947, *STh* I, q. 1, a. 2; Benoît 1997; Bobik 1998.

¹³ On the '*Doctor universalis*' Albertus's empirical achievements in natural science and alchemy, especially introducing the mass of new Latin translations of Aristotle's works through Arabic commentators (Avicenna and Averroës) to his disciple Thomas, see Hannam 2011, 83–87; Wallace 1972 I, ch. 3; Wootton 2016, 355.

¹⁴ Benoît 1997, 292–296; Hannam 2011, ch. 9; Wallace 1972 I, 47–50; Wootton 2016, 321, 370. Despite the methodological influence of his mentor Robert Grosseteste's (c.1168–1253) Aristotelian teaching (e.g. demonstration in *Posterior Analytics*), Roger Bacon ended up developing non-Aristotelian approaches to experimentation, such as reflection and refraction, necessary for mathematical reasoning. In *Opus majus* pt. 6 '*Scientia experimentalis*' (experimental science/knowledge), Bacon famously postulated (1897 II, 201): '*argumenta non certificant haec [...] nullus sermo in his potest certificare; totum enim dependet ab experientia*' (arguments do not ascertain this [...] no discourse can ascertain, for everything depends on experiment). As will be shown, I do not translate 'experientia' as the more general word 'experience' but more specifically 'experiment' or 'experimentation', because the latter is the case for both Bacons (including Francis in the seventeenth century) and Berkeley in their scientific experiments like optics and mechanics. On the other hand, slightly differing from the two Baconian experimental methods, I read that the Berkeley of *DM* emphasises the utility of geometrical reasoning as mathematical-mechanical method, albeit based on experimentation (*experientia*) and sensation (*sensus*).

¹⁵ See also Hutchison 1983, 307, nn. 18–20.

¹⁶ By 'occult', medieval to early modern philosophers meant something hidden or unobservable qualities in the external world, such as gravity and aether. In the astrology of Pico della Mirandola (1463–94), such qualities were attributed to the properties of light (*Disputationes adversus astrologiam divinatricium*, posthumous; Ingegnò 1988, 240–242).

play an exceedingly important rôle in natural philosophising since the sixteenth century or the height of Renaissance Aristotelianism, even though Aristotle himself argued very little about the distinction of those qualities.¹⁷ Certainly, the natural magic tradition in the Renaissance inherited the medieval Aristotelianism of Saint Thomas, Albertus Magnus, Avicenna, and Alkindi, whilst the notion of occult qualities triggered the reformation of natural philosophy, let alone the demise of Aristotelianism (i.e. the theory of substantial forms). But in the seventeenth to eighteenth centuries, to what extent had occult qualities been banished in the reformed natural philosophising of Isaac Newton (1643–1727)¹⁸ and the Newtonians (e.g. Clarke against Leibniz)? As Keith Hutchison spotlights (1982, 250–252), for Newton and the Newtonians in the debate with the Cartesians, occult qualities of objects, such as gravity and attraction, were indeed expunged as something ‘insensible’ but not as something ‘unintelligible’.¹⁹ In other words, the two adjectives became separate connotations in predicating occult qualities of objects. This is because those qualities simply banished objectionable traits as entities without empirical evidence, whilst observed effects have hitherto made sense even though their *causes* are not understood.

This unintelligibility of mechanical causes that refer to occult qualities is so important for the Newtonians that Berkeley’s reception of them should be considered in more depth. For, on my view, this is the point where one can distinguish his pragmatic use of the term ‘cause’ and causal vocabulary such as ‘force’ and ‘mathematical hypothesis’ as opposed to that of the Newtonians. Where the Newtonians and mathematicians of his day still retained metaphysical and theological connotations of the unintelligible causes in mechanics and dynamics, I interpret that Berkeley strictly distinguished metaphysical and mechanical causes and accentuated the pragmatic values of the latter. As Kuhn suggests (1971, 8), the philosopher and the historian ought to be ‘sensible’ or sensitive to linguistic ‘nuances’ in the analysis of the notion of ‘cause’. To this effect, I argue that the Berkeley of *DM* is sensitive to the meanings of causes and causation, regarding to what extent causal vocabulary refers to exact entities, or objects, in his experimental *and* mathematical reasoning. Indeed, ostensibly, he abandons *insensible* and *unintelligible* ‘occult qualities’ in *DM* (emphasis added):²⁰

§4. [S]ince the cause of the descent of heavy bodies is *unseen and unknown*, gravity in that sense cannot be said to be a sensible quality. It is therefore *an occult quality*. But one can scarcely—and, indeed, not even scarcely—conceive [*concipere*] what *an occult quality* is, or

¹⁷ Amongst the Renaissance proponents of occult qualities, such as Paracelsus, Jean Fernel, Marsilio Ficino, and Cornelius Agrippa (*De occulta philosophia*, 1533), a representative is Pietro Pomponazzi (1462–1525). His secular Aristotelianism about epistemological and physical explanations of *occult* phenomena and causes, exclusive of demonic intervention, can be seen as a stepping-stone to post-Renaissance natural philosophy, or naturalistic accounts on the level of human *experientia* (*De naturalium effectuum causis sive de incantationibus*, 1520; Copenhaver 1988, 273). See also Ingegno 1988, 242–244; 1980, 520; Copenhaver 1990, 281; Wallace 1972 I, 139–140; Rossi 1968.

¹⁸ It should be noted that Newton’s interest in magical aspects such as alchemy was so enormous that John Maynard Keynes (1947, 27) once regarded him as ‘the last of the magicians, the last of the Babylonians and Sumerians, [...] the last wonder child to whom the Magi could do sincere and appropriate homage’. See also Henry 2008, 3–4; Iliffe 2017, ch. 6.

¹⁹ See also Hutchison 1983; 1991; Henry 1994; 2004.

²⁰ For Berkeley’s mention of ‘occult qualities’, see more in *DM* §§5–6, 23.

how any quality could act or could do anything. Therefore, it *would be* [foret] better if, *having dismissed occult qualities*, people *were* to consider only sensible effects and if the mind *were* focused on particular and concrete things, that is, on things themselves, by *omitting abstract terms* (however useful for speaking) from the meditation [*meditatione*, reasoning].

It is crucial to seize two points in this gobbet: (i) the distinction of ‘unseen’ and ‘unknown’, or insensibility and unintelligibility, and (ii) that the dismissal of occult qualities is articulated in a subjunctive, conditional sentence (with ‘foret’ of the verb *esse/sum*). It is not baffling that Berkeley admits the insensibility of qualities that mechanical causes have, such as a gravitating cause or ‘gravity’. By contrast, it is arguable that he actually rejects the unintelligibility of those qualities on the grounds of pragmatic utility to formulate from the causes.

On the second point above, I argue that Berkeley, in the subjunctive mood, counterfactually imagines the *better* scenario at a possible world than in reality. I do mean *counterfactual* conditionals, when they come down to the inconsistency between the antecedent and the consequent, namely, the assumption of expunging occult qualities and the result that we still have manifest effects from the causes that describe something occult. To that effect, in correcting our ordinary ‘mode of speaking’ (*DM* §1),²¹ it makes sense to define the use of ‘abstract terms’ or causal terms, like ‘gravity’ and ‘force’, and refine our ‘meditation’ or mathematical reasoning in approaching what is possibly conceivable in scientific discourse. However, in reality, abstract terms to theoretically describe occult qualities *are* deployed and useful for the mechanist in mathematical reasoning. On the one hand, due to occult qualities, abstract (general) terms are fundamentally and intensionally unintelligible inasmuch as they have no objects to describe. On the other hand, however unintelligible in an absolute sense, I view that the utility of the terms is extensionally, or as a frame of reference, neither *dismissed* nor *omitted* to the extent to which the mechanist like us can scientifically define, deliberate, and express them in our practical manner of speaking. In other words, the limits of conceivability conditioned by those of human knowledge (science) is key to understanding the utility of abstract terms in mechanical causation. Here, in a realist sense, the notions of occult qualities are not reducible to observation sentences, but irreducibly integrated into mechanistic practices to confirm the truth of causation. Therefore, in the epistemic and semantic respects of scientific realism,²² in which we stand to realise something incomprehensible but useful and truthful, Berkeley is ontologically committed to the statements of causation that we can reason to conceive.

As will be teased out in the main chapters, a highlight of Berkeley’s ontological commitment to mechanical causes in abstract terms, or objects for framing causal relations and law-propositions,²³

²¹ For the practice, custom, or ‘mode of speaking’ (*loquendi consuetudine*) and more textual analysis of ‘strict and accurate’ discourse (*DM* §26, etc.), see §3.1.3 and its footnotes.

²² See the end of §0.1.2 regarding my definitions by the theses of Psillos’s scientific realism (2017).

²³ There is a difference between ‘theories’ and ‘laws’, in the sense that the former are an explanation of observed phenomena (effects) and the latter are a prediction of observable phenomena. More importantly, law-propositions that I mean are a hierarchical construction to express causal laws, from the data of causal relations to a level of theories and to the bottom level of fundamental laws. If one regards this hierarchical sequence as a ‘theory-evolution’, they may be called structuralist about theories. However, I do not take a structuralist reading, which realistically takes structural features of theories independent of linguistic formulations within our practices (truth and utility within). But I merely clarify

can be seen in the following sentence of *DM*:

§67. [M]athematical hypotheses, like the attractive forces in the planets and the sun [...] have no stable essence in the nature of things, but depend on the notion of the definer.

When ‘mathematical hypotheses’ as above can be taken to be mechanical causes in abstract terms (in short, causal terms), they do not refer to any essential or existential qualities but *occult* ones. On my reading, such causal terms hinge on the definition or formulation of causation to the extent to which the human mind can conceive in scientific discourse, or in its correct ‘mode of speaking’. Therefore, the mathematical conception of mechanical causes is based on defining or formulating law-propositions about causation, so as to ‘speak’ or deduce them for the definer, the language-user themselves. Moreover, in this context, it cannot be stressed enough how Berkeley confessed his version of the indeterminacy of theories, as Quine argued for it (1960; 2013, ch. 2). In other words, one theory is as good as another, although the truth of each theory (or Quinean observation sentence) is not translatable to the others. To this end, contrasting the theories of ‘impressed force(s)’ by Newton, Torricelli, Borelli, and others (*DM* §67), Berkeley clarifies that ‘force is not something that is certain and determinate [*certam & determinatam*]’ and yet those philosophers can ‘retain the truth in the conclusions’ drawn from their theories. Therefore, it is in the context of theoretical indeterminacy that whatever sufficiently explains mechanical effects is of pragmatic value and truth-value, respectively, for each language-user who defines causal terms.

In this sense of useful truth, I will further argue that the terms of mechanical causes do not refer, but rather *quasi*-refer to occult qualities of objects,²⁴ such as planetary forces, the causes of which are unobservable or unintelligible, and thus indeterminate. Put differently, in contrast to a reference to manifest or sensible qualities, such as ‘mass’, ‘figure’, and corporeal ‘motion’, a *quasi*-reference means a useful signification of *quasi*-objects on their own terms. These causal terms Berkeley calls ‘mathematical hypotheses’ (*DM* §17, 28, 66, etc.) in mechanics, such as ‘gravity’, ‘attraction’, and many types of dynamical ‘force’.²⁵ Thus, on this pragmatic causation in abstract terms, the following full passage in *DM* reads (clarification added):

§7. Many are led into error because they see that general and abstract terms are useful in discourse [*disserendo utiles*] and yet do not sufficiently understand their value [*vim* or truth-value of the proposition]. In part these terms were invented [*inventæ*]²⁶ by common custom [*consuetudine vulgari* or ordinary practice] in order to abbreviate speech [*sermonem* or discourse],

the relationship between mechanical theories and laws, both of which the Berkeley of *DM* expresses. Given my pragmatist reading, my reformulation of Berkeley’s theory of causation is realist about some parts of fundamental laws and theories at work that we can formulate, whereas it is not unconditionally realist beyond our practical, discursive knowledge. See Moulines 1996, 10–12; French 2014, 305; Psillos 1999, ch. 5.

²⁴ I reformulate Kenny Pearce’s interpretation of ‘quasi-referring expressions’ and ‘quasi-entities’. See Pearce 2017c, chs. 5–6; for my discussion, Chapter 5.

²⁵ The ‘mathematical hypotheses’ are useful in deductive demonstration and calculation. These are not meant to prove the unobjectionable ‘nature of things’ having occult qualities, even though the hypotheses quasi-refer to them *qua* quasi-objects. See *DM* §18: ‘it is one thing to serve [*inservire*] computation and mathematical demonstrations, and another to exhibit the nature of things.’ See also Robles 1990, 36.

²⁶ On my rendition that the verb ‘invent [*invenire*]’ is in the same category in geometrical reasoning as ‘frame [*ingere*]’ and ‘imagine [*commisicor*]’, see *DM* §§24, 39; Peterschmitt, forthcoming; footnotes in §3.2.1.

and in part they have been deliberated [*excogitatae*] by philosophers for instruction: not because they are adapted to the natures of things, which are only singular and exist in concrete, but only as they are fit for handing down teachings [*tradendas disciplinas*] since they make notions or at least propositions universal.

To reiterate, in the shared practice of speaking, the definer or mechanist in this scientific context is not concerned by the ‘nature of things’ or persistent essence, but how to ‘hand down’ or deductively express formulated propositions to the others. In this practical sense, mechanical causes, here called ‘general and abstract terms’,²⁷ are ‘useful in discourse’. And yet, Berkeley points to a lack of understanding of the ‘value’ or power of mechanical causes. On my reading, it is the value to make ‘propositions’ (also ‘notions’) *universal* after being ‘deliberated’ or confirmed (*DM* §7).²⁸ In this discursive, pragmatic process of linguistic formulation from ‘terms’ to ‘propositions’ (statements and calculations), which I will unfold step by step, I endorse that the truth-values of law-propositions are judged to be either true or false. Most significantly here, as compatible with the realism that I render, I hold a pragmatist view that what is useful can be confirmed to be true in the discursive process.

Accordingly, in this useful *and* true formulation of causation in our linguistic practice, mechanical causes are *quasi*-referential expressions of causal vocabulary. Such expressions, Berkeley thinks, have the value to form or theorise true (or false) propositions. On the other hand, they are deemed to denote *nothing*, more precisely, *quasi*-objects (or *quasi*-entities) that have *unintelligible* or *unknown* occult qualities. This can be more unpacked in *DM* (emphasis added):

§5. [B]odies are supposed to have ‘force’ [*vis*], but this term is used *as if it signified a known quality* that is distinct not only from motion, shape, and all other sensible qualities, but also from all activity of living things. But it will be obvious to anyone who investigates the matter carefully that, in truth, ‘force’ refers to nothing but *an occult quality*.

That is, the causal term ‘force’ refers to a mere *quasi*-object, i.e. mechanical cause, which has its ‘occult’ qualities that appear to be ‘known’ but are in reality *unknown*. Put another way, the object of the cause is fundamentally unknown. Nonetheless, such mechanical causes are not in formulable into causation. In effect, they have been formulated, deliberated, and expressed in common parlance.

In this way, I take the pragmatist, realist rendition of those mechanical causes in abstract terms. That is, with occult qualities, the causal terms are not reducible to any existence and observation sentences, but they still are theoretically and linguistically at work, where they are useful for mechanistic practices. When they come down to meaningful and useful expressions, the causation that

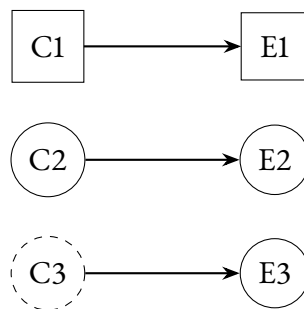
²⁷ It is worth noting that Berkeley’s anti-abstractionism, or nominalism about individual ‘ideas’—that we cannot imagine the same abstract, general, universal objects (e.g. triangles) in our minds—does not apply here to his discussion of mathematical, mechanical practice for our utility in *DM*. See a footnote in §3.2.2.

²⁸ As will be defined and defended, my use of ‘deliberation’ is technically epistemological in confirming the truth-values of propositions, theories, and causal laws. See Fernandes 2017, 694: ‘The deliberative account does not aim to reduce causal relations to evidential relations. But it does aim to derive causal structure from evidential structure. It ultimately aims to relate causation to fundamental laws using evidence as a half-way step.’

they express is already defined and confirmed to be true.²⁹ Moreover, there is a Berkeleyan distinction of empirically sensible, objectionable reference and mathematically occult, unobjectionable *quasi*-reference. By the latter quasi-referential expressions, which are both useful and truthful, we can see the pragmatic utility of conceiving how mechanical causation works from mathematical hypotheses.³⁰ To elucidate this model of causation, the next section will sever it from the other two in *DM*.

0.1.2 Three models of causation

As a frame of reference for the thesis trajectory, I distinguish three models of causation in *DM*: [model 1] metaphysical causation (necessary connection),³¹ [model 2] mechanical causation from an empirical hypothesis, and [model 3] mechanical causation from a mathematical hypothesis.³² In the context of science and religion that the Berkeley of *DM* entertained, they are diagrammed as follows:



For the three models, I postulate that causation is composed of a set of propositions, for instance, ϕ and ψ . Following the definition of J.McT.E. McTaggart (1915, 326–330), we may suppose a relation between ϕ and ψ , which signifies implication in the sense that ϕ implies or entails ψ . If one knows ϕ to be hypothetically true, then one is justified by that hypothesis alone in asserting that ψ is true. By parity of reasoning, if one knows that ψ is consequentially false, then one is justified by the consequent alone in asserting ϕ to be false.³³

Providing this material implication, I consider that three types of *causes* or ‘causal terms’—C1, C2, and C3—are formulated into the respective propositions of causal relations, whilst each of them bears reference to different *objects*.³⁴ C1 entities stand for metaphysical causes that refer to

²⁹ See Pearce 2017c, 86; Chapter 3; *Alciphron* §7.10 (in the voice of Euphranor, clarification added): ‘I presume, you allow there are very evident propositions [...] relating to [the term] force, which contain useful truths.’

³⁰ These kinds of conceptual ‘practical bearings’, which the pragmatist C.S. Peirce repeatedly mentioned, will be textually coalesced throughout this thesis.

³¹ The notion of ‘necessary connexion’ was what Hume sceptically criticised in his *Enquiry* (2000, ch. 7). To the extent that he doubts metaphysical powers or causes but observes mere correlation of transferring objects, Hume is a sceptic. Unlike Humean scepticism, Berkeley is not doubtful about model 1 for his theological and commonsensical reason, but instead, he strictly separates it from the other models of causation in *DM*.

³² See Appendix 1 for my ramification of the three models in terms of 44 instances of the term ‘cause’ in *DM*.

³³ See Paul and Hall 2013, 14; Fernandes 2018. On the logic of causation, see also Mumford and Anjum 2011, ch. 7.

³⁴ By ‘objects’ one may indicate a variety of *real* ‘entities’ of three kinds (causes, effects, and relations) in causal relations, such as ‘events’, ‘agents’, mathematical and qualitative ‘properties of objects’, ‘propositions’ (e.g. that the mass falls),

theological and spiritual objects,³⁵ and C2 signify mechanical causes, or empirical hypotheses,³⁶ that refer to manifest qualities of sensible objects. On the other hand, C3 stand for another type of mechanical causes as mathematical hypotheses, the terms of which do not refer but *quasi*-refer to essence-less objects, i.e. occult qualities. Therefore, in model 3, the perimeter of the C3 circle is dashed or obscured, although E3 is manifestly observed. In particular, I argue that the implication from C3 to E3 is pragmatically understood, because Berkeley finds it useful to mathematically express this mechanical causation within the scope of knowledge that we define. On the grounds of model 3, I will reformulate—and orchestrate—the bishop’s pragmatist theory of causation in *DM*.

As suggested above, a highlight in this thesis is my linguistic distinction of causal vocabulary: (i) ‘causal terms’ that refer to events, and (ii) causation that is propositional (essentially sentential) as a set of fact-like law-statements (propositions about C1, C2, and C3).³⁷ Where causation is theoretically formulable, the expressions that refer to such events or phenomena are (i) singular ‘words’ (*vacabula*).³⁸ They (ii) consist in the formulated sentences, which express—or deductively infer—a certain regularity of nature. Here, the reader may feel uncomfortable with my interpretation that (i) theoretical ‘words’ or causal terms are subsumed under the umbrella terms or phrase ‘mathematical hypotheses’ (*hypotheses mathematicaæ*),³⁹ which I think are not necessarily (ii) law-sentences in *DM*. Usually the hypothesis is deemed to be the ‘assumption’ or ‘antecedent’ of a conditional sentence. In that case, the above three models of C and E, i.e. antecedent and consequent, are understood on the level of sentences or propositions. However, I shall defend my reformulation that mathematical hypotheses (also called ‘suppositions’) are first defined and conceived on the terminological level, as C3 causal terms such as ‘force’, ‘gravity’, ‘attraction’, and ‘impetus’, thereby causation (C3 implying E3) is fully expressed as true and useful in common parlance and scientific practice.

Furthermore, I reformulate that this C3-E3 causation can be rendered as a law-proposition, i.e. the meaning of a certain law of nature or motion. At the beginning of this Introduction, I defined causation as a relation or relations—relating two *objects*, the cause and the effect, where the relation is the third object. Here, in a realist direction, one can stipulate law-propositions as ‘causal laws’ that are framable or theorisable from causal relations.⁴⁰ Different to metaphysical ‘Laws of Nature’ by the ‘Author of Nature’ or God (from model 1 causation),⁴¹ on my reading, Berkeley

and ‘states of affairs’ (if not propositional). Specifically, for the Berkeley of *DM*, I construe that mathematical properties of objects are not *unreal*, albeit unobserved, because they are irreducible objects of either ‘cause’, ‘effect’, or ‘relation’ in formulating causal relations into law-propositions.

³⁵ By ‘spiritual’ Berkeley means ‘animate’ objects or causes, which I think are both divine and human minds/spirits (*DM* §§3, 30–32).

³⁶ On the distinction between models 2 and 3, or empirical and mathematical hypotheses, see also R. Schwartz 2020, 155.

³⁷ On this linguistic distinction similar to mine, see Vendler 1967; Davidson 1967, 703.

³⁸ *DM* §§2, 5, 53–54.

³⁹ *DM* §§ 17, 28, 40, 61, 66–67. On a variety of historical, scientific accounts of the term ‘hypothesis’ from Aristotle, see e.g. Wallace 1972; 1974; 1981; Appendix 3.

⁴⁰ Simon Blackburn’s dictionary is tellingly neutral on the entry of ‘causal law’ (2008): ‘A law of nature framed in terms of a causal relation between two distinct kinds of events, or two distinct features of a system’.

⁴¹ *Principles* §§30ff. On a question about the importance of ‘wandering after second causes’ in the uniformity of nature (*Principles* §32, but also in *Siris* §160), I thank Richard Van Iten (email correspondence, 2022). On my reading of

states mechanistic causal laws (from models 2 and 3) in *DM* (clarification added):⁴²

§28. [J]ust as the truth and use [*veritas* & *usus*] of the theorems of the mutual attraction of bodies remain firm in mechanical philosophy, [...] whatever is said of the rules and laws of motion [*regulis* & *legibus motuum*], and also of the theorems deduced from them, remains unshaken.

§42. [F]rom the knowledge of the laws of nature [*nature legibus*] follow the most elegant theories [*theoriae*], and mechanical practices [*praxes*] useful in life. But from the knowledge of the Author of Nature Himself arise considerations of the very highest order, but these are metaphysical, theological, and moral.

§71. The physicist studies the series or successions of sensible things, by what laws [*legibus*], and in what order, they are connected, what precedes as cause, and what follows as effect.⁴³

These quotations all indicate what is nowadays called the ‘regularity’ theory or the uniformity of nature. Unlike the sceptic David Hume (1711–76),⁴⁴ Berkeley hardly doubts the articulation of causal

Berkeley’s text as a whole, secondary causes like our finite minds do control ourselves and our cognitive, epistemic power, so that we can pragmatically understand the mechanics of the natural order. See also *DM* §§25, 33; Winkler 1989, ch. 5 ‘cause and effect’; Brădăţan 2006, 24, 83; Ott 2009, 110–111.

⁴² On the term ‘law [*lex*]’, see also *DM* §§16 (Newton’s ‘law of inertia [*vi inertiae*]’), 26, 28, 35, 36 (‘laws of motion are appropriately called principles’), 37, 41, 51, 65. According to David Wootton (2016, 370, clarification added):

[I]n the mathematical disciplines [for example, of Roger Bacon, Copernicus, and Petrus Ramus], *lex* was often used as a synonym for *regula*, or ‘rule’, to refer either to natural regularities which could not be shown to be strictly necessary – in other words, where there was no full philosophical (causal) explanation – or to axioms. [...] The term ‘law’ implies unbroken regularities, with no exceptions, but nothing is conveyed about causation. These laws have a specifiable content.

To this extent of the early modern mathematical sciences like mechanics, it appears baffling to connect causal relations and general laws. However, I do connect them heuristically, because Berkeley does so (see the quotations, especially *DM* §71). See also Dear 1995, 157–158; Ducasse 2015, 27; Glennan 2017; Psillos 2002, §5.1 ‘from causation to laws’.

⁴³ Likewise, Hume offers five definitions of causation, including a counterfactual formulation of the first as the second, as follows (Def 1–3 from *Enquiry* §7.29, 2000 [1748]; Def 4–5 from *Treatise* §1.3.14.31, 2007 I [1739–40]):

1. [A]n object, followed by another, and where all the objects similar to the first are followed by objects similar to the second.
2. [W]here, if the first object had not been, the second never had existed.
3. [A]n object followed by another, and whose appearance always conveys the thought to that other.
4. An object precedent and contiguous to another, and where all the objects resembling the former are plac’d in a like relation of priority and contiguity to those objects, that resemble the latter.
5. A CAUSE is an object precedent and contiguous to another, and so united with it, that the idea of the one determines the mind to form the idea of the other, and the impression of the one to form a more lively idea of the other.

See also Ott 2009, 238. In contrast to my construal from *DM*, Walter Ott (2019, 8) argues that Berkeley’s formulation of law-propositions is dissimilar to the above Humean regularity theory, because ‘Berkeley embraces a single concept of a law of nature, namely, a rule God follows in producing events’ and thus ‘the truthmaker of a Berkeleyan law statement is not a regularity.’ Whilst I concur with Ott that Berkeley’s law-statements have sense and thus can be either true or false (unlike the instrumentalist reading), I contend that they also apply to the finite mind’s conception of causal laws in *DM*. For my pragmatist defence, albeit similar to Ott’s line of argument, see Chapter 4.

⁴⁴ Here, it is arguable that Hume is not a straightforward successor of Berkeley, but rather of Nicolas Malebranche. For, if one subtracts the concept of God from Père Malebranche’s occasionalism (viz. occasional causation that everything except God is a mere occasion on which He acts), then Hume’s scepticism about causation is quasi-occasionalist. Moreover, both the père and the sceptic can be labelled empiricists in discovering and confirming no necessary connection

laws in ‘mechanical practices’ (§42). Indeed, deductively, the laws of motion or causal laws are ‘unshaken’, namely confirmed, for the ‘truth and use’ of theorems regarding bodily ‘attraction’—causal term—remain ‘firm’ (§28). Therefore, it is the task of the physicist or mechanist to ‘connect’ mechanical causes like ‘attraction’ and ‘force’, however unobservable in model 3, to their ‘sensible things’ or observable effects (§71). I argue that from these causal relations, the laws or law-propositions can be formulated and pragmatically expressed by maintaining the truthfulness and usefulness.

As is conducive to the scientific realist understanding of causal laws, I follow Stathis Psillos’s three theses (2017, 209–210):⁴⁵

Metaphysical Thesis The world has a definite and mind-independent structure.

Semantic Thesis Scientific theories are truth-conditioned descriptions of their intended domain. Hence, they are capable of being true or false. The theoretical terms featuring in theories have putative factual reference. So if scientific theories are true, the unobservable entities they posit populate the world.

Epistemic Thesis Mature and predictively successful scientific theories are well-confirmed and approximately true. So entities posited by them, or, at any rate entities very similar to those posited, inhabit the world.

Within the purview of this Psillosist realism, I consider that all the three theses apply to [model 1] metaphysical causation and [model 2] mechanical causation from empirical hypotheses, whereas the metaphysical thesis does not to [model 3] mechanical causation from mathematical hypotheses. Because there is a division of labour between the two domains of metaphysics and mechanics,⁴⁶ whatever the mechanist cannot handle within their knowledge is to be dealt with in the higher metaphysical (theological and moral) domain by the ‘Author of Nature’ or God (*DM* §42 above).⁴⁷

between the ideas of entities. See also Pyle 2003, ch. 10; Malebranche 1997b, 433–434. On the other hand, Hume himself and Humeans should be distinguished. For example, a prominent Humean David Lewis clarified contemporary Humean positions in his letter to Terence Horgan (7 November 1974; 2020 II, 39, emphasis added):

I found it a little misleading that you first said that you would assume a Humean conception of *causation* as involving *general laws*, but then turned out to be willing to work within a *counterfactual analysis*. Historically, the latter is also Humean; but it’s not in the tradition from Hume to Mill to Hempel and Mackie that I thought you had in mind. General laws enter the analysis only indirectly, if at all.

As such, Lewis does not regard his own ‘counterfactual analysis’ in the tradition from Hume, which does not concern Hume’s criticism of the uniformity of nature (‘general laws’) in the idea of necessary connection (‘causation’).

⁴⁵ See also Psillos 1999, xvii; 2002; Psillos and Ioannidis 2019, §2.3.3.

⁴⁶ *DM* §§42, 72, etc.; *Notebooks* §855: ‘N. We must carefully distinguish betwixt two sorts of Causes Physical & Spirituall.’ See also Immerwahr 1974, 154.

⁴⁷ Psillos rightly notes (2017, n. 3) that the ‘clockwork of nature’ is the structure where God regularly and constantly produces effects in nature (*Principles* §60). This relates to Berkeley’s teleological conception of metaphysical causation: i.e. ‘any final cause assigned of an innumerable multitude of bodies and machines framed with the most exquisite art’ (§60). Together with efficient causation (i.e. divine creation), final causation that conserves all the created bodies, as it were in the clockwork, is interpreted as (mere) conservationism (viz. the causation of created bodies is independent of divine creation whilst God merely conserves them). This is a minority view in the medieval scholastic debates over causation, distinct from occasionalism (viz. God is the sole cause) and concurrentism (viz. God and created secondary causes concur to produce effects). See Freddoso 1988; 1991; 1994; Stoneham 2018, 43. On my reading that Berkeley is one of the ‘few followers’ of the conservationist, Durandus Saint-Pourçain (c.1270–1334), see *Correspondence* with Samuel Johnson (1729, §3) in a footnote of §2.3.2; Oda 2018; *DM* §34: God as ‘creator and conservator of all things’.

Put differently, there is no mind-independent structure (against the structural realist reading of Stoneham and Cei 2009), but what is definite is the extent of truthful and useful knowledge that the mechanist as ‘definer’ can formulate, confirm, and express in practice (*DM* §67). To this extent, model 3 causation is pragmatically and realistically conceived with the other semantic and epistemic theses. That is, occult qualities are irreducible to observation sentences about empirical kinematics (against the reductionist reading of Hinrichs 1950, et al.). Moreover, mathematical hypotheses with *quasi*-reference to the occult qualities are formulated into the causation, whose dynamical effects are useful, and their law-propositions are meaningful and confirmed to be true or false (against the instrumentalist reading of Newton-Smith 1985; Jesseph 1992, et al.). This line of reformulation (against the three opposing readings) will be endorsed in the name of Berkeley’s pragmatist theory of causation.⁴⁸

0.2 The context of *De motu*

Before carrying out my reformulation as above, I will carve out a brief history of metaphysics from early modern precursors to Berkeley’s *DM*. In there, I think, the bishop’s pragmatic method regarding truth and utility is entrenched in the definition and formulation of causation. On the one hand, to name a few, Newton, Descartes, and Leibniz had magnificent impacts on the creation of Berkeley’s *DM*. Yet, on my view, these natural philosophers are not distinctly pragmatic, but two of the other early moderns—Francis Bacon and John Toland—really are.⁴⁹ Thus my analysis reinforces the latter two’s influence on Berkeley. On the other hand, it can be debated to what extent Berkeley’s pragmatic method anticipated the later philosophical progress. To insinuate it, I have introduced Hume’s scepticism about causation in the last section, i.e. the idea of necessary connection in the eighteenth century.⁵⁰ Yet, in modern times from the nineteenth to twentieth centuries, one can zero in on Charles Santiago Peirce, a modern-day father of pragmatism amongst quite a few varied pragmatists after him.⁵¹ In the final chapter, I consider Peirce’s reception of Berkeley’s pragmatic method.

Accordingly, this second section puts together two components. §0.2.1 delineates a few key precursors to Berkeley in the settings of metaphysics up to the early eighteenth century. Against this backdrop, §0.2.2 explicates facets relevant to the bishop’s pragmatist theory of causation in

⁴⁸ My reformulation shall be further reinforced by Berkeley’s abductive thinking, or the inference to the best explanation that approaches approximate truths. See Lipton 2004; Chapter 4.

⁴⁹ For more contextual understanding of the natural philosophy and religion between Berkeley and his precursors, see e.g. Robles 2004; Berman 2005; Mercer 2019; Pearce and Oda 2020b.

⁵⁰ For a late eighteenth-century criticism of Berkeley and Hume, ‘leading directly to universal scepticism’, see Beattie 1770, 415. It should be noted that Beattie’s interpretation of Berkeley in the *Essay on the Nature and Immutability of Truth* is restricted to the *Principles* alone (*ibid.*, 9–10), obviating the diversity of Berkeley’s works.

⁵¹ Peirce often self-quoted his pragmatic maxim as follows (‘How to Make Our Ideas Clear’, 1878, *CP* 5.402):

Consider what effects, that might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these effects is the whole of our conception of the object.

See also C. Lewis 1929, 133; Misak 2016 §1.2; 2017; a footnote in §5.3.2.

mechanics, by further zooming in on (i) his other works and (ii) the very *DM*.

0.2.1 Precursors

Early modern metaphysics has developed from Aristotle's meaning of the term *visa-à-visa* the title of his work, *τὰ μετὰ τὰ φυσικά*.⁵² Gary Hatfield differentiates two senses of Aristotelian 'metaphysics' that early modern and modern philosophers, particularly Immanuel Kant (1724–1804), have conceived:⁵³

1. *Μετὰ* in the sense of 'trans'. Metaphysics is 'first philosophy' linked with 'theology', i.e. the study of the prime mover—the divine—above or beyond anything physical.
2. *Μετὰ* in the sense of 'prior with respect to nature', but not 'prior with respect to us'. Metaphysics comes *before* any science as 'first philosophy' investigating into the nature or being qua being, whereas it comes *after* physics in our practice of abstracting something farther from sensory images.

Both senses of metaphysics, albeit incompatible (Hatfield 1990, n. 8), are validly inferred in early modern discussion of natural philosophy, mathematics, and mechanics.⁵⁴ Berkeley certainly appears to hold both of the senses. However, the distinction in the second sense is more vital to my thesis, because he admonishes that we ought to 'distinguish between mathematical hypotheses and the nature of things' (*DM* §66).⁵⁵ In other words, metaphysical causation illuminating the essence of things is strictly distinguished from the abstraction of what he calls 'mathematical hypotheses' in mechanical causation. The latter *non*-metaphysical approach to mathematical abstraction of mechanical causes,⁵⁶ on my reading, pertains to Berkeley's pragmatic conception of causation *with respect to us*.

Moreover, in these early modern settings, I pay particular attention to a historically and philosophically loaded construction of 'cause or reason' (*causa sive ratio*). This Vincent Carraud (2002, 31–33) regards as a 'hapax' in Cartesianism, more accurately, the first axiom of reasons that prove

⁵² A Peripatetic editor, Andronicus of Rhodes (1st century BC) placed the book *after* physical treatises when he first published the complete works of Aristotle (Ando 1974, 3).

⁵³ Hatfield 1990, 97–98, nn. 7–10; Ando 1974, ch. 1; Kant, 'Vorlesungen über die Metaphysik' (1900–28, 174).

⁵⁴ On the first sense of 'metaphysics', for example, see Newton's manuscript 'Preface to the *Principia*' (1999, 53–54, trans. Cohen and Whitman; ULC MS Add. 3968, fol. 109):

Natural philosophy should be founded not on metaphysical opinion, but on its own principles; [...] What is taught in metaphysics, if it is derived from divine revelation, is religion; if it is derived from phenomena through the five external senses, it pertains to physics; [...] And although the whole of philosophy is not immediately evident, still it is better to add something to our knowledge day by day than to fill up men's minds in advance with the preoccupations of hypotheses.

⁵⁵ The quotation is the first of his three-fold admonishment to understand the 'true nature of motion' (*DM* §66): '1^o. *Distinguere inter hypotheses mathematicas & naturas rerum*. 2^o. *Cavere ad abstractionibus*. 3^o. *Considerare motum tanquam aliquid sensible, vel saltem imaginibile: mensurisque relativis esse contentos*.'

⁵⁶ In the mathematical science of mechanics, I take it that Berkeley positively appreciates the deployment of 'general and abstract' words (*voces*) and notions (*notiones*) (*DM* §§7, 23, 31, 39, etc.). Whilst he destructively criticised John Locke's theory of abstraction in his *MI* and its *Principles*, but it is not the case in *DM*. See also Taylor 1978, 108.

the existence of God *more geometrico* ('in a geometrical manner').⁵⁷ In Descartes and Cartesianism, it is worth understanding why the *causa sive ratio* in the sense of creative, productive 'efficient cause' is a typical metaphysical expression in late seventeenth- and early eighteenth-century Europe. For, from this reasoning about divine existence and power, albeit in the manner of geometry, the metaphysics of Spinoza, Leibniz, and Berkeley (*DM* §37)⁵⁸ critically emerged. In fact, the nature of mechanical 'causes' in Berkeley differs substantially from those Cartesians and mathematicians of his day. The latter precursors', rather opponents', view of mechanical causation is intertwined with metaphysically theological causes of efficiency and teleology.⁵⁹ By contrast, Berkeley divides the domains and labours of theological metaphysics and mathematical mechanics (including dynamics). This division will be understood in the context of *DM*, for which the three models of causation were posited in the last section.

In this still deeply metaphysical context after Descartes,⁶⁰ what chiefly comes to mind is the influence of Sir Isaac Newton (1642–1727) in the early eighteenth century. It is of paramount importance in Berkeley's critique of absolute space,⁶¹ time, and motion in formulating the law of

⁵⁷ The phrase '*causa sive ratio*' does originate with Descartes. See his *Meditations*, Second Set of Replies, 'axioms of common notions' I–III (*AT* VII 165; *CSM* II 116, emphasis added):

- I Concerning every existing thing it is possible to ask what is the cause of its existence. This question may even be asked concerning God, not because he needs any cause in order to exist, but because the immensity of his nature is the *cause or reason* why he needs no cause in order to exist.
- II There is no relation of dependence between the present time and the immediately preceding time, and hence no less a *cause* is required to preserve something than is required to create it in the first place.
- III It is impossible that nothing, a non-existing thing, should be the *cause* of the existence of anything, or of any actual perfection in anything.

⁵⁸ *DM* §37: 'assigning its cause, that is, the reason why it occurs'. On a commonsensical (and also ancient) defence of the notion of cause *qua* reason, see Davidson 1963, 685: 'rationalization is a species of ordinary causal explanation.' I take it that Berkeley's pragmatist theory of causation concurs with the Davidsonian causal explanation.

⁵⁹ See Osler 1996; 2001; Carlin 2006; 2006; McDonough 2011. For the efficient-final causation as part of Berkeley's metaphysical model of causation in *DM*, which I argue is the assimilation of the Leibnizian two-kingdom analogy of 'power' (efficient cause) and 'wisdom' (final cause), see Chapter 2.

⁶⁰ Contrary to the absolute conception of space-time and motion in the Newtonian paradigm, Descartes and the Cartesians, such as Christiaan Huygens (1629–95), conceived of motion as relational or exclusively a relation amongst bodies. See Descartes, e.g. *Principia philosophiae* II §§24–25 (*CSM* I: bodies having 'different motions relative to each other'); Huygens 1993, 54–55; Slowik 2016, §1.3; Elzinga 1972, 134. For my reformulation of Descartes's argument in the *Meditations*, where he relates to an absolute void or nothing, but finally rejecting it, see Oda and Bucci 2020, 108, along with the Parmenidean postulate in Meditation III (*AT* VII 41; IX 33; *CSM* II 29): '*ex nihilo nihil fit* [nothing comes from nothing].'

⁶¹ As I read pragmatically, the Berkeley of *DM* considers the uselessness of metaphysically loaded terms that predicate of 'absolute space'. The last sentence of one vital section in *DM* reads (clarification added):

§53. If we take away the terms [like 'pure intellect' and 'spiritual and unextended things, such as minds, their states, passions, powers, and similar objects'] from absolute space, nothing will remain in sense, imagination, or intellect, so that those terms designate no more than pure privation or negation, i.e. mere nothing [*merum nihil*].

That is, absolute space is neither perceived, conceived, nor reasoned. See also Peterschmitt 2013, 31–32. In a context other than *DM*, where Berkeley critiques Newtonian absolute space in relation to God, see *Principles* §117; Peterschmitt 2020.

gravity *relative* to ourselves (*DM* §§55, 63, etc.).⁶² In this respect, the appropriation of Newton by John Toland (1670–1722) in the *Letters to Serena* (1704; 2013) and his attack on the Newtonians and contemporary mathematicians,⁶³ such as Joseph Raphson (1668–1715), will be examined in comparison with Berkeley’s similar approach to the cause of relative, not absolute, motion.⁶⁴ After all, in the Irish early eighteenth-century context, did a sullen cloud of the Donegal heretic Toland have a silver lining of Berkeley? In other words, shall the silver lining eternally shine out? Not quite. However, on my reading of Berkeley’s pragmatist theory of causation in *DM*, it was rather supported by his eminent rival, the ‘free-thinker’ Toland.⁶⁵

Simultaneously, the metaphysics and mechanics of Gottfried Wilhelm Freiherr von Leibniz (1646–1716) are vital to Newton and Toland, respectively, and so are they to Berkeley. I view that all of the three needed the arguable originality of Leibniz to establish their own philosophies different to him. Although it is difficult to decide who the inventor of calculus is between Newton and Leibniz in the Leibniz-Clarke correspondence (1717; 1969), one thing is clear: ‘*Calculemus* [Let us calculate]!’ Thus stated Leibniz.⁶⁶ Indeed, somehow different to Blaise Pascal’s Pascaline (1642) and Thomas de Colmar’s arithmomètre (1820), Leibniz originally designed a calculating machine

⁶² No matter how absolute and essential Berkeley and other commentators have taken Newton’s metaphysics, I am aware that Eric Schliesser soundly argues that Newton’s conception of ‘gravity’, planetary ‘action’, and many mechanical causes is relational, not essentially existential, because the strength of the bodily interaction *only* varies and the value of gravitational mass does not (2021, 20). The evidence is in the *Principia*, Book 3, Rule 3 (Newton 1999, 796): ‘I am by no means affirming that gravity is essential to bodies. By inherent force I mean only the force of inertia. This is immutable. Gravity is diminished as bodies recede from the earth.’ However, Newton does agree here that the mechanical cause ‘inertia’ is immanent in, and essential to, bodies. See also *Principia*, General Scholium (*ibid.*, 943): ‘gravity really exists’; Janiak 2007, 129, 141; 2013; Guicciardini 2018; Schliesser 2005; 2021, ch. 1. More seriously, Andrew Janiak presents another reading that ‘gravity’ is actually a non-mechanical cause, from the General Scholium (Janiak 2007, 142):

Newton’s important contention that gravity is not a *mechanical* cause—or, more specifically, that it does not act ‘as mechanical causes are wont to do’—can easily be interpreted as undermining his claim to have avoided action at a distance, as Leibniz would surely insist. So the plot thickens.

Whilst I do not intend to thicken my discussion over Berkeley’s theory of mechanical causation, it should be noted that there is an interpretative distinction between empirical (sensible) and theoretical (mathematical) notions of ‘*gravitas*’, namely, the ‘heaviness’ of bodies (phenomena) in model 2 and the mechanical term ‘gravity’ in model 3, in my reformulation of causation in *DM*.

⁶³ Not to refute Newton himself but the Newtonian sects in philosophy and the vulgar, Toland translated the final sentence of Definition 3 of the *Principia* on *vis inertiae* (2013, §5.20.201–202, clarification from Newton 1999, 404–405):

The Vulgar attribute Resistance to quiescent [resting bodies], and Impulse [impetus] to movent Body; but Motion and Rest, as commonly conceived, are only respectively distinguish’d from one another, nor are those things always in true Repose, which are vulgarly consider’d as quiescent [being at rest].

For his thesis that matter is inherently active, whence motion and rest are relative to it, Toland quashes the passivity of matter in the ‘quiescent’ state, or the real repose in a void space. See Stewart 1981, 54; Leask 2013, editor’s intro, 31; Schliesser 2020. For more discussion on Toland’s appropriation of Newton, see §1.2.3.

⁶⁴ Toland plagiarised Locke’s *Essay* in section 1 ‘Of Reason’ of his *Christianity not Mysterious* (1696, 2; 1696): ‘the mysteries of the Gospel’ have ‘evidence of reason’. With no acknowledgement, Locke might have been offended by the plagiariser’s utilisation of his religious epistemology, for he had no intention to repudiate what Toland labelled ‘priestcraft’ of Christian practices. See also Pearce 2014, 423; East 2017, 203–210.

⁶⁵ A recent column of the Irish Times by Joe Humphreys 2022, ‘Be thankful for intellectual rivals, they can sharpen your mind’, does resonate with my narrative in this thesis, §1.2.1. See also Johnston 1923; Evans 1991; Duddy 2002; Attis 2014, 63. The term ‘free-thinker’ was given its specific meanings in Berkeley’s *Alciphron*, *Defence*, etc.

⁶⁶ Leibniz, *GP* VII, 125, 200; Breger 2005, 488–489.

called *Staffelwalze* (‘stepped drum/reckoner’) in 1673. Thereby he envisioned practical mechanisms for an algorithmic logic. This invention is merely one example of the mathematician Leibniz’s mechanistic application. Here, in the early modern context of mechanics rooted in geometry,⁶⁷ the notion of *mathesis universalis* (‘universal mathematics’) in Leibniz is not unique, but he aimed to accomplish it on his own terms.⁶⁸ In the scope of logics and mathematics, therefore, I highly evaluate Berkeley’s critical reception of Leibniz, although it is not a pragmatic sense when citing him in *DM*.⁶⁹

On the other hand, in a slightly earlier modern context of science *contra* Aristotelian metaphysics and logic, the influence of Francis Bacon, Lord Chancellor of England (1561–1626) upon Berkeley is significant regarding a correct use of language—not to lead us into error.⁷⁰ In his doctrine of four *idola* (‘idols’),⁷¹ which are misleading and malfunctioning, the greatest light shall be shed on the third *idola* of the market.⁷² These idols occur by the cause of abused words, or the discrepancy in linguistic usage between ordinary people in the market and intellectual people who do not speak at the market-based rudimentary level. This is because the way intellectual people speak hinges on general terms, which are too much abstracted from the vulgar, common use of language in the market.⁷³ Thus, in the human mind, the abuse or uncommunicative use of language between different trades causes incomprehensibly or uselessly general ideas abstracted from words.

In addition to this linguistic aspect, Berkeley constantly eschewed *false and vain* ‘barren speculations’ against ‘our *duty*’ in fulfilling human nature ‘to know and to practice’, whilst in favour of ‘the consideration of *God*’ (*Principles* §156, the final section). Provided Bacon’s impact on Berkeley, the phrase ‘barren speculations’ can be understood from a similar expression in Bacon’s pragmatic criticism of old sciences from Greek philosophy: ‘productive of controversies’ but ‘barren

⁶⁷ Newton 1999, *Principia*, Preface (emphasis original):

Therefore *geometry* is founded on mechanical practice and is nothing other than that part of *universal mechanics* which reduces the art of measuring to exact propositions and demonstrations.

See also Dear 1995, 210–213; Boudri 2002.

⁶⁸ Leibniz, *GM* VII, 53–54, etc.; Mittelstraß 1979, 603–607; Rabouin 2009, 11–21; Beeley 2013.

⁶⁹ On Leibniz’s deductive system, closer to logicism than to formalism, Kneale and Kneale 1971, 331; Ishiguro 1990, 99.

⁷⁰ *Notebooks* §564: ‘I Doctrine of Abstraction of very evil consequence in all the Sciences. Mem: Bacon’s remark. Entirely owing to Language.’

⁷¹ The four *idola* in the *Novum organum* (1620) are: (i) idols of the tribe, (ii) idols of the cave, (iii) idols of the market, and (iv) idols of the theatre (2004, Book I, aphorisms 38–44). On the first idols of the tribe—cognitive deficiencies that everyone shares, such as erroneous over-estimation, Bacon laments (aph. 45): ‘The human understanding is of its own nature prone to suppose the existence of more order and regularity in the world than it finds.’ See also Garber 2016, 565.

⁷² For the *idola* of the market concerning ‘speech and wordes’, though without reference to the term ‘idols’, see the *Advancement of Learning*, 2000, 2P3^f–2P4^v. There, Bacon objects to Aristotle’s three-fold semantic theory in *De interpretatione*, 1.1: ‘*Wordes are the Images of Cogitations, and Letters are the Images of Wordes*’ (2P3^f), for the ‘cogitations’ or concepts are not necessarily ‘expressed by the Medium of Wordes’.

⁷³ In the sense of remedying the *idola* of the market, Berkeley at least twice stresses this medieval maxim: ‘think with the learned, and speak with the vulgar [*sentiendum ut pauci, loquendum est ut plures*]’ (*Principles* §51; *Alciphron* §1.12). See also White 1955; Van Iten 2015. On my pragmatist reading, the Berkeley of *DM* is in the same spirit as this maxim.

in works'.⁷⁴ In this way, assuming that Berkeley eagerly read Bacon's works,⁷⁵ the roots of his inclination to pragmatism can be found in Bacon's new method to procure truth and utility,⁷⁶ however inductive.⁷⁷

Therefore, what Berkeley critically (or uncritically) learnt from the above early modern precursors' works is crucial to his philosophical development. In the next section, I will tersely portray who the bishop was and the relationship of his earlier to later works and *DM*.

0.2.2 Bishop Berkeley

Berkeley is nowadays a contentious figure *qua* white-supremacist, élitist, and racist vis-à-vis the *others* subordinated to his privilege—the native Irish, Roman Catholics, enslaved black people,⁷⁸ and Native Americans.⁷⁹ Because of his purchase of three to four slaves in c.1730 and uncountable negative comments on those suppressed people, the popularity of Berkeley studies may falter in future. Indeed, I am aware how inexorably his conservative (Tory) philosophy had been interwoven

⁷⁴ 'Preface to the *Instauratio magna* [Great Instauration]', 1620; 2004, A1^V. *Novum organum* is Part 2 of the *Instauratio*. I take it here that under the surface of critiquing ancient Greek philosophy, Bacon clarifies the uselessness of old ways of thinking including pure mathematics, likened to the fable of Scylla, who had 'the face and countenance of a virgin, but a womb begirt with barking monsters' from which she could not be delivered (*ibid.*, A1^V). See also Bacon, *Advancement* 2000, 2B3^V; Berkeley, 'Anniversary Sermon', 1731 (*Works* VII, 116); his wife Ann's remark 'he was very Pious & his studies were not barren speculations', in Jones 2021, 440; Moriarty, *forthcoming*(b). I thank Clare Moriarty for underlining the relationship between 'barren speculation(s)' and pure mathematics in Bacon-inspired Berkeley.

⁷⁵ See 'A catalogue of the valuable library of the Berkeley family' (Leigh and Sotheby 1796; BL S.C.S. 28), auctioned for six days in 1796; Appendix 3. According to the catalogue, though some books might have been purchased by his son and grandson, Berkeley owned: #398. Bacon's *Elements of the Common Laws* (1639); #485. *Baconi Opera* (1665); #498. *Baconi Opus Majus* (1733); #1408 *Bacon on Good and Evil* (1706).

⁷⁶ *Novum organum* 2004 I, aph. 124 (clarification added): 'truth and utility are [in the distinction arbitrary *idols* of the human mind and authentic *ideas* of the divine stamped upon the human mind] are the very things themselves.' See more quotations from Bacon's works in §1.1.2.

⁷⁷ Bacon established the logic of gradual and untrodden 'induction' to truth (*ibid.* I, aphs. 19, 40):

The other way draws axioms from the sense and particulars by climbing steadily and by degrees so that it reaches the ones of highest generality last of all; and this is the true but still untrodden way. [...] The calling up of notions and axioms by true *Induction* is certainly a sovereign remedy for restraining the *Idols* and driving them off.

Remarking this new approach to the certainty of truth, Bacon brought to light the inadequacy of the Aristotelian paradigm of scientific discovery, disputing about 'useless [*inutilis*]' Aristotelian syllogistic methods (I, aph. 11). See also Cassan 2021, 255–257; Jardine 1974, 76–79; Rossi 1968, ch. 4.

⁷⁸ Berkeley was uncritical about slavery, unlike his contemporaries like Francis Hutcheson (1694–1746; 1755 I, 125) and late eighteenth-century abolitionists like James Beattie (1735–1803; 1770, 484).

⁷⁹ Popkin 1974, 246; Uzgalis 2005, 114–116; Breuninger 2010; Jones 2021, ch. 7; Oda, *forthcoming*. Berkeley's verbal offences are obvious, such as fomenting a kidnap of 'savage' Americans under the age of ten years ('taking captive the Children of our Enemies') to educate at St Paul's college on Bermuda (*Proposal*, 1725; *Works* VII, 374). Setting aside his pursuit of truth in philosophy and science, I view him as pursuing public fame at the cost of many verbal offences to the others. Put another way, Berkeley did not gain momentum on his own. Here is one example in the case of his *Siris* (1744). Whilst the Bermuda project itself was a blunder, during his Bermuda expedition (1728–31), he heard of the reports of the custom and efficacy of tar-water by Native Americans. The later success and popularity of *Siris*, where Berkeley extolled drinking tar-water as a 'panacea' (made from the resin of pine and spruce-fir trees), could be nothing but thanks to the ancient American tradition. This analysis cannot be stressed enough, although the medical usage in America is indeed acknowledged along with the ancient Macedonia, the Atlas mountains (reported by Leo Africanus), and Norway. See *Siris* §§1–2, 17, 108; *Letter to Thomas Prior* (*Works* V), 172, 182, etc.; Chance 1942, 454–458; O'Grady 2009.

with British imperialism, colonialism, and Anglicanism (Church of Ireland) of his day. However, my thesis does not argue these issues of political ideology, albeit commonsensically and socially influencing his pragmatism.⁸⁰ Rather, I take issue with existing literature in Berkeley scholarship by my tripartite definition of a pragmatist theory of causation (§0.3). The definition incorporates realist aspects of occult qualities into the usefulness and truthfulness of mechanical causation, formulated from mathematical hypotheses.

0.2.2.1 Other works

In his early ‘heroic phase’ in Dublin until 1713 (Berman 1994; 2005, 38), publishing the *NTV* (1709),⁸¹ *Principles* (1710), and *Dialogues* (1713), Berkeley bootstrapped a perceptual, epistemological theory of immaterialism, the thesis against mind-independent substantiality. As he declared, ‘*existere is percipi or percipere [to be is to be perceived or to perceive]*’ (*Notebooks* 1707–08, §429).⁸² In fact, A.A. Luce assumes that *DM* ‘is the application of immaterialism to contemporary problems of motion, and should be read as such’ (*Works* IV intro, 3). Likewise, Stefan Storrie endorses that the Berkeley of *DM* holds immaterialism in consonance with the distinction between natural science and metaphysics (2012a, 353). Contrastingly, Lisa Downing argues that Berkeley’s scientific explanation rests on no distinctive metaphysics at all, such as his previous immaterialism or idealism, but rather stems from his ‘rigidly empiricist epistemological views and a certain thesis about the requirements of reference’ (1995a, 199).⁸³ Throughout the main chapters, I examine if those are correct renditions of *DM* concerning Berkeley’s metaphysical and mathematical development of his theory of causation in the immaterialist vein.

Furthermore, there are many writings in mathematics by Berkeley, before and after *DM*. On the one hand, the *Analyst* (1734) and *Defence of Free-Thinking in Mathematics* (1735) cannot be ignored in the interests of Berkeley’s analysis of calculus and mathematical methods.⁸⁴ On the other, putting aside ‘Of Infinites’ (1707), a set of *Arithmetica* and *Miscellanea* was published in 1707 for his preferment to be a fellow at Trinity College, Dublin. Not only is this set the very beginning of publication by Berkeley (before what is called his early ‘heroic phase’), but also I take it that his insight into arithmetic and algebra can be seen as what we nowadays call ‘logicism’ (viz. logic is the ground of mathematical truth),⁸⁵ instead of ‘formalism’ (viz. mathematics consists

⁸⁰ See also Ardley 1968, ch. 10; Van Iten 2015; Caffentzis 2000, 266–267.

⁸¹ For the chronology of Berkeley’s publications with full titles, see [Abbreviations](#).

⁸² *Principles* §3: ‘*esse is percipi.*’ *Dialogues* 3.236: ‘it is infinitely more extravagant to say, a thing which is inert, operates on the mind, and which is unperceiving, is the cause of our perceptions[, without any regard either to consistency, or the old known axiom: *Nothing can give to another that which it hath not itself*].’ Although the bracketed part was deleted in the third edition of 1734, that scholastic axiom ‘*nemo dat quod non habet*’ is a key premiss for Berkeley’s immaterialism.

⁸³ See also Pearce 2017c, 86–87; 2022.

⁸⁴ See e.g. Pycior 1987; 1997; Jesseph 1993; Sherry 1993; Moriarty 2018a; 2018b; 2021.

⁸⁵ There must be a transition of the meanings of mathematical disciplines, such as arithmetic (*arithmetica*). On the medieval meaning, Michael Masi ably puts it (1983, 148):

What we understand by arithmetic, that is the practical use of the four mathematical operations of addition, subtraction, multiplication, and division, was referred to in the Middle Ages as *computus* or

of the rules of manipulation irreducible to logical truths).⁸⁶ In the twentieth-century context, a problem of logicism is duly considered, for instance, by Paul Benacerraf in terms of the collapse of ‘translatability’ of mathematical propositions that are not necessarily ‘reducible’ to those of logic to be analytic (2016, 278–279).⁸⁷ In the analysis of truth, was Berkeley not concerned with the reducibility of mathematics to logic? He is not quite a logicist in the modern sense since the early twentieth century. However, construing his commitment to defining the truth in logic first before deliberating over mathematical rules, I consider that Berkeley had a realist tendency towards logicism since his *Arithmetica* and *Miscellanea* (1707).

Simultaneously, what I should highlight amongst Berkeley’s writings in accordance with *DM* is *Siris* (1744), with respect to his integration of mechanical philosophy into the adoration of ‘tar water’ as a medical panacea. Without delving into the platonist and neoplatonist discussion as well as corpuscularianism in it,⁸⁸ I quote one supportive passage from *Siris* §234 in full (emphasis added):

Mechanical laws of nature or motion direct us how to act, and teach us what to expect. Where intellect presides there will be method and order, and therefore rules, which if not stated and constant would cease to be rules. There is therefore a constancy in things, which is styled the Course of Nature. All the phenomena in nature are produced by motion. There appears a uniform working in things great and small, by attracting and repelling forces. But the particular laws of attraction and repulsion are various. Nor are we concerned at all about the forces, neither can we know or measure them otherwise than by their effects, that is to say, the motions; which motions only, and not the forces, are indeed in the bodies. Bodies are moved to or from each other, and this is performed according to different laws. The natural or mechanic philosopher endeavours to discover those laws by experiment and reasoning. But what is said of forces residing in bodies, whether attracting or repelling, is to be regarded only as a mathematical hypothesis, and not as anything really existing in nature.

This reveals Berkeley’s consistent interest in mechanics. As the last sentence is telling, the distinction

algorithm, which was the Greek practical mathematics, *logistikē* (λογιστική).

I suppose that Berkeley had in mind this practical sense of arithmetic (and also of algebra) in his mathematical thinking. See also *Alciphron* §7.17 (1732, 2nd ed.): ‘logistic operations’, quoted in §1.1.1.2.

⁸⁶ On my favouring logicism over formalism about mathematics in Berkeley, see §1.1.1.1.

⁸⁷ Logical propositions on Benacerraf’s mind (2016, 279) are set theory, model theory, Russell’s ‘no class’ interpretation of *Principia Mathematica*. Indeed, after its heyday in the 1920s, formalism was likewise rebutted by Gödel’s incompleteness theorems of 1931. See also Detlefsen 2005; Simons 2009; Hintikka 2009.

⁸⁸ Corpuscularianism is an early modern theory of the interaction of ‘corpuscles’ as both sensible and theoretical particles, also called ‘*minima*’ (*minima visibilia*, *minima tangibilia*, particles of light, fire, aether, etc.). The theory is not unique to Berkeley (from *Notebooks* to *Siris*), but common to his precursors in natural philosophy, such as Robert Boyle and Newton. However, each of them does not hold the self-same corpuscularianism. In fact, Berkeley does not straightforwardly subscribe to Locke’s hypothesis of ‘real essence’ and Descartes’s hypothesis that the extended, material ‘plenum’ is infinitely divisible (Moked 1988, 175–176), because he refers to nothing about *minima* or minute corpuscles in *DM*. Although the relationship between *DM* and *Siris* calls for further investigation, on my view, what is common is Berkeley’s realism about the irreducibility of occult qualities, such as aether, which are fundamentally unintelligible but useful in common parlance. See also *ibid.*, appendices C–E; Robles 1990, ch. 2; Downing 1995b; Li 2022.

between the ‘mathematical hypothesis’ and real existence in nature is significant, for bodily ‘forces’, be they ‘attracting or repelling’, are taken to be the former. Mathematical hypotheses are not objectionable causes that we cannot ‘know or measure’, whereas the ‘effects’ or ‘motions’ are known and measured. Model 3 causation can be understood in this context, where formulating ‘mechanical laws of nature or motion’ is deemed to be useful for our needs and practices (viz. ‘direct[ing] us how to act’ and ‘teach[ing] us what to expect’). Therefore, in a pragmatist manner, we can see here the connection between Berkeley’s other works and *DM*. At last, the very text will be contextualised as below.

0.2.2.2 *De motu* (1721)

The following is the title in full:

DE MOTU; sive de MOTUS PRINCIPIO & NATURA, et de Causa Communicationis Motuum [On Motion; or on the Principle and Nature of Motion, and on the Cause of the Communication of Motions].

To simplify, the title is telling in the interests of Berkeley’s points of view on (i) the ‘principle’ or law of motion, on the one hand, and (ii) the ‘nature’ or essence of motion, on the other. In this two-fold approach to ‘the cause of the communication of motions’, Berkeley’s theory of causation can be broken down into three types in my analysis of *DM* (§0.1.2). Put differently, the transfer of motions indicates the respective ‘effects’ of three different ‘causes’ or causal terms—C1, C2, and C3. Therefore, the three different types of causal relations are applied to Berkeley’s conception of (i) causal laws and (ii) causal essence in *DM*. Light shall be shed on the distinction between metaphysical causation of C1 implying E1, e.g. (i) Hylarchic principle and (ii) vital essence of the animating spirits, and mechanical causation of C3 implying E3, e.g. (i) Newtonian law of gravitation and (ii) occult quality that the mathematical hypothesis ‘gravity’ refers to. Whilst the C2-E2 causation from empirical hypotheses are differentiated,⁸⁹ the C3-E3 causation in the domain of mechanics shall be defined pragmatic in mathematically theorising and expressing the transfer of motions.

Before this thesis is tessellated with a set of definitions, interpretations, and reformulations of *DM*, it is well worth noting the background of the text here. It is suggested that Berkeley might have originally intended to write this short treatise from his conversation and correspondence with Tommaso Campailla (1668–1740), a Cartesian poet in Sicily, whilst it is uncertain that he really intended to submit it to the first prize competition of the Paris Académie royale des sciences in 1720.⁹⁰ Except for some letters and the manuscript of his travel notes in Italy,⁹¹ what is very much

⁸⁹ As G.J. Warnock lucidly puts it, the Berkeley of *DM* ‘relied on a distinction between *observed facts* of science, and the *theories* constructed to comprehend them’ (1969, 202, emphasis original). I take it that model 2 causation empirically hinges on the former observation, whereas model 3 is the latter. See also R. Schwartz 2020; Peterschmitt 2003; forthcoming.

⁹⁰ Charles 2009, 32–34, n. 29; Brykman 1993, 332; Jones 2021, 271–272. On the Paris Académie, see Appendix 1.

⁹¹ ‘Journals of Travels in Italy’ (1717–18); *Works* VII; BL Add. MS 39307–39310 (microfilm copy in the National Library of Ireland, n. 973–974, p. 1061–2).

uncertain is the period of his early transition between the his *heroic-phase* publications (1707–13) and the *DM* publication (1721). After a long Continental tour,⁹² he reached London, but we have little record between 1720 and 1721.⁹³ Unclear as the exact date may be, it is certain that Berkeley published *DM* in London sometime before September 1721, before he returned to Ireland and Trinity College, Dublin for his preferment in the Michaelmas Term.⁹⁴

More certain is the fact that Berkeley published *DM* at least three times in his lifetime: First London 1721; First Dublin 1752; Second London 1752.⁹⁵ According to a highly close textual analysis by the editor and translator Bertil Belfrage ([forthcoming](#)), there are slight differences of the terms and phrases in the three different editions of *DM*. For instance, a non-negligible change occurred in *DM* §9 between ‘infinite [*infinita*]’ in the First London edition and ‘definite [*definita*]’ in the First Dublin and Second London editions,⁹⁶ In addition, the following phrase in *DM* §38 (First London and First Dublin editions) does not appear in the Second London edition: ‘*cum ex primis illis continuo nexu deducuntur*’ (‘[particular propositions and cognitions] have been continuously deduced from the former [general notions and propositions]’).⁹⁷ In this way, taking the editorial changes into account in my textual analysis, I scrutinise the Latin text on my own. On the other hand, I also comparatively reference as many as six translations of *DM* in English: Wright 1843; Luce 1951 (*Works* IV); Jessop 1952 (abridged); Jesseph 1992; Clarke 2008; Belfrage, [forthcoming](#).⁹⁸

I assume that these translations matter to the respective interpretations and reformulations. For example, as explicated above,⁹⁹ the ‘occult quality’ (*qualitas occulta*) is apparently rejected by Berkeley as a non-sensible quality like gravity. However, one needs to consider a proper interpretation of ‘*missa qualitate occulta*’ (*DM* §4), as either ‘dismissing it’ (Jesseph 1992; Clark 2008) or ‘letting it go’ (Luce 1951). For the former rendition suggests the agent (definer) or human mind’s action that I support, but the latter is more metaphorical as if the occult quality might ‘naturally drift off into the unintelligible void’ (Stoneham and Cei 2009, 73). Through my textual interpretation and reformulation, I aim to identify the metaphysical (and immaterialist) ‘causes’ with human and divine causes (‘animate beings’, *DM* §3), in contradistinction to the other types of mechanical and theoretical causes or causal terms.

⁹² The last letter from Europe when he was in Florence, 20 July 1720, is Letter 96 (to John Percival) in Hight 2003.

⁹³ At latest on 6 May 1721, Berkeley was in London (email correspondence with Jones, 2019).

⁹⁴ Letter 98 (to Percival, 12 October 1721) in Hight 2003; Luce 1992, 80; Jones 2017, 10; 2021.

⁹⁵ Belfrage, [forthcoming](#), editor’s introduction: the First London edition (1721, BK100 B4 55) is preserved in the Johnson Memorial Library at Columbia University, New York, for Berkeley originally presented the copy to Samuel Johnson. The other two copies, i.e. the First Dublin edition (*Miscellany* 1752 (Dublin), 236–264; Keynes K. 5. 18) and the Second London edition (*Miscellany* 1752 (London), 238–267; Keynes K. 4. 11), are in the University Library at Cambridge.

⁹⁶ See a substantial difference in the final sentence of *DM* §9 (also §14): ‘*infinite* power of a strike [*infinita vi percussiois*]’ or ‘*definite* power of a strike [*definita vi percussiois*]’.

⁹⁷ For more differences in the three earliest editions, see Belfrage, [forthcoming](#), intro; [Chapter 3](#).

⁹⁸ A Scottish idealist Alexander Fraser’s two editions (1871 III; 1901 I) contain only the Latin original, although his footnotes are greatly noteworthy. George Sampson’s edition (1897–98 II) borrows G.N. Wright’s translation (1843 II). Except for a few other translations—Fimiani 2009 in Italian; Berlioz-Letellier and Beyssade 1987 (1985–96 II) in French; Breidert 1969 in German, I primarily employ the above six translations in English, if not exhaustively. I am aware that there are many more translations of *DM* in the other languages, as examined in Estonian: Veede 2017, 19.

⁹⁹ See the quotation of *DM* §4 in [§0.1.1](#).

To recapitulate thus far, I have laid the groundwork for achieving what I aim to argue in the main chapters. Grasping the above historical facets and tenets, as well as the annotation in different editions, should be due steps for exploring into the content of my thesis.

0.3 Aims

Finally, on my rendering, the Berkeley of *DM* undertakes a mode of discourse on mechanical causation. The overarching objective of this thesis is to argue that his discursive thinking fulfils my definition of a pragmatist theory of causation. The definition has three generic ingredients in the domain of mechanics as distinct from that of metaphysics.

Definition. A pragmatist theory of causation is one which holds that:

- ① Causal terms are indispensable in scientific deliberation for their usefulness; they cannot be eliminated [*contra* reductionism].
- ② What a cause is is defined by one's temporal deliberative practices, independent of atemporal structure that theories hold [*contra* structuralism].
- ③ Causal laws (theories formulated in causal terms) are genuinely true, not fictitious, when one confirms and deduces them [*contra* instrumentalism].

By justifying this tripartite definition, which are not separate from one another but unified as a set, I will object to three rival readings—reductionism, instrumentalism, and structuralism. They are in contradistinction to my vindication for Berkeley's pragmatism about causation.

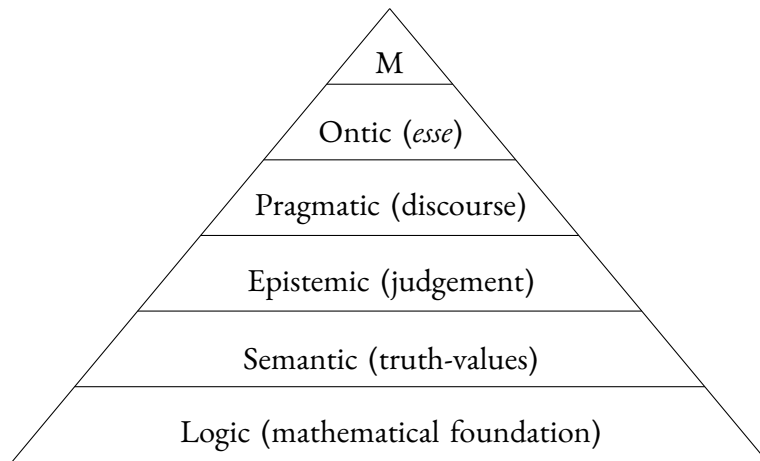
In view of the definition, I will adumbrate the structure of the thesis through five main chapters (and three appendices). The thesis consists of three parts:

Historical [Chapter 1](#) ([Appendix 1](#): Paris Académie);

Textual [Chapter 2](#) ([Appendix 2](#): 'cause'), [Chapter 3](#) ([Appendix 3](#): 'hypothesis' sources);

Philosophical [Chapter 4](#) (q.v. the above three rival readings), [Chapter 5](#) (Peirce).

Through the above structure, I strive to argue that in his *De motu* (1721), Berkeley has a pragmatist theory of causation regarding mechanical theories outlined previously with Newtonianism. What I aim to do first from Chapter 1 is confine his theory as such within a pyramid model as follows:



This diagram is exclusively a pyramid—nothing else. This is because the greatest emphasis shall be placed on the importance of logic and mathematics at the bottom of Berkeley’s scientific approach, on which the other levels build up. From that bottom, in my reformulation, Berkeley’s pragmatic method to *conceive* or mathematically imagine causation makes sense by being sharpened to the pinnacle of M: i.e. *mechanical causes* or *mathematical hypotheses* as the most defined and refined *objects*. Thus, within the above M pyramid model that sustains the mechanist’s ‘universe of discourse’ (e.g. Peirce 1880, *CP* 3.174), I will orchestrate basic components into the definition for Berkeley’s pragmatist theory of causation.

In addition to five chapters, the thesis has three appendices at the end. The appendices are: A1. Paris *Académie royale des sciences* (documentation of my short archival research in 2020 in terms of Berkeley’s possible interest in the first *Académie* essay prize in 1720); A2. The term ‘*causa*’ ramified (enumeration of metaphysical and mechanical types of the term ‘cause’, divided into the three models of causation, in the text of *DM*); A3. Logic, mathematics, and lexicon (scrutiny into Berkeley’s early textbooks and own books). In what follows, the five chapters are primarily abstracted.

1. A Pragmatist History of Causation: Bacon, Toland, and Berkeley

In the first section, I will establish the above M pyramid model, wherein Berkeley’s realist approach to *mathematics* and *mechanics* is reformulated nearly on a par with logicism. Moreover, within the pyramid model, his pragmatic method is set forth in relation to a still underappreciated great precursor to him, Francis Bacon, regarding their scientific methods of truth and utility. I construe that Berkeley is in accordance with Bacon’s novel approach to linguistic problems of abstraction as rooted in the third *idola* of the market.¹⁰⁰ On the other hand, in the second to fourth sections, a chief comparison in my reformulation of a history of pragmatist theories of causation is between Berkeley, bishop of the Church of Ireland, and John Toland, Irish heretic ‘free-thinker’. In the late seventeenth to early eighteenth centuries, before his death in 1727, Sir Isaac Newton’s mechanical philosophy was already confronted with numerous criticisms. I will focus on two of the prominently

¹⁰⁰ On Bacon’s doctrine of four idols, see §0.2.1 above.

similar, yet underappreciated, criticisms in a broadly Irish context. In his *Letters to Serena* (1704), Toland positively yet critically appropriated Newtonian mechanics about gravity in the sense of relative, not absolute, space-time. This, on my view, is almost tantamount to Berkeley's reception of Newtonian mechanics in his *DM*. Overall, my reformulation shall converge on the two Irishmen's respective critiques of the Newtonians' absolute mechanics, not directly that of Newton. That is, Toland's mechanical philosophy for an individual's practical life against the Newtonians' and contemporary mathematicians' theological-metaphysical debates can be regarded as the immediate precursor to Berkeley's argument for one's utility of mechanical causation. Their lines of argument resonate against the abuse of metaphysically-loaded language about 'real nature' in mechanics. Hence, comparatively and historiographically, I delineate underlying tenets of pragmatic causation before Berkeley published *DM* in 1721.¹⁰¹

2. Textual Reconstruction of 'Causes' in *De motu*

The second chapter has a textual objective of resolving why Berkeley treated mechanical causation pragmatically behind the background of theologically metaphysical causation in the short treatise *DM*, composed of 72 sections (passages). One can read *DM* as his critical interpretation of mechanical theories at the time, especially of the Newtonian dynamics or mathematical science that he critically admired. In his scientific discourse, however, metaphysics is given the importance for the natural sciences in relation to theology and morals. For Berkeley argues that 'from the known laws of nature very elegant theories and mechanical practices [*praxes*] useful in life follow; from the knowledge of the Author of nature Himself by far the most excellent considerations arise, but they are metaphysical, theological, and moral' (*DM* §42). Here I argue that Berkeley entertained two types of causation (*DM* §§35–37): theologically metaphysical and pragmatically mechanical. Efficient and final causations (in Leibnizian twofold causal paradigm) are considered in terms of the former theologically metaphysical domain. In this way, as distinct from this metaphysical and theological context, I will cast light on Berkeley's pragmatist theory of mechanical causation. This is because the current literature lacks a full-fledged explanation and justification of what 'causes' are, or what causal terms are used and deliberated.¹⁰²

3. Mathematical Hypothesis in *De motu*

Based on the prior chapter, further light shall be cast on the complexity of Berkeley's text in the third chapter. That is to argue for a new, pragmatic understanding of his argument for causation based on mathematical entities in *DM*. Those entities in the context of Newtonian mechanics are regarded as 'mathematical hypotheses' without their essence, such as 'force', 'gravity', and 'attraction'. These are non-propositional and have no truth-values, for they are taken to be mathematical, dynamical,

¹⁰¹ See [Appendix 1](#) for the historical background in Paris at the time, or probable cause, for Berkeley to write *DM*.

¹⁰² See [Appendix 2](#) for my textual ramification and distinction of the term 'cause'—within *DM*—through the three models of causation.

causal terms (*vocabula*). They are, on my view, objects of mechanical causation or causal relations, which are discursively framed into law-propositions or laws of motion. Berkeley's discourse as such in the mechanical domain avoids any commitment to metaphysical entities, including efficient-final causes, primarily derived from God and 'pure intellect' (*DM* §53). Indeed, the latter entities are spiritual foundations for mechanical laws of motion of his opponents (Leibniz, Borelli, and the Cambridge Platonists), such as their vitalist 'Hylarchic principle' (*DM* §20). In response, Berkeley attacks their metaphysical views of abstraction in *DM*. In his argument for mechanical causation having no foundational essence, Berkeley's treatment of *causes* or mathematical entities is discursive or pragmatic. Such pragmatic 'mathematical hypotheses', I argue, can be regarded as 'suppositions' and depend on the framing of mathematical 'abstraction' or deduction from phenomena. This deductive approach to causation and causal laws by mathematical hypotheses concerns geometrical reasoning.

That reasoning or reason is one of the following three elements in Berkeley's pragmatist discourse (*DM* §§1, 21, 71, etc.):

Element 1 'Sensation' (*sensus*);

Element 2 'Experimentation' (*experientia*);

Element 3 'Geometrical reasoning' (*ratiocinium geometricum*) or 'reason' (*ratio*).

Providing the three elements and zooming in on the third one, I will consider textually how mathematical hypotheses or causal terms are framed into laws in the process of Berkeley's pragmatist discourse. I will initially distinguish two linguistic entities, terms (including phrases) and propositions (theories or laws), and clarify why terms are components of true law-propositions for our utility. Then, a set of causal relations are framed into law-propositions, of which the truth-values are predicated of or judged by the human agent. In my analysis of Element 3, Berkeley's mechanistic, pragmatist theorisation of causation consists of a discursive reasoning in three steps:

Step 3.1 Linguistic definition of causal *terms* (mathematically 'imagining' or framing causal terms into laws);

Step 3.2 Epistemic confirmation of true (or false) *law-propositions* (deliberating about truth-values of causal laws); whence

Step 3.3 Pragmatic expression of *them* (3.2) for our needs and practice (locution of the laws for our utility by mathematical deduction and computation: operational mechanics).

This way of mechanistic reasoning for human needs and practices can be textually vindicated as Berkeley's pragmatist discourse, thereby refuting the objections from his opponents. Thus I explain why mathematical hypotheses are key to understanding Berkeley's pragmatist theory of causation.¹⁰³

¹⁰³ See [Appendix 3](#) for three categories of early modern sources that Berkeley possibly read for conceiving of his meaning of mathematical 'hypothesis' in *DM*—from logic textbooks, loan books, and own books of the Berkeley family.

4. Berkeley's Pragmatist Argument against Three Readings

The fourth chapter philosophically argues that Berkeley has a pragmatist theory of mechanical causation, in the scope of his eighteenth-century natural philosophy in *DM*. By pragmatism about causation, I mean that he takes propositions or formulations in causal terms ('mathematical hypotheses') to be true, requiring analysis or definition from a deliberative viewpoint on human temporal practices. Berkeley differentiates three linguistic categories or *tiers* of scientific terms and sentences (*DM* §39):¹⁰⁴

Tier 1 Abstract and general 'terms [*voces*]' or *mathematical hypotheses* (e.g. 'force', 'action', 'attraction', 'solicitation');

Tier 2 'Theories and formulations [*theoriae* & *enunciaciones*]' (statements or law-propositions);

Tier 3 'Calculations [*computaciones*]'.

The first tier of causal terms, labelled 'mathematical hypotheses', all contribute to the second tier, i.e. Berkeley's unique rationale for the utility of causal laws (or laws of nature) effective in the mechanical domain. This is followed by the third tier, calculations from the laws.

Importantly, through the three tiers involved in the three steps of mathematical, mechanistic reasoning, Berkeley sees epistemic limitations bounded in physics. This is because, on my reading, we human agents are not *atemporal* as finite minds when we deliberate on causation. In his scientific discourse, therefore, I argue that causation is pragmatically assumed to be what is in use from our perspective as *deliberators* who confirm the truth of law-propositions (causal laws). In defence of my pragmatist reading, I object to three different readings in view of Berkeley's *DM*:

Reductionism one can eliminatively translate theoretical notions like forces in dynamics into observation notions about motions of bodies in kinematics (Hinrichs 1950; Myhill 1957; Brook 1973).

Structuralism one can dismiss theoretical entities such as occult qualities, but not the theoretical structure of them for scientific progress (Stoneham and Cei 2009; Cei 2010).

Instrumentalism one can empirically hold the utility of dynamics for calculating bodily motions, even if mathematical hypotheses are fictitious, or their theories are potentially false (Popper 1953; Buchdahl 1969; Newton-Smith 1985; Downing 2005, et al.).

In particular, my pragmatist reading criticises the popular instrumentalist reading because, according to the latter, talk of causal terms like forces can be false or merely fictitious inasmuch as one can hold the utility of theories in mechanical practices. The instrumentalist reading is then compatible with mathematical formalism, according to which it is not truth or meaning that counts as formal manipulation or game of meaningless symbols, whence eschewing a platonist attitude to mathematical objects (Jesseph 1993; Detlefsen 2005, et al.). However, I rebut the formalistic instrumentalism from a logical standpoint in Berkeley. Light shall be shed on the tenet I propose

¹⁰⁴ See also Peterschmitt 2003, 188.

that law-propositions formulated in hypothetical, causal terms must be true, neither false nor fictitious, when we (1) frame, (2) confirm, and (3) deduce them to the extent of our temporal deliberation (in the three steps). Finally, I reinforce my reformulation by Berkeley's Inference to the Best Explanation (BIBE) in *DM*: viz. induction or abduction from observation of observables (i.e. descriptions of sensible bodies in motion or at rest) to approximate truth of unobservables (i.e. theories about occult qualities by mathematical hypotheses).¹⁰⁵ For Berkeley, the formulation of mechanical causation can reliably and pragmatically make us believe the truth within scientific discourse.

5. Peirce's Reception of Berkeley's Pragmatist Theory of Causation

The final chapter furthers my philosophical vindication of Berkeley's pragmatist theory of mechanical causation. In particular, I argue that Berkeley's interpretation of scientific and religious language was significantly received in the pragmatist *semiotic* and scientific view of C.S. Peirce (1839–1914). I place chief emphasis upon Peirce's deriving his pragmatic method from Berkeley's philosophy of language. For at least three times, he reviewed the *Works* of Berkeley, in which he identified his version of Berkeleyan nominalism. For what Peirce meant by 'Berkeleyanism', I examine his Harvard Lectures (1903) along with his reviews of Berkeley's *Works* amongst other writings. Secondly, I explicate Berkeley's own pragmatic method for his theory of signs—more precisely—linguistic theory of reference, which is the basis for his theory of mechanical causation. In this analysis (developed from Pearce 2017c), I will apply the distinction between (genuine) reference and *quasi*-reference in Berkeley to Peirce's use of terms or language. The former referential terms (e.g., 'white' about the idea of a wall) label individual ideas (objects) that exist extra-linguistically. On the other hand, in the latter use, the ideas to which we *quasi*-refer purely depend on the sign system for their existence, but their *quasi*-referential terms (e.g., 'force' and 'gravity' in mechanics; 'grace' and 'mercy' in theology) are useful or pragmatic in directing the disposition and action in the believer's mind. Specifically, I argue that this quasi-reference lends itself to understanding Peirce's reception of Berkeley's pragmatic method in deploying causal terms or signs. Finally, we stand to recognise that Peirce's pragmatic method in science, albeit not exactly his categorised 'Berkeleyanism', is viably established on his reception of Berkeley's pragmatic thinking of language or the sign system. Despite different approaches to causation and causal laws in Berkeley's early modern and Peirce's modernistic sciences, it shall transpire that our present understanding of causation and 'laws of nature' and motion can be better understood through their resembling pragmatic methods.

Conclusion

Consequently, I will come back to the importance of the separation of science from theology in relation to Berkeley's pragmatist theory of causation, as well as my original contribution therefrom.

¹⁰⁵ Lipton 2004; Jesseph 2005, 188.

For this purpose, the overall Conclusion shall close with a recent proposal of *three* big ideas (Zagzebski 2021). The first two great ideas are those which have happened in the Renaissance and early modern period. Whilst the first idea emphasised metaphysics (the unity of the universe and our minds), the second idea began to emphasise epistemology (the beginning of self-independent inquiry into our own minds). The transition from the first emphasis to the second is deemed to be an early modern paradigm shift since the Renaissance. This seems obvious in the cases of Bacon, Descartes, Locke, Toland, and so on. In my view, Berkeley's case is no exception in this shift, in the sense that his pragmatic inquiry into causation in the domain of mechanics is nothing but defining, confirming, and expressing the truth and utility of law-formulations for ourselves. This primarily epistemic endeavour for the mechanist themselves, however subordinate to the divine and spiritual metaphysical efficient-final causation, is their independent, pragmatic thinking to the extent of their knowledge (*scientia*).

On the other hand, the *third* biggest idea that Linda Zagzebski speculated is what can be held in the future. Slightly differing from her speculation, which is intersubjective understanding of ourselves, the third idea that can be inferred from my thesis is a *therapeutic* end of Berkeley's pragmatic method about causation. That is, we would have to heal ourselves in the process of deeper understanding of our minds in a seamless convergence of actual and virtual realities (e.g. avatar-like existences in the metaverse). In this inevitable, decentralised restructure of our traditional culture and ecosystem, what we need to do in future is re-define and re-conceive of ourselves. Here I would call for a Berkeleyan therapy, or semantic and epistemic 'remedy',¹⁰⁶ of our minds as re-configured in the metaversed reality that we keep perceiving. For Berkeley, what can be perceived, confirmed, and reasoned is commonsensically shared with one another in our correct 'mode of speaking' or discoursing (*DM* §1). I conclude that this kind of therapy enabling linguistic and pragmatic interdependence is anchored in our reformulation of theories of causation. This is because, as shown in the three models of causation and the tripartite definition, the analysis of causation can always be applied to what we *conceive* of as current reality. To this extent, our finite minds keep explaining and predicting three objects in causation: what causes, effects, and their relations really are.

¹⁰⁶ *Notebooks* §544; *Principles* preface (only in the first edition of 1710), intro §23, etc.

Chapter 1

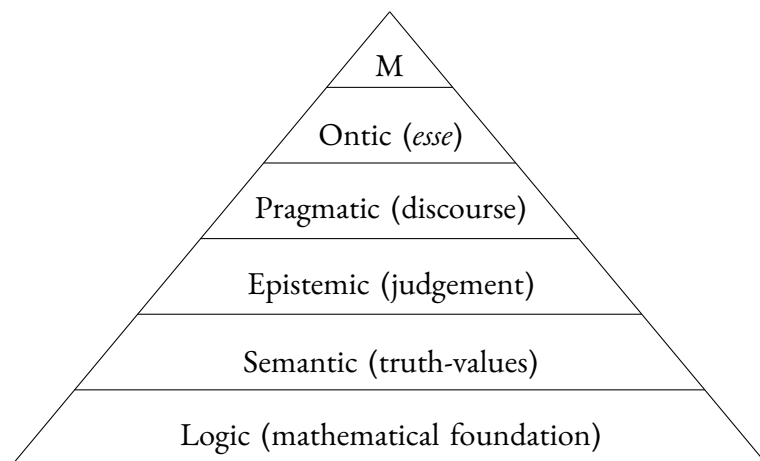
A Pragmatist History of Mechanical Causation: Bacon, Toland, and Berkeley

Introduction



ARDLY can one overstate that the eighteenth century in Europe was the golden age of mechanics through Newtonianism.¹ This is not exceptional in the case of George Berkeley (c.1684–1753) in his *De motu* (1721). This chapter lays out the historical background of my whole thesis on Berkeley’s pragmatist theory of mechanical causation in *DM*.

What I aim to do is, firstly, define Berkeley’s theory as such in a pyramid model as follows:



Why the diagram is exclusively a pyramid—nothing else—is due to my greatest emphasis on logic and mathematics at the bottom of Berkeley’s scientific approach, which gradually tapers to an acuminate top of *M*, *mechanical causes* (*mathematical hypotheses*) as the most defined and refined *objects*. Thus the lowest level in this model, i.e. a logical foundation for mathematical objects, is crucial to set forth the necessity of logical truth about mechanical causation.² Nonetheless, the model that I reconstruct stands far from mathematical formalism. The modern formalism, according to

¹ See e.g. Gabbey 2002, 350; Guicciardini 2018, 167; Fu 1999, ch. 7.

² To the extent to which I maintain logical truths for discursive thinking in Berkeley’s pragmatist theory of causation,

which mathematics consists of valid formal rules not reducible to logic,³ is a salient interpretation that several Berkeley scholars have subscribed to.⁴ Instead of the formalist reading, I will argue that Berkeley's mathematical understanding is most closely grasped by logicism,⁵ the modern view of which is that mathematics is reduced to the principles of logic alone.⁶ Thereby I view that Berkeley's pursuit of truth is expressed by the truth-preserving logical method as applied to the mathematical sciences, especially mechanics in his *DM*. In particular, 'mathematical hypotheses' in *DM*, the objects of mechanical causes, should be understood on the basis of the logical, mathematical foundation that Berkeley envisioned in his first publication (1707), *Arithmetica* and *Miscellanea*. Moreover, the utility of mathematics by logic can be seen as integral to the pyramid model of mechanical causation. This aspect of Berkeley's pragmatism will be further unfolded in relation to a still underappreciated great precursor to Berkeley, Francis Bacon's scientific method of truth and utility. I assume that Berkeley read Bacon in earnest, because he owned some of Bacon's *œuvre* in his home library.⁷ I will construe that Berkeley is in accordance with Bacon's approach to linguistic problems of abstraction rooted in the *idola* of the market. Providing the pyramid model and the Baconian method, then, Berkeley's own pragmatic method will be established through the development of the following chapters.

Secondly, historiographically, I will contrast Berkeley's pragmatic interpretation of mechanical causation with that of a contemporary also born in Ireland, John Toland (1670–1722).⁸ That is,

I will object to the readings of formalism, instrumentalism, fictionalism, etc. Those do not care about truths behind the utility of mathematical-mechanical law-propositions. See e.g. Jessep 1993; Field 2016, P–7; Chapter 4.

³ Barker 1964; Detlefsen 2005; Simons 2009; Hintikka 2009.

⁴ Baum 1972; Silver 1972; Jessep 1993; Detlefsen 2005, et al. As Zoltán Szabó (1995, 59, n. 2) notes, it is important that Berkeley's formalism be concerned with arithmetic and algebra, but not with geometry. For the latter is his wholly nominalist approach to points and extension, to which arithmetic and algebra are *applied*. To me, on the contrary, it is arguable from the beginning to relate formalism to Berkeley's entire mathematics, including arithmetic and algebra.

⁵ Peter Simons (2009, 299–300) recognises that the modern logicism dates back to Gottfried Leibniz (1646–1716), whose view was to be developed by Frege and Russell from the late nineteenth century. See Leibniz's view in c.1679, where he was keen on the logical calculus: 'every judgement (i.e. affirmation or negation) is either true or false and that if the affirmation is true the negation is false, and if the negation is true the affirmation is false; [...] that it is false that what is false should be true or that what is true should be false; that it is true that what is true is true, and what is false, false. All these are usually included in one designation, the *principle of contradiction*' ('On the General Characteristic', 1969, 225). On my rendering, whilst Berkeley does not take Leibniz's conflation of metaphysics and mechanics, or *metaphysical mechanics* as it were, they concur with each other on (1) logicism (more *anon* in this section) and (2) two-kingdom (efficient-final) metaphysics *per se* (Chapter 2).

⁶ Rudolf Carnap, one of the key members of Vienna Circle, also endorsed logicism, which was however to be faltered by Gödel and Tarski (Hintikka 2009, 282–283). However, logicism was revived as neo-logicism (Hale, Wright, Parsons, and Boolos to an extent) some time after Carnap had died (Boolos 1999). On the other hand, another modern (early twentieth-century) interpretation is intuitionism, according to which mathematics is a creation or mental construct independent of our linguistic practice. This is somewhat linked with Wittgenstein's philosophy of mathematics. Furthermore, W.V.O. Quine (1948, 33–34) observes that the modern debate in philosophy of mathematics corresponds to the 'three main medieval points of view regarding universals': realism (logicism), conceptualism (intuitionism), and nominalism (formalism). However, I do not assume that Berkeley stands to intuitionism (medieval conceptualism), for language cannot be divorced from mathematics in his view. See also Detlefsen 2005, 295.

⁷ 'A catalogue of the valuable library of the Berkeley family' (Leigh and Sotheby 1796, BL S.C.S. 28), auctioned for six days; Appendix 3, where I examine the catalogue. According to the catalogue, though some books might have been purchased by his son and grandson, Berkeley owned: 398. Bacon's Elements of the Common Laws (1639); 485. Baconi Opera (1665); 498. Baconi Opus Majus (1733); 1408. Bacon on Good and Evil (1706). The amount is as many as those of Newton, Clarke, and Locke in Berkeley's library.

⁸ In Ardagh ('high place' in Irish), Inishowen (near Derry), northern peninsula of County Donegal in the province of

Toland can be the most immediate precursor to Berkeley in their pragmatic key. This is because, in his *Letters to Serena* (1704, *Serena* hereafter), Toland's trenchant critique of absolute metaphysics of the mathematicians (including Newtonians) will validly foreshadow Berkeley's approach to causation in *DM*.⁹ To this end, it is important to consider how to construe their attitudes towards Newton's¹⁰ and contemporary mathematicians'¹¹ metaphysics in the late seventeenth and early eighteenth centuries. Whilst David Berman called Toland 'the father of Irish philosophy', albeit 'hated and illegitimate' (1982a, 151), I deem Berkeley to be another father, as inspiring as the illegitimate.¹² This can be acknowledged in the light of their respective contributions to Irish *natural* philosophy, spanning from the 1690s to the 1750s.

In what follows, broken down into four sections, the chapter concerns the historical aspects of Berkeley's pragmatist theory of mechanical causation. §1.1 is my characterisation of it, by way of (1) the pyramid model from the logical foundation that identifies mathematical hypotheses as objects in mechanical causation; (2) Bacon's pragmatic method to the extent of Berkeley's reading of his works; and (3) Berkeley's own pragmatic method. §1.2 introduces the broader settings situated in Dublin when Berkeley enjoyed his college life in the 1700s. In particular, his mediate contact with Toland will be taken into account historiographically. §1.3 regiments Berkeley's valid argument against absolute space and motion in *DM*. This is reconstructed along with Toland's contrastive critique of the mathematicians' and Newtonians' theological metaphysics. Toland's critique shall turn out supportive of Berkeley's resembling critique in keeping intact the importance of Newton's mechanics, in their respective appropriations of Newton. In the end, §1.4 underpins Berkeley's and Toland's respective pragmatic methods in inferring mechanical causation from hypotheses (i.e. causal terms), especially, 'action'. In view of 'anti-mathematicism' (Schliesser 2020),

Ulster (email correspondence with Patsy Toland in Inishowen, 2021–22), John Toland was born an Irish-speaking Catholic. His baptismal name was likely Joannes Eugenius (Seán Eoghain), or 'Janus Junius' according to himself (Sullivan 1982, 2–4). Going to a Church of Ireland school in Redcastle, Inishowen, he converted to Protestantism at the age of 14. Sailing to Glasgow by boat (back then much easier than travelling inside Ireland), this Dissenter commenced to read divinity and philosophy at 16 in 1687. I have no information of his apostasy in Christianity. Robert Sullivan labels him 'a servant of God and of country', however unrecognisable and distorted, as it were, the two-faced Janus (*ibid.*, 40). See also Toland 2013, editor Leask's intro, 13; Harrison 1994, 5–7. For a brief and lucid account of Toland's life and thought, which incurred a slight distaste for his character in Queen Sophie of Hanover and Leibniz, see Duggan 2010, 8.

⁹ Certainly, Berkeley's reference to Leibniz's mechanics and metaphysics (especially, *Specimen dynamicum*, 1695) in *DM* and Toland's discussion with Leibniz in Hanover (via Queen Sophie Charlotte) before publishing *Serena* (1704) may lead us to compare the respective critiques of Leibniz's natural philosophy. However, because their critiques of Newtonianism are far more imminent and immanent, this chapter will not broach Leibniz's objection (but the next second chapter shall).

¹⁰ However, I will not problematise the question of Newton's agnosticism about the metaphysical, absolute grounds for mechanical causation (e.g. the cause of gravity). For his agnosticism in a pragmatic key, see Psillos and Ioannidis 2019, 30. For his parting company with Descartes, whose definition of motion was the translation of a portion of matter to the other portions in immediate local relations (*Principia philosophiæ*, pt. 2, §§24–25), see Guicciardini 2018, 160–163; also footnotes on my consideration of Descartes below.

¹¹ Many of the British mathematicians at the time were, broadly conceived, the Newtonians including Richard Bentley, Samuel Clarke, John Harris, John Hancock, William Whiston, and William Derham. See Jacob 1976, ch. 5; Copenhaver 1980, 529; Snobelen 2012, 164; Toland 2013, 29; Peterschmitt 2014, 90. As will be discussed, whilst Joseph Raphson (1648–c.1715) is deemed distinct from a Newtonian, his treatment of 'real space' relating to Newton's absolute space is featured in Toland's *Serena*.

¹² Robert Boyle (1627–91), also born in Ireland, might be another father candidate, but his life after birth is not so Irish.

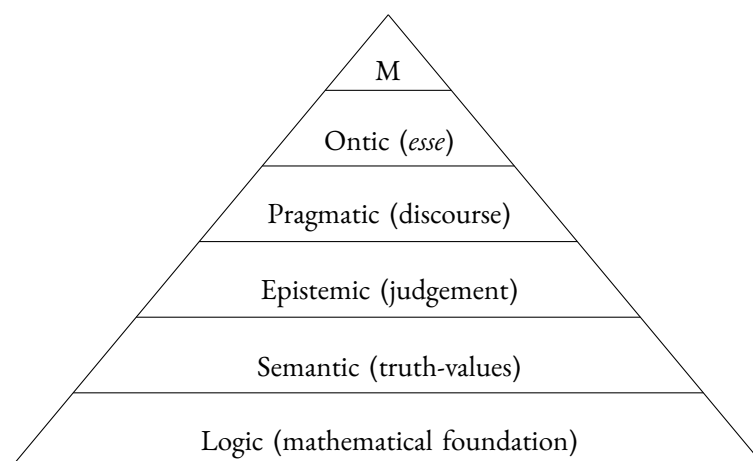
their methodologies in mechanics can be construed on their own terms, whereby objecting to the contemporary mathematicians' and Newtonians' metaphysical realism about absolute motion (not Newton's own). In other words, even if both Berkeley and Toland had *ad hominem* arguments against those philosophers,¹³ the two Irishmen rather held *pro hominem* appropriations of Newton in his scientific initiative.

It is true that the *argumentum ad hominem* is a logical fallacy by irrelevantly attacking the arguer rather than their argument. Nonetheless, I assume a non-fallacious use of the two Irish philosophers' *ad hominem* arguments, as long as their fairness and reasonableness are more appreciated than merely committing the fallacy.¹⁴ Whilst the commentators such as Moriarty and Schliesser do not characterise, I consider that *ceteris paribus*, the two Irishmen's *pro hominem* arguments as appropriations of Newton are also non-fallacious. Hence, providing Toland's similar critique, I will conclude how and why we newly understand the historical background to Berkeley's pragmatist theory of causation in *DM*.

1.1 Berkeley's pragmatist theory of mechanical causation

The first section characterises what I mean by Berkeley's pragmatic method about mechanical causation in the form of theory. This lays the foundations for my reformulation of the entirety of his *De motu*. Through the following pyramid model closer to logicism, not formalism (§1.1.1), and introducing Bacon's pragmatic method (§1.1.2), Berkeley's own pragmatic method shall be understood (§1.1.3). On my rendering, Berkeley's method in *DM* coalesces mechanical causes, as called 'mathematical hypotheses',¹⁵ into useful and truthful theories of causation in his discourse.

1.1.1 Hypotheses as *objects* of human knowledge and practice



¹³ Berkeley, *Analyst*, *Qu.* 66: 'Whether the modern analytics do not furnish a strong *argumentum ad hominem* against the philomathematical infidels of these times?' See also his *Defence* §3; *Journals of Travels in Italy* (1717; *Works* VII, 246); *Advice to Tories* (*Works* VI, 56).

¹⁴ I take into account the views of Clare Moriarty (2018b, 440–441; 2021) and Douglas Walton (1998, 45–54),

¹⁵ On the 'mathematical hypothesis' not 'really existing in nature', see *Siris* §234; *DM* §§17, 28, etc.

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As above, there are at most six levels of objects in Berkeley's pragmatist theory of causation that I champion. Level M, namely, *mechanical causation* taking *mathematical hypotheses* as its objects, is the highest in this pyramid model. This highlights the ultimate application of causation to the mathematical and mechanical (M) universe. The M universe is based on the 'universe of discourse', i.e. pragmatic and ontic levels, where one can assume Berkeley's version of *ontological commitment* to formally bound variables in the propositions of mechanical causation.¹⁶ The model of another M*, *metaphysical causation* by absolute abstraction about spiritual objects such as God, is strictly distinct from this M pyramid model.¹⁷ If one prefers the terms 'epistemological' and 'ontological', then logical aspects are meant to be internal to the respective levels. However, for Berkeley's life-long interests in mathematics and mathematically *speculative* sciences, I posit logic as the most foundational, deepest level of the M Pyramid. Thus, it is detached from the five higher levels. In effect, logically, he was keen to formulate a valid argument (*argumentum*) in premiss-conclusion form.¹⁸ Thereby the necessity of logical truth is set forth from the bottom of Berkeley's mathematical-mechanical philosophy in 'a way of arriving at truth' by 'just' reasoning (*Analyst* §50, *Qu.* 35). Hence, he began to pursue 'truth [*ad veritatem*]' (*DM* §1) for the mechanist's pragmatic

¹⁶ Indeed, the 'universe of discourse' is not Berkeley's phrase, but my rendering of his ontological commitment to *recognising* causes as entities (objects) within the mathematical-mechanical universe. The concerned phrase is from Boole (1854, 30): 'whatever may be the extent of the field within which all the objects of our discourse are found, that field may properly be termed the universe of discourse.' However, the earlier root, albeit not the same wording, is De Morgan's definition of 'the universe' of propositions to be 'expressed or understood' (1846, 380–383). The 'limited' logical universe was extensively observed by the later pragmatist and logician C.S. Peirce (1880, 'On the Algebra of Logic', *CP* 3.174):

De Morgan, in the remarkable memoir with which he opened his discussion of the syllogism (1846, p. 380) has pointed out that we often carry on reasoning under an implied restriction as to what we shall consider as possible, which restriction, applying to the whole of what is said, need not be expressed. The total of all that we consider possible is called *the universe of discourse, and may be very limited* [emphasis added]. One mode of limiting our universe is by considering only what actually occurs, so that everything which does not occur is regarded as impossible.

See also Peirce, *CP* 2.517–518, 2.536, 4.172, 4.561 n.1, 6.351, *MS* [R] 25:2, 455:3–4, 493, S27:9–10, etc.; [Chapter 5](#); Quine (1948, 32, emphasis added): 'To be is, purely and simply, to be the value of a variable [...] and we are convicted of a particular ontological presupposition if, and only if, the alleged presuppositum has to be reckoned among the entities over which our variables range in order to *render one of our affirmations true*.' To this end, I construe that the Berkeley of *DM* has *practical bearings* when affirming and confirming logical truths of mechanical causation (causal relations) whose M variables range over causal terms, such as 'gravity', 'impetus', and 'mathematical hypothesis'. Within this logical, but also epistemically and pragmatically 'limited' universe of discourse, the mechanist in the Berkeley of *DM* is committed.

¹⁷ This does not mean that Berkeley expunged the M* model, because metaphysics was another pillar different to logic for mathematicians. See e.g. *Analyst* §50, *Qu.* 51: 'whether anything but metaphysics and logic can open the eyes of mathematicians and extricate them out of their difficulties?' That is, Berkeley affirms that metaphysics and logic make sense in the mathematical sciences, whereas on my view they do in different domains. On the other hand, Berkeley coherently claimed that geometry be independent of any misled, immeasurable metaphysics containing abstract general ideas and 'absolute external extension'. See *Analyst*, *Qu.* 7: 'Whether it be possible to free geometry from insuperable difficulties and absurdities, so long as either the abstract general idea of extension, or absolute external extension be supposed its true object?'; §§47–50, *Qus.* 8, 48; *MI* §§6, 28, etc.; Silver 1972, 343. [Chapter 2](#) examines metaphysical causation in *DM*.

¹⁸ See *Notebooks* §378, where Berkeley logically formulated nineteen propositions as a train of arguments in premiss-conclusion form. This entry, concerning the epistemic level of ideas, is right between the *Notebooks* entries on mathematics and mathematicians (Newton and Barrow) that he comments on.

ends.¹⁹

1.1.1.1 Berkeley's mathematics nearly on a par with logicism, not formalism

The *veritas*, for Berkeley, is undergirded by mathematics—chiefly arithmetic, algebra, analysis, and geometry.²⁰ I take it that each branch of mathematics, in which he was sufficiently versed, converges at Berkeley's understanding of logic. By his first publication of a set of *Arithmetica* and *Miscellanea* in 1707 (London/Dublin), it was primarily mathematics, not philosophy, that he demonstrated. Thereby he stepped up to a fellowship at his college.²¹ As his original footnote suggests (Pt I, ch. 1; IV, 171), for instance (*v.g.*), Berkeley followed the celebrated John Wallis's *Mathesis universalis* ('Universal Mathematics') and Père François Lamy's *Elémens des mathématiques*. Above all, let us consider a passage from the preface to his *Arithmetica* (IV, 168, emphasis added):²²

Everywhere I have preferred to confirm [*comprobare*] the truth of proof by some obvious and familiar reasoning *a priori*, rather than to deduce a series of *reductio ad absurdum* [*apagogicarum seriem ad absurdum*] by means of lengthy demonstrations.

In his preference of 'obvious and familiar' deduction over ἀπαγωγή also called *reductio ad absurdum*, I view Berkeley's logicism about his mathematical practice. In other words, for him, epistemically *a priori* truths of arithmetic are what the vulgar or common people can clearly and directly confirm, following from deductive logic and analytic definitions. Berkeley demarcated this *a priori* deduction from a *reductio* deduction, which I take to be something abstrusely and indirectly proven. This demarcation is meaningful in reconstructing his use of logic, for he did not mean to apply mathematical logic to a complicated and difficult set of rules, for example, alligation in arithmetic.²³ That is why he first approached mathematics for the vulgar or ordinary pragmatic ends, without reference to Euclidean and algebraic demonstrations. That is, according to Berkeley, 'I have therefore

¹⁹ *DM* §1: 'In the pursuit of truth, the principal point [*præcipuum*] is that we must beware of being misled by terms that we do not correctly understand; almost all philosophers utter this caveat, few observe it.' This very first sentence of *DM* highlights what I reformulate as Berkeley's pragmatist theory of causation, which can be understood in C.S. Peirce's sense of inquiry with 'practical bearings' (1878; Chapter 5).

²⁰ In the context of early modern logics and mathematics right before Bacon, Descartes, and Newton, '[g]eometry was conceived from the beginning as a science in which theorems were derived from axioms according to principles of logical entailment. It was supposed that the axioms were truths known by extra-logical intuition, but that, when once the axioms had been accepted, there need be no use of intuition other than that required for seeing a logical entailment. Algebra and analysis, on the other hand, were not elaborated in axiomatic fashion[. ...] These studies grew out of arithmetic, and were conceived originally as techniques for the manipulation of symbols according to special rules' (Kneale and Kneale 1971, 308–309). I take it that Berkeley's knowledge of the respective studies in mathematics as such was not non-conformist, however critical of contemporary mathematicians in his *Notebooks*, *DM*, *Defence*, etc.

²¹ The publication in 1707 was intended for the election to a fellowship at Trinity College, Dublin, when Berkeley held only a B.A. degree. Right after the publication, within the same year, he became a fellow in June and obtained M.A. in July. See *Works* IV, 159 (Luce's intro); Moriarty 2021; forthcoming(a).

²² The above quotation is my translation from *Arithmetica absque algebra aut Euclid demonstrata* ('Arithmetic without algebra and Euclid demonstrated'): 'Ubique malui obvia et familiari aliqua ratione a priori veritatem praxeos comprobare, quam per prolixam demonstrationum apagogicarum seriem ad absurdum deducere.' For an old translation, see Wright 1843 II, 32.

²³ Alligation is a practical method to find the weighted arithmetic mean of a mixture of ingredients. In Berkeley's example (IV, 194), to have 16 ounces of a metallic compound from 18 ounces of gold and 12 ounces of silver, it is alligated that $\frac{4}{6} \times 18 + \frac{2}{6} \times 12 = 16$.

1.1 Berkeley's pragmatist theory of mechanical causation

substituted' for the rule of alligation 'one of my own, which scarcely requires demonstration. I have deliberately dismissed *the rule of falsity*, since it is defective and quite useless' (*Arithmetica*, 168).²⁴ Here, if not radically put, Berkeley's arithmetic revokes the way to falsify mathematical propositions in its deductive reasoning. Thus on my view, in his salad days (*Arithmetica* IV, 188; *Miscellanea* IV, 205–213), Berkeley was proving theorems of arithmetic (e.g. multiplication of fractions) and algebra (e.g. surd roots) to be logically but also obviously and familiarly true—in his pursuit of truth. Hence, I interpret that there are logical truths, or such objects being pursued as distinct from anything false, within his mechanistic discourse as expressed and understood on the ordinary level.²⁵ This pragmatic inclination in Berkeley can be clarified from the very beginning of his career.

In the above sense within the M Pyramid, there can be Berkeley's pragmatic version of logicism, according to which mathematical propositions are reducible to logic, whereby truth is distinguished from falsity (on the second semantic level). On the other hand, I do not vindicate a logicism in *stricto sensu* accord with modern logicisms of Frege, Russell, and Hintikka.²⁶ What I modestly argue is that Berkeley's logical or mathematical foundation is most congenially understood by logicism, whereas it is far from the other modern mathematical views such as formalism, intuitionism, etc. Specifically, formalism has been featured along with instrumentalism in Berkeley scholarship. According to the formalist reading, it is not truth or meaning that counts as formal engineering or game of meaningless symbols thus eschewing a platonist attitude to mathematical objects.²⁷ It is primarily Baum (1972, 125–128), Silver (1972, 434), Jesseph (1993, 106–117),²⁸ and Detlefsen (2005, 263–268) who defended Berkeley's formalism about some aspects in mathematics. They consider particularly (i) non-representational nature of signs and (ii) non-empirical arithmetic and geometry, as seen in *Principles*, *DM*, and *Analyst*.²⁹ On the contrary, I contend that Berkeley did not concoct formalism on his own terms—this is a *non sequitur* from his logical mathematical foundation. In what follows, provided the M pyramid model, I argue against that formalist implication intertwined

²⁴ *Arithmetica*: 'ejus igitur loco novam, quæ vix ulla demonstratione indigeat, e proprio penu substitui. Regulam falsi, utpote mancam et fere inutilem, consulto prætermisi.' Here and there, I do not problematise Berkeley's grammatical oddities in Latin, especially noun conjugations.

²⁵ I take Berkeley's maxim 'think with the learned, and speak with the vulgar [*sentiendum ut pauci, loquendum est ut plures*]' to be pragmatic. See *Principles* §51: *Alciphron* §1.12; fn. 6 in §0.1.1.

²⁶ Hintikka (2009, 284): 'A reduction of mathematics to logic will be essentially a reduction of the methods of reasoning (proof) used in mathematics to the modes of reasoning codified in logic. This relation of the two is in any case what matters to mathematical practice, the focal point of which is often considered to be theorem-proving.' I also agree with Jaakko Hintikka (*ibid.*, 275–276) on another point about the pragmatist C.S. Peirce. It is true that Peirce once cursorily dismissed logicism in his critique of Dedekind. Also in the sense of utility coming from 'diagrammatic' thought and communication, his puzzling view that logic is part of mathematics may be called 'perverse reverse-logicism' (Dipert 1995, 46). See also Quine 1995. However, in line with Hintikka, I see Peirce taking a clear logicist scheme *par excellence* in a sense, in which he established mathematical reasoning reductive to iconic logic on his own terms. See Peirce, *Collected Papers* 4.239; Haack 1993; my thesis ch. 5.

²⁷ Barker (1964, 99–100): in formalism, 'there is no such thing as meaning or truth in mathematical systems; those systems do not contain statements at all but merely marks. One kind of system is never more "correct" than another (assuming that both are properly formalized).' See also Jesseph 1993, 107; Simons 2009, 292.

²⁸ Jesseph (1993, 106, 118): 'There is a formalist tradition which antedates Hilbert, and I see Berkeley as the first in this line of formalists. [...] Berkeley is a proponent of game formalism.' I disagree.

²⁹ For critiques of interpreting Berkeley as a formalist, see Brook 1973, 152–155; Pycior 1987; Sherry 1993, 210–211, 223; C. Schwartz 2010a, 44–47; 2010b, 35–36; Pearce 2017c, 47–48; Moriarty 2018a, 177.

with instrumentalism.

1.1.1.2 Non-formalist attitude to ‘logistic operations’

Now I will examine a passage in *Alciphron*, which is ostensibly ‘Berkeley’s most complete statement of his formalis[m]’ about algebraic signs used in arithmetic (Jesseph 1993, 116). Nonetheless, in the light of ‘relations’ in semiotically established mathematics, such as algebra, I construe Berkeley’s theory of signs or marks with no formalist implication in *Alciphron* §7.17 (1732, 2nd ed., emphasis added):

Thus much, upon the whole, may be said of all signs: that they do not always suggest ideas signified to the mind: that when they suggest ideas, they are not general abstract ideas: [...] that signs may imply or suggest the relations of things; which *relations, habitudes or proportions*, as they cannot be by us understood but by the help of signs, so being thereby expressed and confuted, they direct and enable us to act with regard to things[. ... A]lthough the ideas marked are not offered to the mind, but even although there should be no possibility of offering or exhibiting any such idea to the mind: for instance, the algebraic mark, which denotes the root of a negative square, hath its use in *logistic operations*, although it be impossible to form an idea of any such quantity. And what is true of algebraic signs is also true of words or language, modern algebra being in fact a more short, apposite, and artificial sort of language, and it being possible to express by words at length, though less conveniently, all the steps of an algebraical process.

The above does suggest (i) the signification or application of signs (symbols) whose ideas are not represented to our minds, and (ii) non-empirical or unreal objects of algebra and arithmetic in our semiotic, mathematical process, such as the denoted ‘root of a negative square’. These points might accord with the formalist reading (as noted in the last sub-section). On the other hand, the objects of classical, or Euclidean,³⁰ geometry pertain to sensible extension consisting of sensible minima, such that geometry has been called applied or mixed mathematics.³¹ For instance, in Euclidean geometry, the ratio (π) of the circumference of a circle to its diameter applies to every single circle.³² Therefore, there is utility in arithmetical and algebraic manipulations to deduce ratios such as π in the geometrical, empirical dimension. This mathematically pragmatic aspect is incorporated into the M pyramid model of mechanical causation.

³⁰ In line with Storrie (2012b, 259–264), I see Berkeley’s considerable reception of Issac Barrow’s edition of Euclid’s *Elements* (1655 in Latin; 1660 in English) as well as his *Lectiones mathematicae* (1683; 1734) and *Lectiones geometricae* (1670). Newton’s teacher, Barrow (1630–1677) justified a valid demonstration in Euclidean geometry, especially its application to motion, in his edition. This was in opposition to the editions and revisionist methods of Tacquet (1654 in Latin) and Dechaies (1684 in French) when Berkeley was learning. On his comments on Barrow or ‘the Barrovian Case’, see *Notebooks* §§170, 501; also §§75, 263, 362, 384, 462, 510, etc.

³¹ *Notebooks* §770: ‘Qu: whether geometry may not properly reckon’d among the Mixt Mathematics. Arithmetic and Algebra being the only abstracted pure i.e. entirely nominal. Geometry being an application of these to points.’ ‘Yes’, would Berkeley answer, but in his pragmatist sense regarding its utility and truth.

³² *Notebooks* §§340. See also *Notebooks* §§26, 258, etc.; Brook 2012, 427.

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At this juncture, there is a key, technical phrase in the above, 'logistic operations', which is used in inferring mathematical utility. Berkeley's use of the term 'logistic' concurs with the usage up until his day. Originally, in the ancient greek to neoplatonic traditions, the λογιστικέ ('logistical art' or 'art of calculation') was in the platonic opposition to arithmetic; as time went on, logistic was to be identified with symbolic algebra.³³ From the period of François Viète (1540–1603) distinguishing symbolic logistic from arithmetic,³⁴ algebra has considerably developed in early modern mathematics. As Barrow put it, 'logistics' was 'a kind of Artifice for designing Magnitudes and Numbers by certain Notes or Symbols, and collecting and comparing their Sums and Differences'.³⁵ Here, do these manipulations of signs in algebra imply logic? Yes, on my view, as with Viète and Barrow, Berkeley called algebra 'logistic' and speculated that it was a part of logical practice to *confirm* the provable truth (q.v. *Arithmetica* IV, 168 above). In other words, it is the *non sequitur* to deduce his formalism, *pace* the above commentators.

Indeed, Berkeley's approach to arithmetic and algebra is abstract and formal.³⁶ That algebra in arithmetic is semiotically abstract practice is true, I agree. However, this does not necessarily lead to his formalism. On my side, Dick Brook contends pithily (2012, 427, emphasis added):

[N]either Baum, nor Jesseph discuss how Berkeley might find "formalism," in the sense of an uninterpreted calculus, like algebra (a set of marks manipulable through rules), *as a way of envisioning classical geometry*. The historical problem was developing geometry's axiomatic structure in words or symbols but dispensing with diagrams except, as with Hilbert, as aids in grasping the formalism.

Thus, agreeing with Brook, I argue that classical Euclidean geometry, which Berkeley was interpreting in his early modern eyes, has no clear formalist foundation. Rather, as a mathematical extension of logical practice and the geometrical application to daily life, there is a way to epistemically envisioning and pragmatically expressing mathematical hypotheses in the M pyramid perspective.³⁷

In view of the application of mathematics to ordinary life, Kenny Pearce (2017c, 47–48) affirms the limit of application of *game* formalism for practical ends, no matter how Berkeley's theory of signs resembles modern forms of formalism.³⁸ *A fortiori*, Gottlob Frege, albeit much later than

³³ Klein 1968, ch. 2, *passim*.

³⁴ Viète (*In artem analyticam isagoge*, 1591 [2006], ch. III [4], 17): 'Numerical logistic is that employs numbers, symbolic logistic one that employs symbols or signs for things as, say, the letters of the alphabet.' See also Klein 1968, appendix; Detlefsen 2005, n. 46; Masi 1983, 148–152.

³⁵ See Barrow 1734, 28; Detlefsen 2005, 267.

³⁶ See also Pycior 1987, 281. It should be noted that Helena Pycior does not really support Berkeley's formalism, either.

³⁷ This relates to Berkeley's vital attention to *mixed* or applied mathematics of geometry, on top of *pure* mathematics of arithmetic and algebra (*Notebooks* §770). It should be noted that, in effect, Berkeley's meaning of *mixed* mathematics differs from that of Barrow, whose work Berkeley did learn. Barrow (1734, 10–11, 20) distinguishes *pure* and *mixed* mathematics; the former constituting 'abstract' or 'two pure and primary Parts' of geometry and arithmetic, and the latter constituting 'concrete' or 'four mixed and subaltern' (secondary) Parts of optics, mechanics, music, and astronomy. On Barrow's distinction, see also Pycior 1997, 156, n. 67. Whether 'Morality may be Demonstrated as mixt Mathematics' (*Notebooks* §755) is beyond the scope of my thesis, but morality may be seen utility in Berkeley's pragmatist eyes.

³⁸ Notably, Jesseph (1993, 107–115) espoused Berkeley's *game* formalism.

Berkeley, abandoned the position of formal arithmetic and offered three-pronged criticisms of the formalists. According to the Frege of *Grundgesetze*, the formalists cannot clearly distinguish between these three contrasts:³⁹

1. signs and what they signify (i.e. ‘rules [...] laid down arbitrarily’);
2. propositions stated *within* a formal context (e.g. a configuration of chess pieces lacking their own meanings) and propositions stated *about* a formal context (e.g. ‘checkmate’);
3. mathematical (arithmetical) theories applied outside mathematics and mere games unable to apply themselves (thus below ‘the rank of science’).

My pragmatist reading goes along with Frege’s three-prongs as above, for the criticisms can apply to the formalist reading of Berkeley’s mathematical sciences. For they are, on my rendering, rather *pragmatic* within my M pyramid model. Even though the final section of *Miscellanea* (IV, 214–220) is ‘De ludo algebraico [On the algebraic game]’, I interpret that on Berkeley’s own terms, the *ludus* (‘game’) does not entail modern *game* formalism. But instead, the algebraic game bears pragmatic applicability on the logical and semantic levels. Therefore, in accord with Brook, Pearce, and Frege, I endorse Berkeley’s non-formalist stance to the logical truth and its utility in life, which eschewed the formalist fallacies (especially Frege’s third prong). On this basis nearly on a par with logicism, I view that Berkeley’s pragmatist theory of causation from mathematical hypotheses is no mere ‘amusement’ by ‘trifling numerical speculations’ (*Principles* §119).

Instead of any game-like amusement, a mathematically conceived truth is preserved, deliberated, and expressed for its daily utility by (i) the signification or application of signs and (ii) unreal objects of algebra and arithmetic in semiotic process. This is my reformulation of the above quoted *Alciphron* §7.17. Put differently, Berkeley does not prevaricate, unlike modern formalists who state no truth beyond the rules of mathematical operations of meaningless symbols *per se*. Rather, he pursued and stated truths, or ‘what is true of algebraic signs [...] also true of words or language’, through ‘logistic operations’ (q.v. *Alciphron* §7.17). Thereby the geometer or mechanist can deliberate on the truths of causal laws and pragmatically express them. This point of mine reinforces Frege’s first and second prongs; that is, meaningful⁴⁰ signs and true propositions are distinctly

³⁹ Frege 2016 [1903] II, pt. 3, §91; Simons 2009, 295–296. The modern interpretations of logicism and neo-logicism stem from Frege’s arithmetic. But arguably, he did not call himself ‘logician’. In addition, there is a caveat: it may be an over-generalisation that Frege had a philosophy of mathematics *per se*, apart from his dominant interests in arithmetic (*Grundgesetze der Arithmetik*, 1893/1903). He is largely silent about geometry, for example, though he wrote a few works like ‘Über die Grundlagen der Geometrie’ (1906). I thank Enda Russell for that caveat. Anachronistic as it may be, I consider Berkeley’s pragmatic method on the mathematical foundation in the key of logicism.

⁴⁰ In fact, hardly can we find Berkeley’s argument *for* meaningless signs or insignificant words, unlike the formalist reading. See *Alciphron* §7.8 (2nd ed., emphasis added): ‘words may *not be insignificant*, although they should not, every time they are used, excite the ideas they signify in our minds [... T]here may be another *use* of words besides that of marking and suggesting distinct ideas, to wit, the influencing our conduct and actions, which may be done either by forming rules for us to act by, or by raising certain passions, dispositions, and emotions in our minds. *A discourse*, therefore, that directs how to act or excites to the doing or forbearance of an action may, it seems, be *useful and significant*’. Through Berkeley’s mouthpiece character Euphranor, I reconstruct that his argument for the ‘discourse’ composed of words or signs deduces its conjunctive conclusion, ‘useful *and* significant’, not disjunctive. Whilst I do not support another reading of non-cognitive emotivism, see also *MI* §20; *Notebooks* §378, 494, 661; *Alciphron* §7.2, etc.

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judged or *confirmed* in Berkeley's valid demonstration against the abuse of linguistic abstractions. Hence, the M pyramid model is indicative of this logical process in the mathematical, mechanical domain.⁴¹

Accordingly, Berkeley does not exactly stand to formalism, on my reading of his pragmatist theory of causation. The theory that I reformulate hinges on the objects of mathematical hypotheses from the levels of logic to mechanical causation. It is important here how he understood the speculative mathematics itself, when objecting to his contemporary mathematicians by labelling them 'Nihilitarians' in the *Notebooks*.⁴² I do not particularly see a radical shift from the *Notebooks* (c.1708) to the *Principles* (1710) in this short period, unlike Jesseph (1993, 75). He thinks 'a shift from zealous revisionism to a brand of instrumentalism', as shown in *Principles* §131 ('*speculative mathematics*').⁴³ Rather, I disagree with Jesseph's formalist reading, for I take no 'brand of instrumentalism' but pragmatism in Berkeley. This should be the case when geometrical theorems and theories are expressed or counted as true and useful by their application to the explanation of practical issues in mechanical causation, such as attraction and gravity.

1.1.1.3 Berkeley's pragmatic causation: M pyramid model

Returning to Berkeley's pursuit of truth within the universe of discourse, the *veritas* is a truth-value that every proposition in mechanics (e.g. a causal law of gravity) has. This logical and mathematical truth necessitates the mechanist's evaluation of it. Thus, in the M pyramid model, the evaluation of this truth occurs at the second semantic level, where the sentence must be given a verifiable meaning as distinct from falsity, the other truth-value.⁴⁴

Then, at the third level, sentences (particular epistemic attitudes)⁴⁵ and propositions (meanings of sentences) are judged and believed to be either true or false. The most vital in this pyramid model is the fourth pragmatic level, where what is judged or confirmed to be true becomes used and practised in order for us to express the sentences, propositions, and laws. But for our human utility, the lower levels do not make sense. In other words, our own using or practising those linguistic formulations is indispensable for maintaining the truth of them. On top of this practice, at the fifth ontic level,⁴⁶ objectual variables of entities in those sentences about causation are *committed*

⁴¹ In passing, I think that Berkeley accepts Leibniz's logicist aspect, to the extent to which the latter states as follows: 'arithmetic and algebra can be so treated by means of logic, as if they were logical mathematics, so that in this way Universal Mathematics coincides in effect with logistics and the logic of mathematics'; 'algebra derives its advantages from a much higher art, namely, the true logic.' See Leibniz, 'universal mathematics' and 'letter to Gabriel Wagner' (1696); *GP* VII, 54, 524; Martin 1964, 84; Ishiguro 1990.

⁴² *Notebooks* §471: 'If the wit & industry of the Nihilitarians were employ'd about the usefull & practical Mathematiques, w^t advantage had it brought to Mankind?'

⁴³ On a view similar to Jesseph's, see Szabó 1995, 58. However, I agree with Brook (2012, 2), seeing no shift as such in Berkeley's geometry about extension consisting of sensible minima. See also *NTV* §§80–83.

⁴⁴ For Berkeley's two-valued logic, I do not presume many-valued logics, although I will later touch on Jaina seven-valued logic called *syādvāda* in a footnote of §3.1.2 for my interpretative clarification.

⁴⁵ For my interpretation of sentences as 'epistemic attitudes' that we have towards certain propositions, such as judgments and beliefs/disbeliefs, see Ducasse 2015, 179–182; W. Johnson 1921–24.

⁴⁶ Objects on the fifth level have unobservable occult qualities, such as gravity and attraction, which the causal terms of 'mathematical hypotheses' can describe for their manifest phenomena (effects). This description by mathematical

on the basis of the lower levels. This ontic level is thus distinguished from M*, any metaphysically permanent and internal essence as the object in causation. Finally, the sixth level of mechanical causation underpins our pragmatist theories of causation ultimately applied to the mechanical universe, M. As a whole, this pyramid-modelling reformulates Berkeley's immaterialist maxim: 'esse is *percipi* [to be is to be perceived]'—*aut exprimi* (or to be expressed).⁴⁷ In the spirit of the Berkeley of *DM*, my Latin addition 'to be expressed' clarifies a pragmatic end within the M Pyramid. This is because the objects that have occult qualities are realistically confirmed at the epistemic level, used at the pragmatic level, and committed on the ontic level for enacting the top level of mechanical causation. Therefore, the truth and utility of causation are expressed and understood in the M-immaterialist universe of discourse.

From this pyramid point of view, I scrutinise what Berkeley meant by 'objects of human knowledge', i.e. those at the epistemic level, in the second edition of *Principles* §89 (emphasis added):⁴⁸

We may be said to have some knowledge or notion of our own minds, of spirits and active beings, whereof in a strict sense we have not ideas. In like manner we know and have a notion of relations between things or ideas, which relations are distinct from the ideas or things related, inasmuch as the latter may be perceived by us without our perceiving the former. To me it seems that *ideas, spirits and relations are all in their respective kinds, the object of human knowledge* and subject of discourse: and that the term *idea* would be improperly extended to signify everything we know or have any notion of.

This passage indicates that the objects of our human knowledge, on which we discourse, are three kinds of entities: (1) ideas or mental representations, (2) spirits or minds, and (3) relations.⁴⁹ The latter two belong to our *notional* knowledge (notions, not ideas). From this epistemic and our pragmatic levels, the ontic level consists of those three entities, on my view of Berkeley's world. Of course, taking just two entities of ideas and minds has been conventional in Berkeley scholarship.⁵⁰ However, I unconventionally take it that the third entities 'relations' are integrated into the M universe of discourse, distinct from the 'things or ideas [...] perceived by us', finite minds (§89).⁵¹ Logically and realistically, when unperceived objects are irreducible to anything else, 'relations' do exist in Berkeley's world as M universe.

On the other hand, corroborating the M universe hypotheses is deemed to be a *quasi*-reference to the *quasi*-entities in the domain of mechanics. See [Chapter 5](#).

⁴⁷ *Principles* §3; *Notebooks* §429, etc.

⁴⁸ *Principles* §89 increased about half the amount from the first edition (1710) to the second (1734), including the above quotation. I see Berkeley's growing interests in 'relations', which pertain to his developed grasp of mathematical sciences such as mechanics. This revised section may contradict the earlier §86, for example: 'human knowledge may naturally be reduced to two heads, that of *ideas*, and that of *spirits*.' Although this section was not revised from the first edition, one can see Berkeley's extended yet complex implication of *notional* knowledge in the human mind, including the notions of relations in mathematics. On Berkeley's early preoccupation with mathematics (arithmetic, algebra, and geometry), albeit many of the entries having the mark ×, see *Notebooks* §§101, 382, 384, 428, 458, 509, 697, 758, 768, 770, 880, etc.

⁴⁹ For similar construals regarding 'relations' as a third kind in Berkeley's world, see Nakano 2014, 54–65; Flew 1993, 222.

⁵⁰ See e.g. Stoneham 2002, 23: 'the world consists of nothing but minds and ideas.'

⁵¹ On the 'relations', see also *Alciphron* §7.17, quoted above.

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semantically, epistemically, and pragmatically, relations are given the meaning and confirmed to be true, whereby used in daily (vulgar) and mechanistic (scientific) practices. That is, deliberating or talking about them is useful in our discourse and discursive thinking. Otherwise, *per impossibile*, (causal) relations could not be objectified in our human knowledge (nor could they be subjectified in our discourse).

In relation to the 'relations' in §89, let us also consider *Principles* §101 (emphasis original):

The two great provinces of speculative science, conversant about ideas received from sense and their relations are *natural philosophy* and *mathematics*, with regard to each of these I shall make some observations.

This clarifies that, for Berkeley, 'natural philosophy' deals with sensible ideas, and 'mathematics' does with the *relations* of the ideas. The latter relations, on my rendering, are causal relations or causation in the M pyramid model. *A fortiori*, the ideas of relations in mathematics are distinct from Locke's doctrine of abstract general ideas of 'relation' that Berkeley discards.⁵² To infer mechanical causation from *mathematical hypotheses*, such as gravity and attraction, on the top level in the above model, it can be seen that the mathematical province bases itself on that of natural philosophy. Therefore, I also take it that for Berkeley, causation is to some extent inductive by natural philosophical methods, whereas it is primarily deductively applied to the mechanical universe in our pragmatist discourse. This is because the input from 'sensation' (*sensus* or sense) and 'experimentation' (*experientia* or experiment) is vital to the following 'geometrical reasoning' in our correct 'linguistic usage' (*DM* §1). This theorisation of mechanical causation will be unfolded in due steps.

But here, light must be shed on the mathematical hypotheses as objects of human knowledge in the mechanistic practice. Those objects are causes for manifest effects at the top M level of mechanical causation or relations of ideas. In the context of *DM*, also called 'supposition' (*DM* §§15, 55, 61), the 'hypothesis' is a collective term referring to '*force, gravity, attraction*, and terms of this sort [...] useful for reasonings and calculations' (*DM* §17). 'Even though they would be sought in vain in the very truth of things and in actually existing bodies', the hypotheses are 'framed' (*finguntur*) or imagined in human minds as general notions and propositions by 'mathematical abstraction' (*DM* §39).⁵³ Thus, such hypotheses denote nothing metaphysically absolute or 'no stable essence in the nature of things' (*DM* §67). But instead, we mathematically imagine or make hypotheses describe each 'occult quality' unperceived in external phenomena, which is not 'sensible' or manifest to our minds (*DM* §§4–6, 23). However, upon the logical and semantic bases, whilst

⁵² *Notebooks* §733: 'The Obscure ambiguous term Relation w^{ch} is said to be the largest field of Knowledge confounds us, deceives us.' This derogatory 'relation' or necessary 'connexion' in mathematics is not the same as what Berkeley meant about e.g. the idea of a triangle. This is because the former Lockean abstract relation ('the three angles of a triangle are equal to two right ones') concerns 'aeternae veritates' (eternal truths) that must 'vanish' (*Notebooks* §§735, 831). That is, Berkeley has nominalism and conventionalism, according to which it is impossible to represent universal, general knowledge of the 'triangle' from particular and arbitrary conceptions of it in our different minds (*Notebooks* §§528–531, 687; *MI* §§21–26, etc.). Thus, we entertain the nominalist/conventionalist abstraction of relations in Berkeley's mathematics. This relates to his pragmatic method within the M pyramid model. See Locke, *Essay* §§4.1.9, 4.3.18, 4.11.14; Kneale and Kneale 1971, 19, 312; Baum 1972, 119–120.

⁵³ On the term 'framing' or 'imagining' (*fingere*), see also *DM* §§27, 33, 40, 50, 53.

epistemically and realistically deliberating the sentences of unobserved entities to be true of false, we have the pragmatic level of those objects to express their utility by our discourse.

Hence, in pursuit of truth *in use*, mathematical hypotheses are pragmatic objects that can be pragmatically applied to the mechanistic system of M universe, wherein ordinary people can confirm and express truths. Rejecting the need for formalism as I argued, the pragmatic objects as hypotheses are epistemically confirmed to be true, so that one can hold the pragmatic level of our correct linguistic use (*DM* §§1–2) and ‘mechanical practice’ (*DM* §42). By the law of excluded middle, if we judge any epistemic objects to be false, then they cannot be expressed on the pragmatic level of utility. But instead, causal laws from the mathematical hypotheses are useful as true sentences. Here, my pyramid-model reformulation of Berkeley’s way of expressing causal laws here bases itself on a pragmatic theory of truth.⁵⁴ In other words, if we deploy the notions of mathematical hypotheses for some sentences that are both useful and true, then our mechanical practice is the pragmatic outcome of our deliberative judgement of truth-values of law-propositions. For the Berkeley of *DM*, the mechanical practice from mathematical hypotheses is independent of metaphysical, absolute causes (M*). Moreover, those hypotheses are taken to be merely unperceived notions, but formulated into truthful and useful causation between ideas that we can recognise and talk about within the M pyramid model.⁵⁵

To that pragmatic end, I maintain that mathematical hypotheses are mechanical causes as essential to the third entities ‘relations’, or causation, in Berkeley’s world (M universe).⁵⁶ That is why the mathematical province, whilst supported by the natural philosophical province, is indispensable for his pragmatist theory of mechanical causation. On the other hand, in terms of objects of human knowledge in practice, there is one early modern source for Berkeley’s pragmatic method to enable the M universe of discourse. That is Bacon’s new scientific method.

1.1.2 Bacon’s pragmatic method

It is my view that Berkeley was at pains to make his pragmatic method clear and distinct, whereas the roots of his inclination to pragmatism can be found in the precursors’ scientific attitudes. Amongst all, I consider here that the new scientific method of Francis Bacon (1561–1626) is worth examining

⁵⁴ Whilst I view more connections between Berkeley’s pragmatist theory of causation and Peirce’s pragmatist theory of truth, Simon Blackburn (2008, 285–286, clarification added) explicates that the pragmatist theory of truth is ‘especially associated with James, that the truth of a statement can be defined in terms of the utility of accepting it. Put so baldly the view is open to objection, since [first fork] there are things that are false that it may be useful to accept, and conversely [second fork] there are things that are true that it may be demanding to accept.’ This two-pronged objection is no concern for instrumentalism that I will later reconstruct in Berkeley’s *DM* context, for utility of law-propositions can be taken without the truth-values. However, I argue that this instrumentalist reading is mistaken when it comes to Berkeley’s inquiry into truth and utility within the same pragmatic bearings. See also Peirce 1878; Walker 2017, 534–538.

⁵⁵ See *Principles* §§27, 89, 101, 142; *NTV* §150; *DM* §§53, 54, 63, etc.

⁵⁶ See §0.1.2 on three models of causation. The third model concerns Berkeley’s pragmatist theory of causation from mathematical hypotheses.

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from the perspective of Berkeley's reception.⁵⁷ I assume that Berkeley read Bacon as he owned Bacon's *œuvre* in his home library.⁵⁸ It is true, as William and Martha Kneale (1971, 310) put it, Bacon 'did not suggest any development of logic in that sense of the word', however methodically introducing his theory of induction and opposing Aristotelian logic. Despite this fact and many other early modern philosophers,⁵⁹ I will argue that Bacon is one of the greatest precursors to Berkeley for his scientific method in a pragmatist key. To this Baconian end, specifically regarding our use of language, I will begin with a prelude of Galileo Galilei (1564–1642).

It is Geneviève Brykman (1984, ch. 9, n. 95) who argues that, before Wittgenstein, Berkeley is a dignified ('digne') successor of Galileo in interpreting the use of habitually used terms, such as 'gravity'. It seems true that the early Galileo of *De motu* (c.1590) as essentialist (with Descartes and Locke) is different to Berkeley as anti-essentialist (anti-Cartesian) regarding the epistemological explanation of reality, either ultimate or conventional.⁶⁰ However, the later Galileo of *Dialogo* argues in the following (1632; 1967, Day 2, 234, in the voice of his mouthpiece, Salviati, emphasis added):

You are wrong, Simplicio; what you ought to say is that everyone knows that it is called 'gravity'. What I am asking you for is not the name of the thing, but its essence, of which essence you know not a bit more than you know about the essence of whatever moves the stars around. I except *the name which has been attached to it and which has been made a familiar household word* by the continual experience that we have of it daily.

From here, I agree with Brykman that Galileo and Berkeley both perceived that the most functional and the most unrecognised pitfall of language lied in the familiarity of our conventional use of names and terms. That is, it would be baffling when daily terms, like 'heaviness' or 'gravity', made little or no sense in our communication. Here comes a pragmatic understanding of causal terms,

⁵⁷ 'As to Bacon', only once in his correspondence (to Prior, 1 December 1726; Hight 2003, Letter 160), Berkeley fretted over his 'management in South Sea House', etc., but this Mr Bacon should not be confused with Francis Bacon. Returning to the British Isles in the late autumn of 1721, Berkeley had been concerned by the South Sea Bubble of the same year.

⁵⁸ 'A catalogue of the valuable library of the Berkeley family' (Leigh and Sotheby 1796, BL S.C.S. 28); Appendix 3. According to the catalogue, the Berkeley family (his son and grandson included) owned: 398. Bacon's Elements of the Common Laws (1639); 485. Baconi Opera (1665); 498. Baconi Opus Majus (1733); 1408. Bacon on Good and Evil (1706).

⁵⁹ In the scope of early modern logics and mathematics, I do not disregard Berkeley's critical reception of Leibniz, although it is not at all in a pragmatist key when citing him in *DM*. For Leibniz's deductive system of knowledge, closer to logicism than to formalism, see Kneale and Kneale 1971, 331 (also ch. 5, §§2–3); Ishiguro 1990, 99 (also chs. 5–6).

⁶⁰ Popper 1953, 28–29; 2002, 98–105; Atherton 1991, 50, n. 29. Margaret Osler (1973, 504–507) points out the development from the early to the later Galileo, namely, from an essentialist epistemology in the *De motu antiquiora* and a non-essentialist one in his mature mechanics with regard to the nature of motion. What I mean by 'essentialism' is chiefly an epistemological view, in the domain of mechanics, that the internal, real natures of objects are unveiled to us in observations. This is contrary to non- and anti-essentialist views that the real essences of objects are not discovered, such that the mechanist is merely concerned with the operational or phenomenological attributes of the objects. On my rendering, the Berkeley of *DM* takes the latter in discovering 'no stable essence in the nature of things' (§67). However, I do not take essentialism to necessarily signify realism. Put another way, as indicated with the Psillosist realism with three theses in §0.1.2, I defend that Berkeley does not deny an epistemological aspect of scientific realism regarding undiscovered occult qualities. This is because the objects having such qualities are described in causal terms, thereby the mechanist can semantically formulate and epistemically confirm truthfully useful mechanical causation.

as we conventionally express them for utility and truth in scientific discourse without ultimately comprehending the essence or nature.⁶¹ Therefore, my pragmatist reading is that, as with Galileo, Berkeley had been mindful about how to express truth and utility by our common use of theoretical, causal terms (e.g. ‘gravity’).

On the other hand, slightly prior to Galileo’s fame via translation, there was a more immediate influence in the British Isles: the works by Francis Bacon, Lord Verulam, Lord Chancellor of England. In fact, already in his salad days in the 1700s, Berkeley read Bacon’s work, such as *Novum organum* (1620; 2004). Here is the evidence. Where criticising Locke’s discourse on ‘abstract general ideas’ (*Essay* §4.9.7; approx. *Notebooks* §§561–567),⁶² Berkeley’s *Notebooks* §564 reads:

Doctrine of Abstraction of very evil consequence in all the Sciences. Mem: Bacon’s remark.
Entirely owing to Language.⁶³

This highlights one of the four *idola*⁶⁴ that should be dismantled by Bacon’s new method of induction in *Novum organum* (§1.43, etc. aphorisms): i.e. the third ‘Idols of the Market’ (*Idola Fori*, of forum).⁶⁵ These idols occur by the cause of abused words, or the discrepancy in linguistic usage between ordinary or vulgar people in the market and intellectual people who do not speak at the market-based rudimentary level. This is because the way intellectual people speak hinges on general terms too much abstracted from the vulgar, common use of language in the market. Thus, in the human mind, the abuse or uncommunicative use of language between different trades causes incomprehensibly or uselessly general ideas abstracted from words.

Likewise, Berkeley was mindful, lest this abused abstraction leads to ‘evil consequence’ in the sciences by the semantic and thus pragmatic applications of our terms (q.v. *DM* §§1–3). The above

⁶¹ Brykman 1993, 327; Clavelin 1968, 392–397.

⁶² Owing to Berkeley’s extensive reception of Locke, albeit critical about abstractions, Moriarty views that Locke’s philosophy of language (*Essay*, ‘Of Words’) is more formative than Bacon’s ‘new science’ in an aspired scientific community (e.g. *New Atlantis*), whereas she does argue that ‘Bacon is a potential influence that has never been seriously considered in Berkeley scholarship’ (2018a, 24–26). Developing more from Moriarty’s thesis, I argue that Bacon is the prime influence on Berkeley in their common interests of pragmatism.

⁶³ See also *Notebooks* §§642 (‘the chief thing I do or pretend to do is only to remove the mist or veil of words’), 178, 513, 537, 553, 596, 636, 638, 696; *Principles* §§6 (Intro), 23 (Intro), 79, 89, 144; *Dialogues* 1.199, 3.239; *NTV* §120; *TVV* §§33, 35, 70; White 1955, 172. See, in particular, *MI* §30 (deletion/emphasis original): ‘I come now to consider the Source [Cause] of this Prevailing Notion [Imagination in the Minds of Men,] And that seems to me most evidently to be Language. [...] That [Words are] the Conceit of Abstract ideas owes its birth and Origine to Words [...] I find it also declared in express terms that *General Truths can never be well made known and are [is] very seldom apprehended but as conceived and expressed in Words.*’

⁶⁴ On Bacon’s own terms, ‘idols’ (*idola*) can be paraphrased to be misleading, malfunctioning ‘predispositions of the mind’ (Jardine 1974, 80), which hold back our scientific progress.

⁶⁵ *Novum organum* §1.59: ‘*Idols of the Market*, which have slipped into the intellect through the alliance of words and names, are the greatest nuisances of the lot. For men believe that their reason rules words but it also happens that words turn and bend *their* power back upon the intellect; and that has made philosophy and the sciences sophistical and inactive.’ §1.60: ‘*Idols* imposed on the intellect by words are of two kinds: for they are either the names of things which do not exist [...] or names of things which do exist but are muddled, ill-defined, and rashly and roughly abstracted from the facts. [...] But the other kind, which springs from wrong-headed and ignorant abstraction, is convoluted and hard to eradicate. For example, take a certain word (*Moist*, if you like) and see how far the things signified by it agree with each other, and you will discover that this word *Moist* is nothing but a vague label for different actions which refuse to be reduced to any common factor.’ See also Pérez-Ramos 1988, 85; Jardine 1974, 81–82. The wrongly abstracted or abused language, being deceptive, is the root cause of practical knowledge to be dismantled.

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quotation from *Notebooks*, in fact, echos what Bacon admonished (*Novum organum* §1.9):

But the root cause of practically all the evil [*Causa verò Ǝ ferè omnium malorum*] in the sciences is but one thing: that while we mistakenly admire and magnify the powers of the human mind, we fail to seek out true helps for it.

The 'powers of the human mind' are understood to be those of our linguistic abstraction, provided Bacon's new logic in the sciences, however called 'induction'.⁶⁶ The question at issue is how Berkeley learnt the Baconian inductive logic and scientific method in successfully confirming and expressing the truth in scientific practices. Thereby I deem the Berkeley of *DM* to be a type of Baconian in the mathematically mechanical, mainly deductive practices.

The key to this question, I think, is the powers of abstraction in the human mind for establishing one's practical knowledge that Berkeley intended to defend. The knowledge or a collection of correctly abstracted ideas is not restrictive to either induction or deduction or even abduction, when it comes to pragmatically expressing true causal relations for our sake. On the other hand, on my view, the knowledge is directly chained with what are epistemically deliberated to be true (or false) in scientific investigation and discourse. In other words, in my pyramid-model reformulation, the scientific practices correspond to the process of abstracting and generalising true theories of mechanical causation from mathematical hypotheses as pragmatic objects.

On Bacon's influence on Berkeley's treatment of pragmatic objects, apart from the cases of occult qualities, C.J. Ducasse suggestively labelled Bacon a 'quasi-Berkeleyan' in appreciating sensible qualities in nature that we can perceive and deliberate over. This is because such an appreciation is possible 'either by actual sense experience or by the representative imagination properly controlled' (Ducasse 1960, 70). To me, this interpretation is simply anachronistic; born more than a century later and actually reading his work, Berkeley is rather a 'quasi-Baconian' in appropriating Bacon's insight into truth and use/practice. The Berkeley of *DM* is, indeed, *quasi*-Baconian because he upholds true and useful theories from empirical hypotheses describing manifest qualities.⁶⁷ However, on my rendering, he is even more *quasi*-Baconian in the sense of those theories from mathematical hypotheses, which describe the objects of occult qualities that we cannot perceive but find useful, such as 'attraction' in mechanics and dynamics.⁶⁸ Hence, the 'quasi' in my sense implies that Berkeley's prime interest is not in induction unlike Bacon, but in deduction by his discourse on mathematical, mechanical causation. Nonetheless, featuring the Baconian human practical knowledge, I argue that the consonance of truth and practice, or better said the pragmatic theory of

⁶⁶ By 'logic' Bacon primarily meant the approach of gradual and untrodden 'induction' to truth (*Novum organum* §1.19, 105, etc.). He found this logic as a new scientific method, and so did his followers, I think, including Berkeley. See Bacon's letter to King James I (12 October 1620; 1874): the *Novum organum* is 'no more but a new logic, teaching to invent and judge by induction, (as finding syllogism incompetent for sciences of nature) and thereby to make philosophy and sciences both more true and more active.' Thus, in his discourse on the certainty of truth, Bacon brought to light the inadequacy of the Aristotelian paradigm of scientific discovery, disputing about 'useless [*inutilis*]' Aristotelian syllogistic methods. See also *Novum organum* §§1.11–15; Cassan 2021, 255; Jardine 1974, 76–79.

⁶⁷ That is model 2 of causation from empirical hypotheses. For the three models of causation that I posited, see §0.1.2.

⁶⁸ For the utility of mathematics—pure and applied/mixed—in Bacon's pragmatic method of knowledge against the backdrops of in the British Isles from the sixteenth to seventeenth centuries, see Gaukroger 2001, 20–27.

truth, is the foundation for Berkeley's theory of mechanical causation (q.v. the pyramid model as above).

Thus, I consider Berkeley's quasi-Baconian perspective on mathematical hypotheses for our utility in pursuit of truth in *DM*. Putting aside his labelling, I now assume that Ducasse rightly unpacks the viability and pitfalls of Bacon's pragmatic method, as follows (1960, 52–53):⁶⁹

In the first aphorisms of the first book, Bacon declares emphatically that the test of real knowledge, as distinguished from what has hitherto passed for knowledge, is ultimately pragmatic one. [... Bacon] is fully conscious of the weakness of the senses and of the understanding when left to their spontaneous modes of activity, but he believes that when the faculties of man are provided with an adequate instrument, such as the method that he intends to formulate will constitute, it will become as easy for these weak human powers to obtain real knowledge as it is for the most unskilled hand to trace a true circle when provided with a compass.

This understanding that the human knowledge is pragmatic, no matter how unreliable our senses and reason are, can apply to Berkeley's quasi-Baconian method. Firstly we should consider the beginning aphorisms in Bacon's *Novum organum*, especially §1.3:

Human knowledge and power come to the same thing, for ignorance of the cause puts the effect beyond reach. For nature is not conquered save by obeying it; and that which in thought is equivalent to a cause, is in operation equivalent to a rule.

This, probably the most renowned aphorism in Bacon, underscores that the knowledge of natural causes is 'in operation' or pragmatic for our sake. We can further see why this pragmatic knowledge is simultaneously true. *Novum organum* §1.124 reads:

Thus truth and utility are [...] the very things themselves [*ipsissimæ Res*]; and the very works give much more as guarantors of the truth, than providers of material benefits.⁷⁰

This illuminates Bacon's emphasis on the certainty of truth in practice, which is likened to the *Ideas* of the divine, over 'material benefits', which are produced by arbitrary abstractions from the *Idols* of the human mind. The divine *ideas* and the human *idols* are contrasted in this section, for Bacon intended to 'lay foundations in the human intellect for a true pattern of the world as we actually find it and not as someone's own private reason hands it down to him' (§1.124). However divine it were, the true pattern that Bacon aimed to infer must be found in the human mind. On my view,

⁶⁹ Ducasse's distinction of Bacon and the American pragmatist William James is also suggestive (1960, ch. 3, n. 6): 'Bacon virtually asserts: *Unless* an idea "works," it does not constitute real knowledge; while James's position is rather: *If* an idea "works," it constitutes knowledge, truth [... for James] there is no difference anywhere that does not make a difference somewhere.' This contrast of the unless-if conditionals in each antecedent is effective in the discourse over scientific knowledge. I take it that the *unless* condition implies a counterfactual assertion, which is reinforced by mathematical hypotheses that Berkeley pragmatically discussed. In this sense, Berkeley is not a Jamesian pragmatist with the *if* condition but a quasi-Baconian one, who is rather close to C.S. Peirce's pragmatism. Peirce's reception of Berkeley's pragmatic method will be discussed in [Chapter 5](#).

⁷⁰ *Novum organum* §2.4 ('what is most useful in operating, is most true in knowing'), §1.8, 'Plan of the Instauration', Argument of Part 3, etc.

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that is identified with the practical knowledge of truth, or true scientific theories, which we finite minds successfully acquire.

Accordingly, the pragmatic knowledge that the human mind truthfully constructs and formulates for itself is likewise what Berkeley of *DM* aimed to discourse. Thus I think, for him, true and correct linguistic abstractions are to defuse general ideas that are useless in the light of the third *idols* of the market.⁷¹ Not only was Berkeley conscious about (i) the idols of this misleading abstraction, but also about (ii) how to infer scientific knowledge in his pragmatist discourse over mathematical hypotheses. These two respects are the backbones of Berkeley's pragmatic theory of mechanical causation, which I will further define.

Finally, in relation to mathematical hypotheses in mechanical practice, we have to consider another work of Bacon that Berkeley probably read through. That is the *Advancement of Learning*, particularly in the following passage (1605; 2000, 2H3^v):⁷²

Tennis is a game of noe vse in it selfe, but of great vse, in respect it maketh a quicke Eye, and a bodie readie to put it selfe into all Postures: So in the Mathematickes, that vse which is collaterall and interuenient, is no lesse worthy, then that which is principall and intended. And as for the *Mixt Mathematikes* I may onely make this prediction, that there cannot faile to bee more kindes of them, as Nature growes funder disclosed.

On the above mixed or applied mathematics in Bacon, Berkeley ponders the 'analogy between the handball to play and mathesis' (approximately, tennis and mathematics)⁷³ and the utility in common. From this Baconian analogy, we cannot infer Berkeley's game formalism, because the utility is not to be understood merely within the game or below the level of science. But rather, in Bacon's passage above, what are 'collaterall and intervenient' as well as 'principall and intended' are useful for the other human purposes. In other words, mathematics is not purely for its sake, but for the other purposes that we aim at within our capacity. That is why the analogy works; playing tennis is useful for maintaining our bodies and postures, and so is applied mathematics (geometrically mixed reasoning). This Berkeley must have understood. As Peter Dear (1995, 155–156) points out, in contrast to Aristotelianism dissecting natural and human views, Bacon upheld the paramount

⁷¹ As Paolo Rossi (1968, 170) rightly points out, Bacon's theory of language is rooted in 'his mistrust of language—as of all the products of the human mind—because [...] it tends to hinder the true understanding of reality by coming between man and the world he inhabits.' I hold the view that Berkeley was sympathetic to Bacon's attitude to language and how to correctly use it in science. For the *idola* of the market concerning 'speech and wordes', though without reference to the term 'idols', see the *Advancement of Learning*, 2P3^r–2P4^v. There, Bacon objects to Aristotle's three-fold semantic theory in *De interpretatione*, 1.1: 'Wordes are the Images of Cogitations, and Letters are the Images of Wordes' (2P3^r). However, for Bacon, cogitations or concepts are not necessarily 'expressed by the Medium of Wordes'. See Cassan 2021, 257.

⁷² Bacon's book is identified by Luce (*Works* IV, 219). See also Moriarty 2018a, 24–26.

⁷³ *Miscellanea* ('De ludo algebraico', IV, 219): 'analogiam quandam inter pilæ palmariæ lusum et mathesin'. The μάθησις (*mathesis*) had been restrictive in the domain of geometry, whereas throughout the seventeenth century, primarily by Descartes (arithmetisation of geometry) and Leibniz (logical calculi—arithmetical, algebraic, and infinitesimal), analytical geometry developed to the philosophical notion of '*mathesis universalis*' (universal mathematics) over the original mathematical framework. See Mittelstraß 1979, 608–610; Rabouin 2009, 11–21; Beeley 2013, 42–44. I take it that, following in the footsteps of Descartes, Leibniz, and John Wallis (*Mathesis universalis*, 1657), Berkeley meant the application of 'universal mathematics' by '*mathesis*' in the above passage of *Miscellanea*.

importance of human purposes, because the way to achieve human ends drives to create our knowledge according to his natural philosophy. This ‘utilitarian’,⁷⁴ or pragmatic, method for the human mind lends itself to Berkeley’s approach to his pragmatist theory of causation that humans can imagine and express.

To summarise, starting with Galileo’s inclination to pragmatism regarding our use of daily terms, this sub-section clarified Bacon’s pragmatism against the *idola* of the market rooted in linguistic miscommunication between different types of people. Although Bacon’s new method was largely inductive, it was pragmatic knowledge that Berkeley would have recognised in it. To the extent to which Berkeley read his work, it should be clear that Bacon is the outstanding precursor to Berkeley in establishing what is scientifically true and useful for the human practical purposes in our life.

1.1.3 Berkeley’s pragmatic method

The Baconian pragmatic method of truth and utility is, historically and philosophically, integrated into the earlier pyramid model for Berkeley’s pragmatist theory of mechanical causation. Within that purview, I hold a view that Berkeley’s mechanical philosophy embarked upon defining our correct use of language from the beginning of his career. Here, I will further elaborate on generic ingredients in Berkeley’s pragmatic method, which will be defended step by step throughout my thesis.

On the aim of Berkeley’s pragmatic method in *DM*, or his linguistic and pragmatic approach to a discourse on mechanical causation, his unpublished *Notebooks* (1708–09) is first perspicuous (§178):

The impossibility of defining or discoursing clearly of most things proceeds from the fault & scantiness of language.

That is, Berkeley’s pragmatic method was supposed in a bid to maintain our ‘commonly received’ or correctly defined ‘use [or practice, (*usus*)]’ of language (*DM* §28). It particularly concerns our understanding of causal terms, in preventing the ‘abuse’ or misuse of useless terms.⁷⁵

At this juncture, *Principles* §108 in the first edition (1710) reveals Berkeley’s linguistic practice in the sense of ‘grammar’. Although he substantially deleted and revised that section in the 1734 edition, I assume that before publishing *DM* in 1721, Berkeley did not intend to delete a large portion of the following in *Principles* §108:

[T]he steady, consistent methods of Nature, may not unfitly be stiled the *language* of its Author, whereby He discovers His *attributes* to our view, and directs us how to act for the convenience and felicity of life. And to me, those men who *frame general rules* [emphasis

⁷⁴ See e.g. *Novum organum* §1.66: ‘all utility and capacity for producing works lies in intermediate causes [...] for the good of mankind.’ This is rather contrasted with the uselessness of ‘abstracting from nature until they arrive at potential and uninformed matter’. That is, Bacon criticised those theorising natural philosophy beyond human capacity and objectives.

⁷⁵ See *DM* §23, also §§1–7.

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added] from the phenomena, and afterwards derive the phenomena from those rules, seem to be *grammarians, and their art the grammar of Nature. Two ways there are of learning a language, either by rule or by practice* [emphasis added]: a man may be well read in the language of Nature, without understanding the grammar of it, or being able to say by what rule a thing is so or so. And, as it is very possible to write *improperly, through too strict an observance of general grammar rules* [emphasis added]: so in arguing from general laws of Nature, it is not impossible we may stretch the analogy too far, and by that means run into mistakes.

This initial version of the *Principles* suggests that Berkeley appreciates a properly, not 'improperly', ruled and practised language. The final sentence above unveils his ambivalence that, by looking to the 'rules' too closely, one may err in one's understanding of the nature or world. This implies that 'by practice' or mode of speaking, one might do better if one were to fail in discoursing 'by rules'. That is why he refers to the two ways of complementary language learning: 'either by rule or by practice'. As Peter Walmsley puts it, the 'grammarians' here insinuate those succumbing to 'the sort of pedantic, book-bound scholarship rejected by the modern natural philosopher' (1990, 160). For they do not grasp the 'grammar' of 'the language of Nature' in actual practice of the mathematical sciences, so that they are prone to grammatically or linguistically improper 'mistakes', such as analogy (§108). In contrast to them, Berkeley indicates Newton's *Principia* as '[t]he best grammar of the kind we are speaking of [...] acknowleg'd to be a treatise of mechanics' (*Principles* §110, another deleted part in the later editions). Through his critical admiration of Newton's grammar in mathematics and mechanics, it transpires that the Berkeley before *DM* aimed at a proper or correct use of language in the mathematically-applied mechanical practice as accurately as Newton's *Principia*. This implies that causal talk of mechanics in *DM* is by nature linguistic, according to the grammatical rules (or laws) and practices (or operations).

Overall, the above reading converges on Berkeley's pragmatic method, on my view. This is because, in such a linguistic framework of operational language, it is important that one be deliberating or confirming a correct use of causal terms so as to express law-statements. To that effect, these propositions must be deductively true in geometrical reasoning, whilst also being inferred inductively through sensation and experimentation. Hence, I argue that Berkeley's pragmatist theory of causation in *DM* can be read as part of his coherent linguistic, pragmatist discourse: namely, avoiding the improper misuse of language for us, finite human beings. As seen above, this is in accordance with his historical precursors, such as Galileo and Bacon.

In this principally linguistic context, Berkeley's pragmatic method can be reformulated within the pyramid model with the pride of place, Level M. To reach the top level of mechanical causation, the bottom levels of logic and semantics are important. For at the beginning, causal terms, such as 'force' and 'gravity' in *DM*, refer to theoretical or *hypothetical* entities (objects) on the term-level.⁷⁶

⁷⁶ In terms of 'hypothetical entities', my reformulation of Berkeley's causal terms (or mathematical hypotheses) principally stands upon David Lewis's argument for the Ramsey sentence (1970, 428–430). By the Ramsey sentence, I mean that theoretical, causal terms refer to the realisation formula or realised postulate of theories about n -tuple entities. My reformulation does not contradict Lewis's scientific realism about hypothetical entities, because Berkeley's pragmatic

Thereby the terms are formulated, i.e. framed, to occur in the propositions about laws and rules on the sentence-level.⁷⁷ Then, those propositions are predicated of or judged to be either true or false, as having truth-values. Given the two levels of language within the M Pyramid on the two bottom levels (logic/semantics), it is vital to understand that Berkeley's meaning of causal terms is identified as 'mathematical hypotheses'. For, on the lower epistemic level (q.v. the pyramid model), those causal terms relate to the objects having occult qualities, which cannot be observed as mathematical, hypothetical entities. However, realistically, the confirmed propositions as formulated from those causal terms are epistemic objects. On the higher pragmatic level, the objects therefrom are expressed in view of our useful discourse. In this way, on the higher levels of ontological commitment (only within the universe of discourse) and mechanical causation (top), there exist the final objects of causal laws and theories that the mechanist can deduce and compute.

Accordingly, with the prime importance of mathematical hypotheses as realistically incorporated into the M Pyramid in *DM*, one can concentrate on abstract reasoning from such mechanical causes. This inference is called 'geometrical reasoning'.⁷⁸ Thereby his pragmatist discourse on mechanical causation shall be clarified. In my reformulation, the geometrical reasoning can be broken down into three steps:

Step 3.1 Linguistic definition: *theorisation* by mathematical imagination or abstraction, i.e. the first framing of causal terms into law-propositions (*DM* §§33, 38, 39, 66, 67, etc.)

Step 3.2 Epistemic confirmation: *deliberation*⁷⁹ by judging the truth-values of theorised law-propositions in which causal terms occur (*DM* §§20, 28, 31, 38, 40, 67, etc.)

Step 3.2 Pragmatic expression: *locution* of law-propositions from mechanical causation for utility by mathematical deduction, followed by calculation (*DM* §§7, 28, 38, etc.)

These three steps of 'geometrical reasoning' are, in a narrow sense, taken to be a framing of causal terms in the mechanist's discursive thinking. Within the *DM* context of Berkeley's discourse, the three-step framing of causal terms is essential to deducing (and computing) pragmatic expressions of causal theories for the human utility in the end. Given this overview of Berkeley's pragmatic method about causation (i.e. causal relations in abstract terms) thus far,⁸⁰ [Chapter 3](#) will delve into his analytical, deductive, and mathematical method in the domain of mechanics.

To wrap up the whole first section, I have explained three matters: (§1.1.1) Berkeley's meaning of mathematical *hypotheses* (causal terms) as *objects* for mechanical causation in the M pyramid

approach to occult qualities that causal terms describe in *DM* concerns the irreducibility of those qualities in formulating causation. Put another way, even though entities that have occult qualities are purely mathematical (*DM* §67), they are semantically and epistemically taken to be realistic in true (or false) causal relations and laws within the scope of our practical knowledge. See also Ramsey 1931 (ch. 9.A 'Theories'); 1991; Introduction §0.1.2.

⁷⁷ The process of linguistic formulation from terms to law-propositions will be considered in [Chapter 3](#).

⁷⁸ [Chapter 3](#) will textually recount that element called 'geometrical reasoning' (reason), which is distinct from the other two elements, 'sensation' (sense) and 'experimentation' (experiment). See *DM* §§1, 4, 21, 36, 40, 71.

⁷⁹ This deliberation is the primary function in geometrical *reasoning*. For, on my view, it sifts what is causal from what is non-causal (statistical, topological, etc.) in mechanics, in addition to judging the truth-values of propositions. Thereby, mathematical hypotheses as causal terms can be strictly embedded in the application of causal laws from low-level mechanics to high-level sciences that we can express.

⁸⁰ By 'pragmatic' I designated model 3 of causation from mathematical hypotheses. See §0.1.2.

1.2 Toland's and Berkeley's appropriations of Newton

model, (§1.1.2) Bacon's pragmatic method that can underlie that of Berkeley, and (§1.1.3) Berkeley's pragmatic method as a stepping-stone to understanding his theory of mechanical causation. The theory that I reformulate represents Berkeley's pragmatist discourse in the above three steps. Given the pyramid model and the process of mathematical framing, I strictly distinguish theoretical, causal terms and propositions (theories/laws), in the context of *DM*, because 'mathematical hypotheses' are defined as the former. Therefore, from the terminological level of mathematical hypotheses grounded in the logical necessity and semantic evaluation, the human mind can express causal laws as clearly framed, deliberated, and expressed for one's needs and mechanical operations. However, this is solely feasible to the extent to which one *knows* or recognises that the formulations are true within one's framing: i.e. geometrical reasoning. As lastly shown, this process bases itself on one's linguistic abstraction and thus pragmatist discourse. Providing Berkeley's pragmatic method as such, the next sections will delve into another historical source for his pragmatism. Much more than Bacon, it is Toland that I think was on Berkeley's mind when completing his early works and *DM*. By Toland's appropriation of Newton in his own pragmatic approach to mechanical causation, we can recognise him as the most immediate precursor to Berkeley in Ireland. This is the goal of Chapter 1—my historiographical analysis.

1.2 Toland's and Berkeley's appropriations of Newton

From this section onwards, I will argue that Berkeley's pragmatist theory of mechanical causation is sourced in John Toland's appropriation of Newton and his critique of the Newtonians' and mathematicians' theological metaphysics. For this reason, on the foundation of the last section, I keep focusing on key terms such as 'hypothesis' or 'supposition' in natural philosophy on Berkeley's and Toland's own terms.⁸¹ Put differently, I explicate why Toland's argument was formative of Berkeley's pragmatic account of mathematical hypotheses in his *DM*. The Donegal heretic, Toland, is a conspicuous yet blatant free-thinker whom his contemporaries excoriated, especially in Dublin. For historians of early modern philosophy, it has been an interesting comparison between him and Berkeley regarding their respective critiques of abstract metaphysics of their contemporaries. For, as will be unpacked, they agree with each other as opposed to metaphysical mathematicians, despite the fact that Toland's religious rationalism (nothing beyond human reason)⁸² was repugnant to Berkeley's theological defence of mysteries.⁸³ These contrastive aspects will be examined

⁸¹ Unlike Berman (1994, 15–16, 148–150), Belfrage (1986, 325–330), et al., I do not take the emotivist interpretation of abstract terms in any non-cognitivist discourse (utterances) devoid of truth-values. This is not effusively obvious. Instead, on my rendering, a similar use between Berkeley's 'Gibberish' (*Notebooks* §696) and Toland's 'Blictri' (*CNM* §3.53) can be understood in the context of pragmatism, in which one ought to avoid the misuse of language like those terms but favour the meaningful or useful language.

⁸² Even for Toland, rationalism implies many senses: not merely religious, but also methodological (*contra* empiricism), mathematically deductive, and epistemically *a priori*. In the context where Berkeley disagrees with Toland, the rationalism concerns religious mysteries beyond our rationale.

⁸³ Geographically, when he was Dean of Derry (1724–1734) at St Columba's Cathedral, even if absent in Derry for his Bermuda project across the Atlantic Ocean, Berkeley was a neighbour of the people of Inishowen Peninsula. From them, he might have heard of Toland's uncommon childhood. On the other hand, in London through coffeehouses

historiographically.

1.2.1 Prologue to two Irish natural philosophers

In Toland and Berkeley scholarships, about a century ago, G.A. Johnston claimed that Berkeley's 'general philosophical position is intended to be, in the main, a criticism of Toland' (1923, 341–342). To me it seems that Johnston primarily meant Berkeley's *Alciphron* (especially Dialogue 7), in which Toland's anti-mystery view was voiced in Alciphron, one of the two characters of libertine free-thinkers. R.R. Evans further observed that 'Berkeley's star rose later, almost in proportion as Toland's fell. [...] Berkeley's growing popularity may well have contributed to Toland's obscurity' (1991, 217, n. 52). Amongst those scholars, Thomas Duddy (1999, 51) held a view that Toland's criticism of 'the irrational hypothesis' (i.e. credulity when not comprehending the Christian mystery, *CNM* §3.2.23) is more favoured than Berkeley's defence of it.⁸⁴ In these ways, whilst both similarly inherited Locke's theory of correspondence between ideas and words, there is stark contrast between the two Irish philosophers' theological attitudes.⁸⁵ In a scientific, mechanistic context, however, is there any sharp split between the two? We can assuage that on my view.

Taking my emollient route, it is their resembling critiques of metaphysical aspects in Newtonian mechanics that I will scrutinise. Thereby I reconstruct their pragmatist theories of causes that are expressed to be useful for human needs and practice (in the following chapters). Particularly, David Attis's preliminary summary is telling in this contrastive context (2014, 63, emphasis added):

Newton's work was full of inconsistencies, problematic assumptions, and dangerous implications, and the two figures who most clearly demonstrated this were both Irish—George Berkeley and John Toland. Toland was the first and the most dangerous of the free thinkers and *the specter that haunts Berkeley's entire body of work*. Toland argued that the science of Newton and the philosophy of John Locke invalidate the claims of established religious authorities. The revealed truths of Christianity, the doctrines of the Anglican and Catholic churches, he

and the Scriblerus Club (since 1714) in the 1710–1720s, Berkeley might have discussed the (notorious) legacy of Toland. In Putney, near London, Toland had lived for the last four years after coming back from the continent, dying there in 1722. See also Jones 2021, 38, *passim*; Sullivan 1982; Des Maizeaux 1726, 87.

⁸⁴ I disagree with Duddy's view, for I see the validity of Berkeley's Anglicanism, which is linguistically based on expressing what is meaningful ('significant'), such as 'the Comprehension of Men as the particular pleasures of the Saints in Heaven', upon which St Paul discoursed (*MI* §36; TCD MS 453, called 'Chapman Manuscript'). See also Pearce, *forthcoming*, ch. 3 'Faith'.

⁸⁵ On my view, Toland's reception of Locke is far less critical than that of Berkeley, for Toland pretends to accept Locke's ideational theory (correspondence between ideas and words or speaker utterance). If this theory is true, both Locke and Toland held quite a similar view that it is unreasonable to utter or assent to what is incomprehensible (not signified as an idea) when it comes to understanding Christian scriptures. Putting aside the issue of abstract ideas, Berkeley criticises the ideational theory on the grounds that what is incomprehensible is operationally useful to change dispositions of the hearer by human linguistic conventions and the universal truth of scriptures. See *MI* §§40–41b, *Principles* Intro §20, *Alciphron* 7. Keota Fields (2021, 825–827) rejects that the scriptural truth is determined (in his sense 'fixed and constituted') by human conventions in Berkeley. However, I slightly contend to him that the scriptural truth (of divine language) is not determined by, but applied to those human conventions or habits, such as our linguistic 'contrivance', 'appointment', and 'imposition' (*MI* §19 ['common Use of Men']; *NTV* §§146, 152 ['languages of human contrivance'], *Dialogues* 3.247, *Alciphron* §4.10 ['arbitrary imposition of Providence'], *TVV* §§36, 40 ['arbitrary appointment of mankind'], etc.), so that we can take the meaning in use or the utility.

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declared, are *all meaningless cant*. Matter itself [...] is active and requires no external intervention from God. And *the universal laws of science* [...] demand a world where all men are equal before the law. For Toland, Newtonianism supported deism, *pantheism*, and republicanism, and invalidated Anglicanism and monarchy.⁸⁶

Therefore, it is high time that we acknowledged the two Irishmen's contrastive views in the beginning of the eighteenth century. It is ostensible that Toland's materialism and Berkeley's immaterialism are contradictory to their theological ends, which are dissimilar indeed. Yet this aspect can be dismissed. By philosophical and mathematical reasoning, borrowing Attis's word, it is my view that the specter-haunting similarity of their critiques of Newtonian mechanics in natural philosophy ought to be explored. This has not amply been developed in Toland and Berkeley scholarships. In particular, why their critiques of abstract metaphysics resemble each other invites further interpretation in the mechanistic context against their common opponents, i.e. metaphysical Newtonians and mathematicians.

That is my objective to achieve in this chapter, for the sake of which I will concentrate on a comparative analysis of two specific texts: Toland's *Letters to Serena* (1704) and Berkeley's *De motu* (1721). On the other hand, the remainder of this current section is to historiographically construct the relationship between the two Irish philosophers, if both being regarded as such with their Newtonian indoctrinations.

1.2.2 Newtonian backdrops of Toland and Berkeley

On the whole, Toland's *Christianity not Mysterious* (1696) is representative of his impious oeuvre. It was radically iconoclastic by uprooting anything unintelligible in Christianity and championing human reason whereby biblical doctrines made intelligible.⁸⁷ In this sense, however eloquently scandalous, he has been regarded as a rationalist.⁸⁸ Much to his chagrin, indeed, by order of the Irish Parliament with condemnation by the Dublin Jury,⁸⁹ the book was burnt thrice by the common

⁸⁶ Here it is noteworthy that Toland did not use the term 'pantheism' in any of his works (Daniel 1984, 211–212). After *Socinianism Truly Stated: [...] by a Pantheist* (1705) and *Origines judaicae* (1709), in *Pantheisticon* (1720, in Latin, 'On the pantheists'), he solely referred to the 'pantheists' who belonged to what he called 'Socratic Brethren'. Pantheism is not his own, but the product of either commentators' interpretations of his rationalist-materialist critique of religious mysteries or Joseph Raphson's original coinage of '*Pantheorum*', '*Panbylistæ*'/'*Panbylismi*' and '*Pantheismus*' in terms of Spinozism in his *De spatio reali* (Raphson 1702 [1697], 2, 8, 21; Thomson 2008, 54). Toland probably borrowed the first of Raphson's two definitions: (i) *pantheus* (as whom Toland regards himself in *Socinianism*, etc.) embracing that 'a certain universal substance, material as well as intelligent, produces whatever exists by forming from its own essence', and (ii) (atheistical) *panbylist* believing that there is nothing but matter or every material existence (Raphson 1702, 2; Daniel 2021, 241). Most importantly, whilst noting his (i) 'pantheist' materialism, I do not discuss pantheism but Toland's anti-metaphysical stance to contemporary mathematicians regarding mechanical causation.

⁸⁷ It is not coincidental that Toland was preparing to publish this 'literary bombshell' (McGuinness 1997, 315, n. 12) right after the expiration of the Licensing Act in 1695. This meant the end of censorship by those who 'licensed': namely, the lord chancellor, the Archbishop of Canterbury, and the secretaries of state.

⁸⁸ In his celebrated book, Paul Hazard included Toland in the chapter 'Rationalists'—the Cartesians, Malebranche, and Spinoza—correctly pointing to Toland's refutation of Spinoza in *Serena* (1935, pt. 2, ch. 1). See also Berman 1982a, 151–153; 2005, 83, who called Toland an 'epistemological rationalist', albeit different to Spinoza and Leibniz.

⁸⁹ The concerned book was referred to the Committee of Religion in the House of Commons, where the motion was made on 14 August 1697 (Toland 1697, 22). See also Sullivan 1982, 7–9.

hangman in Dublin in September 1697: twice in College Green before the Parliament Buildings and once near the Tholsel, issuing a warrant of arrest (M. Brown 2013). As he was then staying in Dublin, Toland might have been arrested or at worst cost his life; by his own account, a member in the Committee of Religion requested that ‘Mr. Toland himself should be burnt’ (Berman 2005, 84; Toland 1697, 24–26).⁹⁰ No wonder that he never came back to Ireland.

In the same city, on the other hand, it is unknown when exactly Berkeley came to know the heresy of Toland. I assume that he did, relatively soon after he entered Trinity College as a pensioner on 21 March 1699/1700 (Jones 2021, 37). The provost back then was Peter Browne (1699–1710), who published his *Letter in Answer to a Book Entitled Christianity not Mysterious* (1697), which led him to take the college’s top position in 1699 as recommended by Narcissus Marsh (former provost, 1679–83). Since the book-burnings and the promotion of Browne, it is plain to imagine that the anti-Toland atmosphere in said college had been maintained for a while. That is where Berkeley studies and taught in the 1700s, along with the Church of Ireland sentiment.⁹¹ It is hard to see him standing in awe of Toland. Despite their theological dissonance from the start, I consider how the two Irish philosophers’ scientific views were to resemble each other.

Toland’s scientific education should be first highlighted. I take it that his declamations are to a great extent owing to his autodidacticism and networking. Rather than Spinoza et al., Giordano Bruno’s works in astronomy had been formative of Toland’s understanding of matter, e.g. in *Pantheisticon* (1720). However, prior to Bruno’s influence,⁹² one cannot ignore the period until 1690 when Toland encountered or read into Newton’s natural philosophy whilst studying at Edinburgh under David Gregory (1661–1708), friend of Newton.⁹³ Gregory popularised Newtonianism by lecturing Newton’s *Principia* at the University of Edinburgh as well as by the Boyle Lectures at Oxford (McGuinness 1997, 314–315; Jacob 1969, 310).⁹⁴ In and after this Scottish period,⁹⁵ Toland

⁹⁰ According to his first biographer, des Maizeaux (1726, 22), ‘Mr. Toland, it seems, was dreaded in Ireland, as a most formidable enemy of Christianity, a second Goliath, who at the head of the Philistines defied the Armies of Israel.’ However, according to himself (1697, 23), Toland was also supported by some unnamed members in the Committee: ‘Several Persons eminent for their Birth, good Qualities, or Fortunes, oppos’d the whole Proceeding, being of opinion it was neither proper nor convenient for them to meddle with a thing of that nature.’ See also Berman 1982b, 271; M. Brown 2013.

⁹¹ See also F.H. Heinemann’s summary: Berkeley’s philosophy stands as ‘a violent reaction against Deism, Free-thought (or what he called “Scepticism, Atheism, and Irreligion” or “Minute Philosophy”) and against Materialism; that is, against everything Toland stood for’, such that Berkeley ‘followed [his teacher Browne’s] lead’ (1945, 438, clarification added).

⁹² Toland discovered a copy of *Lo spaccio de la bestia triforme* (1584) by Bruno in 1696, probably whilst writing his *CNM*. Bruno’s *De la causa, principio et Uno* (1584) seemed likewise influential on Toland. See Heinemann 1944, 140; McGuinness 1997, 316; Daniel 1984, 208.

⁹³ As a Dissenter, Toland began studying theology at Glasgow from 1687, although evading the oath of allegiance by graduating from Edinburgh in 1690 at the age of 19. Then he went abroad, studying at Leiden and Utrecht, constantly imbibing radical thoughts such as Spinozism. See Toland 2013, 13.

⁹⁴ Toland, later in 1704, articulates in *Serena* (Preface §3); ‘while I enjoy health and liberty, no consideration shall be able to debar me from the use of good books, wherein I am persuaded the only perfect pleasure is to be found.’ I reckon that Toland’s ‘good books’ must include Newton’s *Principia*.

⁹⁵ In fact, later on, none of Newton’s books were owned by Toland, according to two manuscript lists of his books. See Toland 1999, 302–314 (referring to BL Add MS 4295 ff. 41–42 and 79). The first folio is a list of c.150 works at his library (actually piled on chairs, trunks, and chests of drawers) in Putney near London, and the second is a list of his research in progress probably on the ancient Celtic history. Champion notes that Toland seems not to possess

1.2 Toland's and Berkeley's appropriations of Newton

seems to have incorporated Newtonian mechanics and its natural philosophy into examination.⁹⁶

On the other hand, Newtonianism (including the divine aspects) in Berkeley's scientific education at Trinity College in the 1700s is sufficiently traced back. For instance, his paper 'Of Infinities' delivered to the Dublin Philosophical Society on 19 November 1707 in said college testifies his understanding of Newton's theory of fluxions.⁹⁷ Berkeley went on learning Newtonian mathematics and mechanics, the culmination of which may be his middle work, *the Analyst* (1734).⁹⁸ At the same time, since his salad days, Berkeley disparaged his contemporary English 'Mathematicians' (*Notebooks* §393):⁹⁹

The Mathematicians think there are insensible lines, about these they harangue, these cut in a point, at all angles these are divisible ad infinitum. We Irish men can conceive no such lines.

This concerns Berkeley's anti-mathematicism, which I will discuss in the final §1.4. On the other hand, prior to the 1707–08 *Notebooks* record and the 1707 delivery to the Society (the beginning of his writing career), hardly is it detectable whether Berkeley was concerned with any Toland problem (e.g. regarding religious mystery). Moreover, his first sermon 'On Immortality' preached in the college chapel on 11 January 1708 (*Works* VII, 9–15) reveals no obvious evidence against Toland at the time.¹⁰⁰ Therefore, one may wonder mere coincidence when both Toland's and Berkeley's scientific critiques came to resemble each other. This worry notwithstanding, my assumption of Toland's influence on Berkeley stands on the latter's Anglo-Irish circumstances and sufficient knowledge of the former's works including *Serena* (1704).¹⁰¹

heterodox works, such as Bruno, Spinoza, and Simon, either.

⁹⁶ Be it earlier or later than his Newtonian learning, by contrast, Cartesianism (i.e. matter as extension and its plenum theory) is another stream of influence on Toland for his materialism (the *tourbillon* system of a vortex universe in flux). See *Serena* §5.15.188: 'All the parts of the universe are in this constant motion of destroying and begetting, of begetting and destroying: and the greater systems are acknowledged to have their ceaseless movements as well as the smallest particles, the very central globes of the vortexes turning about their own axis; and every particle in the vortex gravitating towards the centre.' See also *Serena* §5.15–16, where Toland was taking action essential to matter. See Vartanian 1953, 124, n. 171; Jacob 1969, 329.

⁹⁷ Jones 2021, 54; Jessephe 1993, 53 (referring to British Museum Add MS 4812).

⁹⁸ For more of Berkeley's mathematical works, such as *A Defence of Free-Thinking in Mathematics* (1735), see *Works* IV.

⁹⁹ See also *Notebooks* §§392, 394, 398, where Berkeley displays his *Irishness* as if 'we Irish men' together resisted to the mathematicians. To what degree Berkeley was empathetic to the Irish people and thus a 'true patriot' is a moot point, providing his castigation of Roman Catholicism and Papacy (*Alciphron* §7.18, the 1732 second ed.; Oda 2021, 163). On Berkeley's life-long Irish patriotism (Breuninger 2010, 7–10), which I think is yet arguable, see *NTV*, Dedication; *A Word to the Wise or an Exhortation to the Roman Catholic Clergy of Ireland* (1749; *Works* VI, 248); *Maxims concerning Patriotism* (1750; *Works* VI, 253–255), etc.

¹⁰⁰ However, Berman (1994, 16–17) suggests that Berkeley's critique of the term 'infinite' as meaningless at the 1707 Society meeting ('Of Infinities') gave a loathsome impression of 'destructive Tolandian consequences' to Provost Browne and Archbishop William King (Visitor or Trinity College). On my reading, without emotivism, Berkeley claims that 'an infinitesimal [...] is merely nothing', not actually meaningless or useless in mathematical reasoning (*Works* IV, 236). Nonetheless, I take it that the provost and the archbishop found invalid the connection between Berkeley's treatment of the term 'infinite' at the 1707 meeting and his mentions of 'things of infinite weight' and 'infinite eternal bliss' at the 1708 sermon, whereby also finding Berkeley's theological position not far from Toland's heresy. Both Brown and King did attend the meeting and might have also attended the sermon at the chapel. See also Belfrage 1986, 320–324; *Notebooks* §720, etc.

¹⁰¹ On my view (also email correspondence with Steve Daniel, 2021), it is hard to believe that Berkeley did not read Toland's 1704 *Letters to Serena* (besides *CNM*, etc.) before he published *DM* in 1721. That is, my discussion relies on a certain necessary connection between Toland and Berkeley.

Finally, when it comes to mathematics, Toland's rationalist emphasis on deduction elucidates Berkeley's similar discourse on 'mathematical hypotheses' for mechanical causation in *DM*. This pertains to Toland's and Berkeley's *ad hominem* arguments against metaphysical mathematicians, which shall be discussed in more depth in §1.4. Indeed, it was Newton who theorised the methodology of 'deduction from phenomena' in the *Principia*, which was meant to demonstrate an action-at-a-distance force, such as a centripetal force. This is the necessary and sufficient condition for planetary motions given Kepler's orbital explanation (Stan 2007, 284). Here one of Toland's errors in terms of the Newtonian deduction is confusing the human *intellectus finitus* with an immeasurable *intellectus infinitus*, whereas Leibniz, Malebranche, and their contemporaries understood the finitude of the human mind that can measure the truth only to their extent (Heinemann 1944, 143–144). On my view, belonging to the latter camp, Berkeley correctly followed the Newtonian finitude of human intellect (reason) for deduction and induction in *DM*. On the other hand, following Stuart Brown (2008, 243), I interpret that Berkeley might have viably developed Toland's critique of abstract metaphysics, directed to contemporary mathematicians or the Newtonians in their interests of theology.¹⁰² This is because, with more finesse than his *CNM* (1696) and other works,¹⁰³ Toland's *Serena* is his materialist bombshell to the Newtonians and contemporary mathematicians in natural philosophy. In effect, as Philip McGuinness (1997, 317) suggests, Toland's *hylozoism* (vitalist theory assuming the life in every matter)¹⁰⁴ might have made Newton revise his *Opticks*. For he ended up adding seven more Queries to the Latin edition *Optice* in 1706 after the first edition in 1704 (sixteen Queries).

In contrast to Newton himself, however, the Toland of *Serena* assumes a *pro hominem* attitude in appropriating Newton on his own terms.¹⁰⁵ Put differently, instead of Newton, Toland's real *ad hominem* target was contemporary mathematicians infused with absolute metaphysics in Newtonian

¹⁰² It is technically labelled 'natural theology' in the flourishing of eighteenth-century natural science. As Jacob and Stewart put it, natural theology *promoted* 'order and harmony' in the manner that Newton's *Principia* unveiled the celestial yet metaphysical stability qua the model of society, whereas Toland (and also d'Holbach) *promoted* instead 'change and reform' whereby disturbingly upsetting the established churches as well as the clergy sustaining the church-system (2004, 24). See also Jacob and Jacob 1980, 265.

¹⁰³ We needed to await another blasphemous bombshell by Toland, *Nazareus: or, Jewish, Gentile, and Mahometan Christianity* (1718), though it was clandestinely circulated in the 1700s. See Toland 1999, 96.

¹⁰⁴ This term was originally coined by Ralph Cudworth, in the sense of 'Hylozoick Athism' in opposition to 'Atomick Atheism' that assumes no life other than 'extended resisting bulk' in the idea of body. See his *True Intellectual System of the Universe* (1678, pt. 1, ch. 3, 101–105); Thomson 2008, 77–79; Hutton 2015, 178.

¹⁰⁵ Nowhere can one find Toland attacking Newton when referring to the *Principia*. See *Serena* §5.13, etc.

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anism at the beginning of the eighteenth century.¹⁰⁶ It is, thus, via his appropriation of Newton that Toland's influence on Berkeley can crucially be evaluated as opposed to their common opponents. This will be unpacked in more depth.

1.2.3 Toland's critique based upon his appropriation of Newton

In his appropriation, however, did Toland repudiate Newton at all? I argue that Toland is far from that position. David Kubrin (1981, 116) points out that Newton, on his private view, did not necessarily oppose Toland (and free-thinkers) in terms of the divine omnipresence *in* space, nature or matter. This was what Newton originally meant, but he modified and nuanced the phrase to material presence *to* God, which was his public view in Query (*Quare*) 28 in the *Optice* (1706). Of course, by no means did Newton intend to be entangled in a public skirmish with Toland. This Newton sensibly evaded by revising his publications regarding the divine sensorium (organ or place of perception).¹⁰⁷ However, this possible conflict may be superficial. This is because, despite their political and scientific differences, the Newton-Toland conflict might have not occurred for their private and religious reasons. For instance, both of them had the interests in Hermetic mythicism (Kubrin 1981, 116).

Rather, more importantly, it can be viewed that Toland intentionally critiqued the mathematicians' and Newtonians' (Samuel Clarke included) theological, metaphysical positions in mechanics, not Newton's own. In this respect, Toland's Newtonian critique excluding Newton is clarified as follows (*Serena* §5.13.183, clarification added):

I am convinced that these words ['absolute places' and 'absolute motions' in 'Mr Newton', *Principia*, bk 1, def. 8, schol. 4] are capable of receiving an interpretation favourable to my opinion; but I choose to cite them in the sense wherein they are commonly understood: besides that his book (as I said before) is neither way concerned.

If this account is true, Newton's argument for absolute space (and time) in his *Principia* proffers a 'favourable' basis for Toland's discourse, for the *Principia* is not 'concerned' with Toland's actual critique of the Newtonians and mathematicians in his *Serena*.

¹⁰⁶ In eighteenth-century Europe, Newtonianism permeated in the following four respects (Riskin 2003, 576):

1. a mathematical, synthetic approach to natural philosophy (inverted square laws of force);
2. an inductive, experimental approach to natural philosophy (analysis and synthesis experiments);
3. the attribution of forces to weightless, force-bearing aethers or 'imponderable fluids';
4. the appeal to final causes, manifestations of the will of a divine intelligence, as the ultimate cause of natural phenomena, in contrast with Descartes's and his followers' strict adherence, in their natural philosophy, to mechanical causes.

Toland and Berkeley, on my view, are specifically concerned with the above 1 and 4 in critiquing their contemporaries working on mathematics and metaphysics in the broad Newtonian tradition.

¹⁰⁷ Through the Leibniz-Clarke correspondence (1715–1716; Leibniz's 2nd letter §3; 1969, 678), Leibniz was to attack (Clarks's quotes from) Newton's view of *sensorium* of the immanent God in the 1706 Latin *Optice*, Query 20 (1706). The query was softened from his original view by adding the term *tanquam* ('as it were'). See also Koyré and Cohen 1961, 561–566; Kubrin 1981, 116; Newton 1718.

In fact, regarding Toland’s appropriation of Newton, Stephen Snobelen (2012, 173, n. 95) points to the above quotation as Toland’s deist radicalisation of Newton’s thought. However, reading it closely, I consider that Toland does not radically reform Newton’s mechanics *per se*, nor does he justify deism (i.e. rationalism negating any deity’s conservation whilst agnostic about its creation) in the context of *Serena*. Rather, his concern was to rectify the secondary interpretations of the (British) Newtonians and mathematicians, who ‘suppose that levity and gravity are not mere relations [...] but that they are real beings, or absolute and inherent qualities’ (*Serena* §5.13.184). Likewise, when Berkeley refers to Newton, in particular, regarding the bucket experiment to show circular motion (*DM* §§60–62, etc.),¹⁰⁸ he does not directly criticise or amend Newton’s own position. He is rather concerned with secondary interpretations of the Newtonian absolute space and motion. These are, on my rendering, uncritically and unquestionably established, such that they can be detached from one’s own observation and practice in pursuit of truth. Put differently, regarding Newtonian mechanics (or anything established) as ‘philosophical authority’ was one of the roots of ‘all prejudice [*omni præjudicio*]’ that Berkeley aimed to defuse, in addition to clarifying ‘linguistic usage’ (*DM* §1). Thus, on my view, when things are merely relative and relational to their locations in one’s mechanistic practice, the respective discourses of Toland and Berkeley demonstrate their Newtonian methodologies similar to each other. Thereby they become dissimilar to the methodologies of the Newtonians and mathematicians.

To summarise this historiographical section, Toland’s and Berkeley’s backdrops were portrayed in contrast to each other. In spite of the contrastive religious positions, the two Irishmen’s appropriations of Newton will make sense in their critiques against their common opponents. To this end, the following sections will read more into their texts. Specifically, Toland’s *pragmatic* aspect in *Serena* is to be brought to light in his critical methodology that keeps the foundation of Newtonian mechanics intact. This methodology of Toland is a primary confluence with Berkeley’s pragmatist, relativist tendency in *DM*, which I will soon reconstruct as his argument. That is, for the human needs and practices, Berkeley argues for mechanical causation from mathematical hypotheses, or abstract causal terms such as ‘gravity’ and ‘attraction’. This can be distinguished from the Newtonian establishment of metaphysical abstractions about pure, spiritual causes.¹⁰⁹

1.3 Comparative analysis of the texts—*Letters to Serena* and *De motu*

In the following textual analysis, it will be understood why Toland’s critique of the Newtonians’ and contemporary mathematicians’ absolute metaphysics paved the way for Berkeley’s pragmatist theory of causation. My analysis delves into Letters 4 and 5 in the five *Letters to Serena*,¹¹⁰ each of

¹⁰⁸ Newton, *Principia*, schol. to def. 8.

¹⁰⁹ See *DM* §20, etc.; Chapter 2 later.

¹¹⁰ The title in full: *Letters to Serena: Containing, I. The Origin and Force of Prejudices. II. The History of the Soul’s Immortality Among the Heathens. III. The Origin of Idolatry, and Reasons of Heathenism. As Also, IV. A Letter to a*

1.3 Comparative analysis of the texts—*Letters to Serena* and *De motu*

which concerns Toland's mechanical theories of matter and motion under the guise of his rebuttal of Spinoza.¹¹¹ In line with Toland's way of reasoning, I will consider Berkeley's similar points in *DM* by way of argumentation.

1.3.1 Toland's hypothesis of 'action' as the principle of motion

First of all, Toland argues in *Serena* (§4.9.141–142, emphasis added):

Whoever then goes about to explain by their first causes the origin of the world, its present mechanism, or the affections of matter, must begin with the *first cause of motion*: for no manner of variety is included in the bare idea of extension, nor any cause of alteration; and seeing it is *action alone* that can possibly produce any change in extension, this *action or principle of motion* must be well cleared and established, or the system must quickly be found defective. If it be only taken for granted, the system will be but a *hypothesis*; but if proved and explained, then we may expect to find some greater certitude than hitherto in natural philosophy. It is not enough then to build on local motion, which, as we said before, is but an effect of this action, as well as all the other varieties in nature: so is rest, which is now generally acknowledged to be no privation nor a state of *absolute inactivity*, as much force being necessary to keep bodies at rest as to move them; wherefore local motion and rest are *only relative terms, perishable modes, and no positive or real beings*.¹¹²

This whole passage illuminates the importance of what Toland meant by 'hypothesis' in 'natural philosophy'.¹¹³ The 'first cause of motion' is assumed on the hypothesis of 'action' or 'principle of

Gentleman in Holland, Showing SPINOSA'S System of Philosophy to be Without Any Principle or Foundation. V. Motion Essential to Matter; in Answer to Some Remarks by a Noble Friend on the Confutation of SPINOSA. To All which is Prefix'd. VI. A Preface; Being a Letter to a Gentleman in London; Sent Together with the Foregoing Dissertations, and Declaring the Several Occasions of Writing Them. The preface, actually before Letter I, was probably written to Pierre des Maizeaux (c.1673–1745), exiled French Huguenot journalist in London, who wrote the first biography of Toland (*Memoirs*, 1726 [1722]) and edited the writings of Locke, Bayle, Leibniz, et al. The first three letters were with little doubt written to 'madam' Sophie Charlotte of Hanover (1668–1705) in the edified name of 'Serena'. However, the last two letters were written to 'sir'. Supposedly, the correspondent of Letter IV is Johann Georg Wachter (1673–1757), German Spinozist; that of Letter V is Jakob Heinrich von Fleming (1667–1728), Saxon nobleman and soldier. See Toland 2013, 115, 129; Leask 2020, 207.

¹¹¹ Pierre Lurbe (1990, 43) argues that the sole debate that mattered to Toland was that with the Newtonians (e.g. Richard Bentley), not with Spinoza that camouflaged this real issue. Daniel (1984, 187) similarly contends that Toland was concerned to call into question the Newtonians' works on metaphysics, whereby also religiously and politically attacking 'High Churchmen' (i.e. Anglo-Catholic conservative theologians) who employed their works. On the other hand, Jeffrey Wigelsworth (2003, 530) treats that Spinozism (assuming one single substance encompassing the universe that dispenses with individuated separate entities) was positively incorporated into Toland's critique. However, some scholars are still agnostic about the recognition of Spinozism in Toland (Schliesser 2020, n. 64). See also Toland 2013, 27–35. To be clear, my discussion does not concern Toland's Spinozism.

¹¹² See also *Serena* §5.29.231: 'one motion is always succeeded by another motion, and never by absolute rest, no more than in any parcel of matter the ceasing of one figure is the ceasing of all, which is impossible.'

¹¹³ Regarding Toland's meaning of 'hypothesis', see e.g. *CNM* §3.11 (emphasis original): 'The most compendious Method therefore to acquire sure and useful Knowledge, is neither to trouble our selves nor others with what is useless, were it known; or what is impossible be known at all. Since I easily perceive the good or bad Effect of Rain upon the Earth, what should I be the better did I comprehend its Generation in the Clouds? for after all I could make no rain at my Pleasure, nor prevent its falling at any time. A probable Hypothesis will not give Satisfaction in such Cases: The

motion’,¹¹⁴ but it is not grounded in any bodies in ‘local motion’ or at ‘rest’. This is because local motion and rest are merely ‘relative terms, perishable modes’ in the mechanical system of Toland’s hypothesis of action. It presumes ‘no positive or real beings’ or no essential entities in it. Certainly, if one proves and explains this hypothesis of action as the mechanical cause of motion, then ‘some greater certitude’ may be inferred. However, this certitude is never expressed absolutely in my construal of Toland’s theory of mechanical causation. This is because his theory de-essentialises or de-ontologises material ‘beings’ (entities) for the causes of local motion and rest. De-ontologically or without any particular ontological basis, such causes are solely rooted in ‘action’ as *perishable* in flux,¹¹⁵ for the rest has nothing to do with ‘absolute inactivity’.¹¹⁶

Hence, for Toland, as will be clearer, it is action that is merely essential to matter. Moreover, the first cause of motion, or action, is merely hypothetical in Toland’s theory of mechanical causation that does not absolutely imply any spiritual and divine cause. I uphold that this standpoint of Toland intended to challenge the Newtonians’ absolute metaphysics chained to the divine first cause, rather than Spinozism (*Deus sive Natura* or Spinozistic pantheism) on the surface. The Spinozism, I think, may not ultimately matter to Toland’s hypothesis of ‘action’.

1.3.2 Berkeley’s argument for relative motion

By contrast, in his works, Berkeley keeps presupposing the primacy of divine cause in its metaphysical sense or in M* model,¹¹⁷ different to M pyramid model. Put differently, he does distinguish two kinds of causes of motion—theologically metaphysical (M*) and pragmatically mechanical (M)—in my reformulation of *DM* (§1.1.1). In other words, putting the former aside, the latter mechanical causes are hypothetically formed (or theorised) without supposing their real entities. Therefore, those causes are pragmatically relative to the mechanist’s discourse, inasmuch as the causes are discursively thought or expressed, instead of metaphysically purely thought with absolute space. As with Toland’s case, I define that Berkeley’s pragmatist discourse on mathematical entities (hypotheses) is de-ontological. Here is Berkeley’s distinction of absolute and relative spaces/locations in a full

Hands, for Example, of two Dials may have the same Motion, tho the Disposition of the latent Springs which produce it should be very different.’ From here I read that the ‘hypothesis’ in Toland carries a pragmatic connotation ‘to acquire sure and useful’ knowledge for ourselves.

¹¹⁴ In Toland’s definition (*Serena* §4.16.159), the whole motion is called ‘action’, as distinguished from all local motions, whose qualities are direct/circular, fast/slow, and simple/compound. See also §5.4.170: ‘matter is never conceived but under some notion of action’; Daniel 1984, 193–200.

¹¹⁵ See *Serena* §5.15.188–189 (emphasis added): ‘Our bodies [... are] not altogether the same yesterday as today, nor to continue the same tomorrow, being alive in a perpetual flux like a river, and in the total dissolution of our system at death to become parts of a thousand other things at once; our carcasses partly mixing with the dust and water of the earth, partly exhaled and evaporated into the air, flying to so many different places, mixing and incorporating with innumerable things’. On my reading, as Leask seems also aware (2013, 140; Spinoza 2002, *Ethica*, pt. 4, prop. 39, schol.), this Tolandian materialism about ‘perpetual flux’ free from its absolute basis, implying material life reincarnating after death, should be contrasted with Newtonianism (implying metaphysical absolutism), not primarily with Spinozism.

¹¹⁶ See *Serena* §5.19.199 (emphasis added): ‘Since rest therefore is but a certain determination of the motion of bodies, a real action of resistance between equal motions, it is plain that this is *no absolute inactivity among bodies, but only a relative repose* with respect to other bodies that sensibly change their place’; §5.20.201: ‘though Mr Newton be deemed an advocate for extended incorporeal space, yet he declares that perhaps no one body is in absolute rest’, etc.

¹¹⁷ See *DM* §§34, 56, 72; *Notebooks* §584, *Alciphron* §5.20, etc.

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section of *DM* (emphasis original):¹¹⁸

§52. The Peripatetics used to distinguish various kinds of motions by the variety of changes which any thing [*res*] could undergo. Today those who are concerned with motion understand only local motion [*motum localem*]. But they deny that local motion can be understood unless it is also understood what location [*locus*, ‘space’ or ‘place’] is. This is indeed defined by moderns [*neotericis*] as *a part of space which a body occupies*, whence location is divided into absolute and relative according to which space [*spatii*] is understood. For they distinguish between absolute or true [*verum*, real] space and *relative or apparent space*. Indeed they postulate that there is *a space on all sides, immense, immobile, insensible, permeating and containing every body* [*corpora universa*], which they call absolute space. But space comprehended or defined by bodies and so subjected [*subjectum*] to the senses is called relative, apparent, and vulgar.

Although starting with the Aristotelian distinction, in the second sentence, Berkeley takes issue with ‘those’ modern philosophers’ definition of ‘local motion’ in the two senses of space:¹¹⁹ absolute and relative. I consider that those ‘moderns’ are the common targets for Toland and Berkeley, i.e. the Newtonians (rather than Newton himself)¹²⁰ and contemporary mathematicians, such as Samuel Clarke and Joseph Raphson (not Newtonian himself), who took for granted abstract metaphysics in its theologically absolute sense. It should be noteworthy that, in ‘Of Infinities’ (1707), Berkeley already referred to Raphson’s *De spatio reali* (1702 [1697], ch. 3, p. 50),¹²¹ where he appears to amply understand Raphson’s meaning of ‘real space’ or true space.

As opposed to those metaphysical mathematicians, *DM* §§52–66 are the sections on the two (relative/absolute) types of space in Berkeley’s interests of ‘local’ motion. Against their assumptions of absolute space and location for motion, firstly I shall reconstruct Berkeley’s argument for relative motion, primarily within those sections in *DM*:

Berkeley’s argument for relative motion

1. Every location ought to be defined by either relative or absolute space. [§§52, 57, etc.]
2. No location ought to be defined by absolute space. [§58]

¹¹⁸ All the *DM* translation from Latin is mine, by comparing and integrating all the available English translations, such as Luce, Jessop, and Belfrage. See [Abbreviations](#).

¹¹⁹ By ‘space’ here I mean ‘location’ (*locus*) *qua* ‘space’ (*spatium*). In Aristotle’s ten-fold *Categories* (1b25–2a4), the location or being in a position (*κεῖσθαι*) and the space or somewhere (*ποῦ*) are distinct. However, I take it that Toland and Berkeley, as well as other early moderns, defuse this distinction when it comes to space for ‘local motion’, even though Berkeley respects Aristotle’s definitions (especially *Physics* bk. 8, three times) in the domain of mechanics (*DM* §§19, 32, 48, 57).

¹²⁰ The bucket experiment that Berkeley critiques (*DM* §60) should be credited to Newton (*Principia*, Scholium to Def. 8). However, my focus is on the interpretation of absolute space derived from Newtonian mechanics, not Newton himself.

¹²¹ Berkeley critiques that Raphson ‘will have a particle infinitely small to be *quasi extensa*. But wt Mr. Raphson would be thought to mean by *pars continui quasi extensa* I cannot comprehend’ (‘Of Infinities’, IV, 237–238). A.A. Luce (editor of *Works* IV, 237, n. 2) notes that Raphson’s work ‘left a profound impression on Berkeley because of its virtual deification of space’. For more about Berkeley on Raphson, see *Notebooks* §§298, 827; *Correspondence* to Johnson (24 March 1730, §2): ‘As to Space. I have no notion of any but that which is relative.’

3. So, every location *must* be defined by relative space. [from P1 & P2]
 4. If not every location is relative, then it is not properly defined by relative space. [§§62–63]
 5. So, every location *must* be relative. [from P3 & P4]
 6. If every location is relative, then ‘so is every motion’. [§58]
- ⊢ Therefore, every motion is relative. [from P5 & P6]

P1 refers to the relative-absolute distinction of any location as spatially, thus geometrically and mechanistically, conceived by the moderns and Berkeley. P2 negates the possibility of any conceived location in absolute space, when Berkeley recognises that no true or real location (*locus verus*) is appropriately defined by ‘absolute space’, within which motion is ‘a change of [...] absolute location’.¹²² Therefore, we can see the necessity of relative location by his *disjunctive syllogism* in the first sub-conclusion (P3). In other words, this ‘relative’ location is propositionally judged to be *true* in Berkeley’s deliberation that excludes *absolute* space. It is fallacious in this sense to equate the adjectives ‘true’ and ‘absolute’ *tout court*.

Then, according to the implication of P4, if not every location is relative (but *absolute* in Newton’s bucket experiment to show ‘single conatus’ or ‘truly circular motion’), then it is not appropriately defined by relative space. In that case, the location is defined by *absolute* space, which Berkeley’s mechanist cannot measure by the senses. However, *DM* §63 unveils Berkeley’s position that ‘[n]o motion can be recognised or measured, unless through sensible things. Since, therefore, in no way does absolute space affect the senses, it is necessarily quite useless for distinguishing motions.’¹²³ As P3 negates the consequent of P4, based on this §63, the antecedent is likewise negated by Berkeley’s *modus tollens*. Thereby he can deduce the necessity of relative location in the second sub-conclusion (P5).

Furthermore, according to P6, ‘[s]ince every location is relative [*Siquidem omnis locus est relativus*], so is every motion [*ut et omnis motus*]’ (*DM* §58). In Berkeley’s way of reasoning step by step, P5 affirms the antecedent of P6, so that the consequent can be deduced affirmatively. As a result, by *modus ponens*, he holds the third or final conclusion to be true in defence of *relative* local motion. In other words, for Berkeley, local motion cannot be absolute inasmuch as defined by

¹²² *DM* §58 (clarification added): ‘we ought not [*non convenire*, it is inappropriate] to define the true location [*locum verum*, real place] of a body to be the part of absolute space [*spatii absoluti*] which the body occupies, and true or absolute motion to be a change in true or absolute location [*loci veri & absoluti*].’ The phrase ‘absolute motion’ first appears from this section in *DM*.

¹²³ *DM* §62 refers to Newton’s bucket experiment about ‘truly circular motion’, in contrast to Berkeley’s view in §63. In addition, *DM* §63 distinguishes between a dynamic notion of ‘motion’ and a kinematic notion of ‘change in location’. To this end, there is no reduction or translation of dynamic causes to kinematic ones unlike the reductionist reading (see more in [Chapter 4](#)). As Kenneth Winkler (1986, 24, emphasis original) ably puts it, ‘[c]hange in relative position is a *necessary* condition of motion but not a sufficient one’. This is because assuming the motion of a body is impossible but for the body, ‘on which the force causing the change of distance [i.e. position or location] is impressed, or in other words, that to which the action is applied’ (*Principles* §113, clarification added). In this line of argument, Berkeley’s pragmatist use or application of mechanical causes, such as ‘action’ to its effect of ‘motion’ relative to the user, can be understood.

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absolute space.¹²⁴

At this juncture, I label P2 above a pragmatist (non-metaphysical) thesis. This is because, within the three steps as unfolded in §1.1.3, correctly defining the location and linguistically theorising the cause of motion in the domain of mechanics (for P2) is the first step of ‘geometrical reasoning’. That is why his linguistic distinction between ‘absolute’ and ‘relative’ is primarily significant on the terminological level, as ‘relative’ location concerns Berkeley’s theoretical meaning of ‘true’ or ‘real’ motion (*motus verus*). This first step is, then, followed by the second step of deliberative confirmation of causal laws and the third step of articulation or expression of the laws for the practitioner’s utility.

Here, it is important to see a semantic distinction between the adjectives ‘true’ and ‘absolute’.¹²⁵ On the one hand, in the context of Newton’s writings, Nick Huggett (2012, 209–211, n. 18) clarifies that ‘true motion’ and ‘absolute motion’ are not synonyms; in the former sense the laws of mechanics logically imply the motion, whilst in the latter sense absolute space defines the motion.¹²⁶ In fact, they both relate to the same object, such that Newton at times writes ‘true and absolute motion’. On the other hand, I argue that the two senses of motion—‘absolute’ and ‘true’—must be correctly distinguished but disagreed in Berkeley’s above argument in *DM*. This is because the ‘true motion’ is nothing but relative, when he judges or confirms and thereby articulates causal laws of motion in his linguistic, pragmatic method, as follows (*DM*, emphasis added):¹²⁷

§64. [I]n order to determine true motion and true rest, by which *ambiguity is removed* and the mechanics of philosophers who have a more comprehensive view of the system of things is developed, it would suffice to accept, instead of absolute space, the relative space of the fixed stars in a heaven that is regarded as at rest.

From here, I construe that the *ambiguity* in mechanistic practice, as in the case of relatively fixed stars in astronomy, lies in the abuse of language or causal terms that signify too much. Moreover, it lies in the abuse of knowledge that judges too much beyond the use of language. That is, it is too much in Berkeley’s metaphysical sense, where what is absolute and real in the mechanical domain cannot clearly be recognised and articulated on one’s own terms.

More precisely, for Berkeley, causal terms or mathematical hypotheses that are used and applied in one’s mechanistic practice does not presuppose ‘stable essence’ (*DM* §67) or ‘real nature of things’ (*DM* §69). Nonetheless, causal laws from the hypotheses determine the phenomena (effects)

¹²⁴ See also *DM* §64 (emphasis added): ‘however forces may be impressed, whatever conatus there may be, we admit that motion is to be distinguished by *actions* [*actiones*] exerted on bodies; but never will it follow that there is this absolute space, and location, and the change of this is true motion [*locum verum*].’

¹²⁵ For Berkeley’s offensive against absolute or ‘pure’ space (§117), time, and motion, see *Principles* §111–117. It is also worth noting his own contrasts between ‘*absolute* and *relative*’, ‘*true* and *apparent*’, and ‘*mathematical* and *vulgar*’, concerning ‘a certain celebrated treatise of *mechanics*’, namely, Newton’s *Principia* (§110, emphasis original). To the extent of these distinctions, the adjectives ‘absolute’ and ‘true’ are different for both Newton and Berkeley.

¹²⁶ See Newton, *Principia*, Scholium (1999, 411–413). There, Newton distinctly explicates that ‘true motion’ is always changed by impressing forces following the laws as opposed to relative motion that is ‘null’, whilst ‘absolute motion’ is determined by ‘unmoved’ or absolute space, in the context of explaining the circular motion in the bucket experiment.

¹²⁷ See also *DM* §58.

of ‘true’ motion and rest (*DM* §64). Berkeley was so conscious about this linguistic and epistemic abuse that he embarked on his pragmatist ‘pursuit of truth [... not to be] misled by terms that we do not correctly understand [... and] all prejudice, be it originating in linguistic usage or in philosophical authority’ (*DM* §1, clarification added). In other words, it is linguistically, epistemically, and pragmatically abusive when the user infers causation in metaphysically *ambiguous* terms by connecting the ‘true’ motion and ‘absolute’ space, for there is no confirmable or verifiable connection between them, even based on the senses and experimentation. However, mechanical causes are frequently unobserved such as ‘gravity’ and ‘attraction’. In such cases, causal laws formulated from those causes are confirmed to be true, solely to the extent to which they are relative to the mechanist and their own discursive thinking. This reinforces P2, the pragmatist thesis, for the conclusion of relative motion.

By contrast, whilst Berkeley takes umbrage at their reasoning, the modern metaphysical mathematicians (Newtonians included) would make an objection to P2:

–2. Every location ought to be defined by absolute space.

This is because causal terms or mathematical hypotheses can be primarily abstracted from their absolute *or* true (real) space. This metaphysical space is conceived and sustained by ‘the pure intellect [*intellectum purum*], whose faculty is concerned only with spiritual and unextended things, such as our minds, their states, passions, powers, and such like’ (*DM* §53).¹²⁸ These metaphysical terms and notions are critically exposed in Berkeley’s discussion of his opponents. In effect, earlier in *DM* §9, Berkeley began to criticise ‘various absurdities [*varia absurda*]’ rooted in the absolute or ‘infinite force of percussion’ that Borelli, Galileo, Torricelli, and others subscribed to.¹²⁹ There, Berkeley quoted in the following: ‘the force of percussion, no matter how small, is infinitely great [*vim percussionis utcunque exiguae esse infinite magnam*]’ (*DM* §9).¹³⁰ Probably, he indiscriminately modified the quotation as a collective source of his opponents, for it concerns not a single author but all the above including Leibniz (*DM* §§8, 14).¹³¹ Such forces are indeed not relatively measured and understood.

In my reconstruction, Berkeley’s metaphysically loaded opponents find it difficult to follow *DM* §64 in particular: ‘motion is distinguished by the actions exerted on bodies. But never will it follow that there is such space [*spatium illud*] and absolute location [or place, *locum absolutum*], in which the change is true location [*ejusque mutationem esse locum verum*].’ Therein, I think, lies a

¹²⁸ For more of Berkeley’s exposition of his opponents, see *DM* §20 and [Chapter 3](#).

¹²⁹ Borelli 1667, *De vi percussionis*, ch. 24, etc.; Galilei 1967, *Discorsi* VI; Torricelli 1715, *Lezioni*, 4.

¹³⁰ Here I reference the First London edition (1721) of *DM*. In the editions of First Dublin (1752) and Second London (1752), the term ‘infinite [*infinite*]’ is ‘definite [*definite*]’. I take it that the context in *DM* §9 concerns the infinity of a striking power or percussion, whence following the 1721 edition. See Belfrage, [forthcoming](#), editor’s introduction.

¹³¹ See *DM* §45 (emphasis original): ‘Many also define [*definiunt*] motion by *transition* [*transitum*], forgetting indeed that transition itself cannot be understood without motion, and by it be necessarily defined [*definiri oportere*].’ It is likely here that Berkeley read Borelli’s *De vi percussuionis* (1667, ch. 1, 1-2, emphasis added): ‘Erit igitur *motus localis transitus successivus* ab uno ad alium locum in aliquo determinatio tempore excurrando successivis contactibus partes *omnes loci*, seu spatii transacti sese consequentes.’ See also Breidert 1969, 212; Jessep 1992, 76; D. M. Clarke 2008, 246.

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problem of *truth* for the pragmatist Berkeley. For his opponents like Leibniz and Raphson, beyond one's perception and language, it is not difficult to generate a true proposition about absolute space whereby formulating true or real motion in its theologically metaphysical essence. Hence, when Berkeley denies this metaphysical essence or genuine nature of things in mechanistic practice, the opponents must wonder: where can we find any real location for the true motion without the truth of absolute space? They thus hold on to the above $\neg P2$.

Nevertheless, the pragmatist Berkeley must answer that what is truly expressed for one's mechanical utility is the motion relative to space in one's discourse. Therefore, the true motion as a manifest effect can be as sensed, experimented, and reasoned, so as to be defined, confirmed, and thus deduced or calculated. That is, this series of discursive thinking does not concern absolute motion beyond one's sensation/experimentation (steps 1–2) and geometrical reasoning (step 3.1–3.3) in Berkeley's pragmatic method. In other words, Berkeley further defends P2, his pragmatist thesis, on the grounds of our linguistic and discursive use of 'relative space' that is 'comprehended or defined by bodies and so subjected to the senses', whence also called 'apparent and vulgar' (*DM* §52). This is meant to rebuke the metaphysical mathematicians who, unlike Berkeley, had no recourse to the apparent and common (vulgar) senses on their practical level in applying mechanical causation.

On the contrary, those opponents take on *absolute* or *true* meanings of space and motion, from which the infinity and infinitesimals are conceived. As opposed to them, Berkeley contends that a motion in any space or location is *relative to* the user or practitioner engaged in mechanical causation. For a motion that the user can truthfully confirm is relatively *measured* (not '*immense*'),¹³² *mobile*, *sensible* (or *manifest*),¹³³ *impermeable*, and *uncontainable*, such that the vulgar can express it (*DM* §52). The last being 'uncontainable' (*DM* §52) concerns Berkeley's de-ontological position about no essence contained in things (*res*) when they are mathematically (or geometrically) conceived in mechanics.¹³⁴ Thus, providing the above demonstrated argument for relative motion, Berkeley's pragmatist thesis (P2) as the true proposition entails that local motion is not absolute. This is because it is dependent on one's sense perception or the extent to which one recognises phenomena given the following experimentation and geometrical reasoning.

¹³² See, for mechanical causes that one can geometrically 'measure', *DM* §§10, 11, 16, 38, 66.

¹³³ This relates to Berkeley's concern with 'occult qualities'. See *DM* §§4–6, 23. In terms of an early modern definition of 'occult quality', a representative is of course that of Newton. Whilst Toland did not witness it before writing *Serena*, the second edition (1718) of Newton's *Opticks* has increased the Queries up to 31 at the end of the book (16 Queries in the 1704 first edition did not contain the definition of 'occult'). See Qu. 31 (1718, emphasis added): 'the *Aristotelians* gave the Name of occult Qualities not to manifest Qualities, but to such Qualities only as they supposed to lie *hid in Bodies, and to be the unknown Causes of manifest Effects*: Such as would be the Causes of Gravity, and of magnetick and electric Attractions, and of Fermentations, if we should suppose that these Forces or Actions arose from Qualities unknown to us, and incapable of being discovered and made manifest. Such occult Qualities put a stop to the Improvement of natural Philosophy, and therefore of late Years have been rejected. To tell us that every Species of Things is endow'd with an *occult specifick Quality by which it acts and produces manifest Effects, is to tell us nothing*.' Here, I consider that Berkeley (i) probably did not read the second edition of *Opticks* whilst travelling in Italy before his 1721 *DM*, (ii) yet uncritically accepted the abuse of language rooted in the 'occult' in Newton's definition as 'hidden' in matter, (iii) nonetheless maintained that the 'unknown causes' of those qualities for manifest effects are still useful for causal formulations. This is germane to Berkeley's appropriation of Newton. For more consideration of occult qualities, see earlier §0.1.1; Hutchison 1982, 250–253.

¹³⁴ See especially *DM* §§ 39, 67 ('Mathematical entities have no stable essence in the nature of things'), etc.

To conclude, given the absolute-relative distinction in *DM*, Berkeley's argument for relative motion was meant to combat against the metaphysical mathematicians who essentialised the foundations of absolute space for true motion from the pure intellect. In my reconstruction, Berkeley was prepared to contend against their objection (\neg P2) from his de-essentialised or de-ontological perspective in the domain of mechanics. In that sense, the distinction of 'absolute' and 'true' primarily sourced in Newton (Huggett 2012) was vital to Berkeley's divergent pursuit of truth as excluding absolute metaphysics. This line of Berkeley's pragmatist argument for utility and truth, defending P2 in particular, echoes Toland's similar points. These will be discussed in the next sub-section.

1.3.3 Toland's discourse in defence of Berkeley's argument

From the earlier sub-sections on Toland's hypothesis of 'action' and Berkeley's argument for relative motion, I will now consider Toland's defence of Berkeley's argument from their similar pragmatist perspectives. To achieve this, I shall explain what pragmatism means to the two Irishmen once again.

I will first account for my interpretation of the pragmatist purport of discursive thinking, deliberation, and expression for both of the two Irish philosophers. In fact, the inference from P5 and P6 to the conclusion ('every motion is relative') in Berkeley's argument befittingly relates to Toland's pragmatic position. For Toland explains mechanical causation by the application of 'action' to *relative locations*, whence *relative motions*.¹³⁵ Toland clearly argues for 'relative motions', not 'absolute' ones (*Serena* §5.22.204–205).¹³⁶

I have industriously omitted to speak anything of the relative motions of all those bodies conceived to be in repose; and I shall but hint them now, to put you in mind that at the same time they cease not to be absolute.¹³⁷

Toland is thus to refute the possibility of absolute 'repose' or rest, for one can solely observe the transition of relative motions of matter. In contradistinction to absolute conceptions of mechanical causes, Toland's relativist notion of motion converges on the causal term 'action' that we can express and communicate. The action is identified to be the only mechanical 'cause' of motion in Toland's discourse: '[a]ction is the *immediate cause* of all local motions, changes, or varieties in matter' (*Serena* §5.29.230, emphasis added). Hence, I view that the term 'action' can be a mathematical hypothesis in Berkeley's pragmatist discourse.

¹³⁵ Note that the Toland of *Serena* does not refer to the noun 'location' but the adjective 'local'. See e.g. *Serena* §5.17.194: 'the external local motion or changes of places [...] are but the various modifications of the essential action.'

¹³⁶ Whilst it is in a wholly different context (Letter 3 on the origin of idolatry), see also *Serena* §3.19.123 (emphasis added): 'notwithstanding the nice distinctions of *supreme and absolute*, of *inferior and relative* worship; all the common people are downright gross idolaters.' I do not think that this distinction in religion is incompatible with that in mechanics and dynamics in Letters 4 and 5, where Toland embraces the latter 'inferior and relative'.

¹³⁷ For Toland's absolute-relative distinction, if not predicating motions, see *Serena* §§4.9.142, 5.6.173 ('imaginary or relative' and 'real and absolute'), 5.7.174 ('relative or modal' and 'real, absolute, and positive'), 5.12.180, 5.19.199, 5.20.200 ('words from a relative to an absolute signification'). For Newton's own absolute-relative distinction of motions, see his *Principia*, def. 8, schol. 4.

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Then, why I deem Toland’s discourse on mechanical causation to be pragmatic should be justified. Above all, consider the following passage (*Serena* §5.29.231–232, emphasis added):

Thus one motion is always succeeded by another motion, and never by absolute rest [...]. These *determinations of motion* in the parts of solid extended matter, are what we call the phenomena of nature, and to which *we give names or ascribe uses*, perfection or imperfection, according as they affect our senses, and cause pain or pleasure to our bodies, contribute to our preservation or destruction: but *we do not always denominate them from their real causes*, or ways of producing one another, as the elasticity, hardness, softness, fluidity, quantity, figures, and relations of particular bodies. On the contrary *we frequently attribute many determinations of motion to no cause at all*.

Whilst action is the ‘immediate cause’ of local motions in bodies or matter, it is clear here that one neither uses nor mentions ‘real causes’, but ‘no cause at all’ for bodily phenomena in Toland’s discourse. This is because one feels difficult to ‘denominate’ or ‘give names’ to any effects immanent in absolute rest or unmoved foundation, such as what are regarded as *real or true causes*. Instead, one can ‘ascribe uses’ to whatever motion one observes and thus imagines in the senses or bodies. That is why I regard Toland’s discourse as pragmatic with no ontological foundation or metaphysical cause for local motions. Such motions are understood without internal absolute rest (arising from absolute space). Therefore, deflating any absolute implication behind the denominated and ascribed uses in mechanical explanation, his discursive thinking about the cause of motion hinges on apparent ‘determinations of motion’ or successions of motions.

In Berkeley, those denominable determinations of motion can be labelled ‘force, virtue, or corporeal action [*vim, virtutem, aut actionem corpoream*]’, which are at work or in use without ‘truly and properly causing the effects’ of metaphysical ‘mere passivity [*passio mera*]’ (*DM* §70). By ‘mere passivity’ Berkeley means a change ‘both in the moved and in the resting’ (§70). However, such passivity is understood to be a purely metaphysical, not pragmatically mechanical, cause. On the other hand, the term ‘action’ in mechanics, on my view, is one of the mathematical hypotheses or causal terms by abstraction, such as ‘force’ and ‘attraction’.¹³⁸ These cannot be found within bodies in Berkeley’s mathematisation, as he criticises his opponent metaphysical mathematicians, who affirm ‘active force, action, [or] the principle of motion’ ‘really in bodies’ (*DM* §31). That is, Berkeley also identifies ‘action’ to be the principle or cause of motion. Furthermore, *DM* §63 about relative motion implies the cause of ‘determination’, essential to motion, since it consists in phenomenal or observable ‘relation’ (i.e. one location relative to another). Thus, where there are causal relations and effects,¹³⁹ those determinations are their causes as taken to be the hypothesis of action.

In line with Berkeley, Toland’s discourse on causation goes on to uphold that we ascribe uses of ‘action’ to the labelled determinations of motion. For ‘all local motions’ are ‘called *motion*,

¹³⁸ *DM* §§9, 11, 17, 28; Chapter 3.

¹³⁹ At the beginning of this thesis, I defined causation as having three objects: cause, effect, and their relation(s). See footnote 2 in Chapter 0.

being only the several changeable *determinations* of the *action* which is always in the whole' (*Serena* §4.16.159, emphasis original). In other words, propositions about this ascription or application of action are judged to be true in this pragmatic sense. Just after the last quotation,¹⁴⁰ for example, Toland identifies a dog's action of 'running' to be its *animal machine's*¹⁴¹ cause of 'motion' for the effect of preying on a hare. This is not to imply any underlying pure cause of the (canine) *machine*, because Toland pragmatically labels or discursively applies the mechanical action to the cause of local motion, so as to deduce its effect. I thus maintain that this line of reasoning about the truth of mechanical causation by 'action' is pragmatic in Toland's discourse.

Furthering this pragmatic method, we deploy names—'action' and other causal terms—to understand a true proposition (meaning of sentences) and utility of effects, without presuming anything *metaphysical* or foundational *behind* phenomena. For Toland, nowhere can we find absolute ontological causes in existing, perishing matter, but only mechanical causes rooted in action when they are applied to physical effects. Therefore, in Toland, action or the principle of motion is discursively understood within the denominated uses. This Tolandian action is the very de-ontological, de-essentialised cause without *absolute space* for reposing or cessation. In this way, Toland must support P2 of Berkeley's argument:

2. No location ought to be defined by absolute space. [the pragmatist thesis]

Moreover, both Toland and Berkeley similarly have the pragmatist discourse on local motion. Why it is so shall be further demonstrated in the next section, by continuing my comparative reading into the two Irishmen's similar methodologies or pragmatist deliberative approaches to mechanical causation.

To wrap up this section, I have reconstructed Berkeley's argument for relative motion, which squarely goes against absolute space and motion in the Newtonians' and contemporary mathematicians' mechanical explanations. This argument of Berkeley is in accordance with Toland's hypothesis of action, which is very likely supportive of the former. To this end, the two Irishmen's mathematical methodologies in the domain of mechanics, or better put, their respective anti-mathematicist attitudes, should be considered in my comparative analysis below.

1.4 Toland's and Berkeley's anti-mathematicism in their pragmatic methods

This final section will establish their pragmatist methodologies to infer mechanical causation in Toland's and Berkeley's discursive thinking. That is, Berkeley's pragmatist theory of mechanical

¹⁴⁰ *Serena* §5.29.232: 'however those motions may be accompanied by thought, yet, considered as motions, they have their physical causes, as a dog's running after a hare, the bulk of the external object acting by its whole force of impulse or attraction on the nerves, which are so disposed with the muscles, joints, and other parts, as to produce various motions in the animal machine.'

¹⁴¹ Nowadays it is fairly disagreed that dogs and animals are *machines*. I suspect here Descartes's influence on Toland.

1.4 Toland's and Berkeley's anti-mathematicism in their pragmatic methods

causation in *DM* will newly be grasped in view of Toland's methodology against his opponents, viz. his anti-mathematicism. As with the last sections, the basis of my interpretation is that both Toland's and Berkeley's ultimate aims were not to undermine the works of Newton, but those of the Newtonians and contemporary mathematicians. To this extent, both Berkeley and Toland had *pro hominem* arguments in their appropriations of Newton, and *ad hominem* arguments against the latter Newtonians and mathematicians.¹⁴²

1.4.1 Berkeley's and Toland's discursive, deliberative approaches

From my reconstruction of Berkeley's argument in the last section, one of the premisses will be further defended in my exegesis of Toland's and Berkeley's pragmatist methodology against the mathematicians who upheld absolute metaphysics. The reasoning derived from Berkeley's argument for relative motion (§1.3.2) is as follows:

2. No location ought to be defined by absolute space. [the pragmatist thesis]
 7. If no location ought to be defined by absolute space, then causation of local motion is not purely thought but discursively thought by deliberation.
- ⊢ Therefore, causation of local motion is not purely thought but discursively thought.

Specifically, it is the implication of a new premiss (P7) that calls into question in the eyes of metaphysical opponents. The premiss can be justified towards the conclusion of Berkeley's and Toland's deliberative approaches without thinking through a pure intellect. This is because the two Irishmen's pragmatist methodologies intended to disambiguate the mechanist's linguistic practice about laws of motion, or causal laws abstracted from mathematical hypotheses. Therefore, their approaches are first captured as their pragmatist thesis (P2), followed by each discursive thinking of mechanical causation (P7).

Providing the justification of P7, above all, it should be noted that Toland kept emphasising the meaningfulness of his rationalist discourse, avoiding it being mysterious, meaningless, or useless. The letter style is effective in this sense. As Steve Daniel puts it (1984, 163):

Toland preferred the letter format: anything that is meaningful implies an audience. More than the treatise, the essay, or the written dialogue, the letter was directed to an explicit reader, through whose understanding the communication became meaningful.

Although his *CNM* and many polemical treatises were not publicly welcomed *simpliciter*, I argue that Toland's discourse in the letter style engaged a rational practice through useful communication with the readers as 'potential coreasoners' (*ibid.*, 163).¹⁴³ Without exception, Toland's *Serena* did

¹⁴² On this point, I disagree with Daniel (1984, 11) on his view that Toland's *Serena* resulted in 'an implied refutation of some of Newton's works'. Ultimately, on my view, the point for Toland and Berkeley was not to attack Newton himself.

¹⁴³ Toland's native predilection for *discoursing* was observed in coffeehouses and taverns of Oxford in 1693. In fact, his radical tendency in Oxford (and everywhere) brought on necessitous consequences. As Robert Sullivan (1982, 7–9, n.

intend to make his discourse on mechanics (based on Newton's *Principia*)¹⁴⁴ meaningful or useful for the audiences, who can understand the respective Letters and respond to him. In particular, in the context of his rebuttal of Spinoza, Toland and his correspondents of Letters 4 and 5 must have the common interest to discuss mathematical, mechanical philosophy involving causation. This I regard as Toland's pragmatic method about mechanical causation.¹⁴⁵

On the other hand, Berkeley's *DM* does not take the letter format, whereas one can assume that the short treatise was originally related to one of the Paris Académie's first prize competitions in 1721.¹⁴⁶ On this assumption, there were particular audiences, notably, French Cartesians in the Académie (given his original motivation to write *DM*), whom Berkeley intended to convince by his critique of absolute space and motion. Here, Berkeley's argument makes sense in his pragmatist discourse on mechanical causation, as opposed to the Newtonians' and mathematicians' metaphysical causation. In other words, I argue that Berkeley and Toland had the *ad hominem* attacks in common.

In the above light, I will further defend the commonality between Berkeley and Toland on their own mathematical terms. Regarding their common methods, I start with Toland's stance to the British mathematicians (e.g. Samuel Clarke), whose metaphysical foundations and theological implications that he undermined. In this Tolandian light, Berkeley's resembling pragmatist discourse shall be better understood in the mathematical, mechanical context of *DM*.

1.4.2 Toland's *ad hominem* anti-mathematicism congruent with Berkeley's pragmatic method

Centring on Letters 4 in *Serena*, Eric Schliesser calls Toland's position 'anti-mathematicism', owing to his 'expressed reservations about the authority and/or utility of the application of mathematics' (2020, 52).¹⁴⁷ This position is also labelled 'global' in the sense that the anti-mathematicists like

22) ably puts it and documented, Toland was such a 'waif, apostate, spoiled parson, habitué of taverns' that not only was he ousted from Oxford by order of the vice-chancellor by the winter of 1695, but also he once burnt a copy of the Book of Common Prayer (whence 'arraigned and convicted'), 'talking against the Scriptures, commending Commonwealths, justifying the murder of K.C. 1st [Charles I], railing against Priests in general, with a Thousand other Extravagancys'. See also Daniel 1984, 8. It is noteworthy that there was always someone to whom his discourse was directed, albeit often obnoxious.

¹⁴⁴ See *Serena* §5.13.183 in §1.2.3 above.

¹⁴⁵ For Toland's mathematical reasoning, albeit in another context of esotericism and exotericism, see his 'Clidophorus' ('key-bearer') in *Tetradymus* (1720, 70, emphasis added): 'From the Senses arises Opinion, from Reason Demonstration: on the former are huddl'd up the prejudices of the Vulgar, following the bare appearance of things; on the latter are founded the axioms of the Wise, who consider things as they are in themselves.' Here one can see two types of discourse in Toland: the 'opinion' from vulgar senses and the 'demonstration' from axiomatic reason. I assume that this distinction was not invented as late as 1720 but methodologically applied to his earlier works, especially, *Serena*.

¹⁴⁶ On my archival research at the Académie royale des sciences in Paris (2020), see [Appendix 1](#). It is verified that no document of Berkeley is preserved in the archives.

¹⁴⁷ Toland's disbelief in the authority of practising people and his staunch belief in practical knowledge in science itself are summarised in the final two sections of his 'Physick without Physicians' (1726b, clarification added): 'The Craft I abhor'd, the Skill I admir'd; herein precisely of my Author's mind [i.e. Cicero], who says, that the *antients did not condemn the thing, but the trade*.' This treatise written in 1721–1722 is arguably his last piece just before his death in dire poverty.

1.4 Toland's and Berkeley's anti-mathematicism in their pragmatic methods

Toland 'challenge and de-privilege the epistemic authority and security of mathematical applications' (*ibid.*, 52).¹⁴⁸ On the one hand, in Newton's *Principia*, there is fundamental neutrality of the mathematical structure and the source of motion, so as to make matter neither active nor passive (Schliesser 2018, 55). On the other hand, Samuel Clarke, prominent Newtonian about whom Toland was critical, underpinned the passivity of matter in his *Demonstration*,¹⁴⁹ however associated with Newton's view.

Here, the contrast between the contemporary mathematicians and Toland transpires on Toland's own terms, i.e. his emphasis on the active nature of matter or the principle of action. On this point, *Serena* §4.16.158–160 (emphasis original) reads:

I hold then that *motion is essential to matter* [...] I deny that matter is or ever was an inactive dead lump in absolute repose, a lazy and unwieldy thing [...] I hope to evince that this notion alone accounts for the same quantity of motion in the universe, that it alone proves there neither needs nor can be any void, that matter cannot be truly defined without it, that it solves all the difficulties about the moving force, and all the rest which we have mentioned before.

In addition, *Serena* §4.8.141 (clarification added) reads:

The mathematicians generally take the moving force for granted, and treat of local motion as they find it, without giving themselves much trouble about its original [cause]; but the practice of the philosophers is otherwise, or rather ought to be.

Thus, entailing conflicts with the 'mathematicians' and Newtonians,¹⁵⁰ the anti-mathematicist Toland universally denies that mathematics is the pride of place in scientific practice, because the mathematicians' practice 'ought to be' *troubled* about the 'original cause' by their metaphysical implicature.¹⁵¹ On the other hand, the anti-mathematicist makes room for mathematics to play a 'pragmatic'¹⁵² rôle in mechanics. This can be understood when we assume the non-overlapping two domains regarding causation—theologically metaphysical and pragmatically mechanical.

¹⁴⁸ The so-called 'global anti-mathematicist strategy' is not originated from Toland's argument (Schliesser 2020, n. 68), but traced back to those of Descartes (e.g. Rule 4 in his abandoned *Rules for the Direction of the Native Intelligence*, 1628; *CSM* I, 15–20) and Spinoza ('Letter on the Infinite' in his *Opera posthuma* (1663); Letter 12, 2002, 787–791) in response to Galilean science (Nelson 2019, 3485; Schliesser 2018, 173). These seventeenth-century philosophers were concerned with the limited applicability or utility of mathematics to natural philosophy.

¹⁴⁹ Clarke argues in *A Demonstration* (§9, 1998, 52): 'Everything in the universe must be passive and nothing active, everything moved and no mover, everything effect and nothing cause.'

¹⁵⁰ One may further argue the socio-political conflicts, but I do not engage here. See Koyré 1957, ch. 8; Daniel 1984; Jacob and Stewart 2004. On the 'mathematicians', see also *Serena* §§5.9.177, 5.12.181, 5.20.200, 5.25.217, etc.

¹⁵¹ See *Serena* §5.11.179 (emphasis added): 'I hinted something to you before about the *abuse of words* in philosophy, and we may instance particularly certain terms invented to very good purpose by mathematicians; but misunderstood or perverted by others, and not seldom *very wrongly applied by certain mathematicians themselves*, which can never fail to happen when *abstracted notions are taken for real beings*, and then laid down as principles whereon to build *hypotheses*.' As emphasised, Toland critiques the mathematicians' 'abuse' of mathematical 'hypotheses' derived from abstract ideas of 'real beings'. Challenging such mathematicians, Toland goes about the principle of motion on his own terms, i.e. 'action'.

¹⁵² Schliesser equates 'pragmatic' with 'instrumental' for his broadly instrumentalist reading of Toland's text (2020, 53). For my pragmatist reading, however, I refrain from the term 'instrumental'. This denotes the instrumentalist reading to which I will object later in Chapter 4.

This anti-mathematicist position of Toland within the domain of mechanical causation, on my view, applies to the context of *DM*. In there, Berkeley mechanistically discourses upon ‘the cause of the transfer [*communicationis*] of motions’ (*DM* §67). By ‘transfer’ (not ‘communication’),¹⁵³ I interpret that it is our mind, human ‘definer’ (§67), who defines causal terms and expresses causal laws, whereby transferring the motions of bodies (matter), properly speaking in mechanics. Therefore, ‘the same thing can be explained in different ways’ in their own discourse, regarding ‘no stable essence’ of mathematical entities (§67).¹⁵⁴ This is because a mathematical hypothesis such as ‘action’ is the cause (causal term) as *explanans* of a phenomenon, which is what is explained, *explanandum*, as every different motion in one’s linguistic use and discourse. In particular, this section (*DM* §67) is taken to be a source of the instrumentalist readings about causation (i.e. indeterminacy of truth-values of causal laws when taking their utility). By contrast, I hold my pragmatist reading that the consequential *explananda* differ from one another due to each definer’s temporal (finite) conditions in determining laws, whereby determined causation is either true or false within their discursive thinking.¹⁵⁵ In Berkeley’s pragmatist discourse, the mechanical domain of the human mind cannot be confused with the metaphysical domain of a divine ‘mind [*Mentem*]’ beyond our temporal needs and practices. The divine mind, ‘which moves and contains this universal corporeal mass, is the true efficient cause of motion, and is the same cause, properly and strictly speaking, of the transfer of this motion’ (§69). However, this metaphysical causation cannot be explained in Berkeley’s discursive approach to mathematical, mechanical causation. Hence, for the latter causation from mathematical hypotheses, finite minds express their *explananda* of the ‘transfer of motion’ that can be manipulated within their definition and discourse.

Thus, to the extent to which ‘Toland’s strategy may well have inspired Berkeley’s in *De Motu*’ (Schliesser 2020, 54),¹⁵⁶ I uphold that the division of labour in the two domains of causation is crucial. Certainly, efficient and final causation in the theologically metaphysical domain is the pride of place as glorified in *DM*. This Toland was reticent about. However, in the other domain of causation, I argue that Berkeley takes the anti-mathematicist position similar to that of Toland, on his own mathematical terms against the mathematicians’ metaphysical realism. The group of contemporary mathematicians (or ‘geometers’), whom the anti-mathematicist Berkeley of *DM* attacks, include Raphson (as seen above) and the Cambridge Platonists such as Henry More and

¹⁵³ I partially follow the newest translation of Belfrage, [forthcoming](#).

¹⁵⁴ The indeterminacy of translation into other definers’ discourses can be pointed out in the context of *DM* §67. See Quine 2013, ch. 2; §0.1.1.

¹⁵⁵ This concerns the third part of my tripartite definition of a pragmatist theory of causation: §1.3. For another valid objection to the instrumentalist readings of §67, see Peterschmitt 2008, 29.

¹⁵⁶ Schliesser further points us to the Toland-Berkeley commonality, in view of ‘how much Toland anticipates features of Berkeley: they both think there is a hierarchical division of labor in which the metaphysician/philosopher assigns causes while the work of the natural philosopher/geometrician can be interpreted as a mere tracking of the relations of the phenomena’ (2020, 55–56). Whilst I agree that Berkeley is likewise a ‘global anti-mathematicist’ (*ibid.*, 56) inasmuch as criticising metaphysical foundations for the Newtonians’ mathematisation, I disagree with Schliesser (*ibid.*, 56; 2005, 56–57) that he is an instrumentalist about Newtonian natural philosophy. This is because I contend that the instrumentalist reading of ‘mathematical entities’ in *DM* is mistaken by equivocating the judgement of truth when those terms (mathematical hypotheses) are meaningfully used. Yet, my pragmatist reading unequivocally considers the confirmation of truth-values in the mechanist’s discursive thinking. For more analysis, see later Chapters.

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Ralph Cudworth, but also continental natural philosophers such as Leibniz, Torricelli, and Borelli (e.g. *DM* §§8, 20, 53).¹⁵⁷

On the basis of his *ad hominem* attacks, I construe that Berkeley develops his pragmatist theory of mechanical causation on his own terms, using his definitions of abstract causal terms, i.e. 'mathematical hypotheses', outside the metaphysical domain (*DM* §§17, 39, 40, 47, 66). In other words, within the mechanical domain, the premiss for Berkeley's pragmatist discourse (P7) can be justified by defining, deliberating, and expressing the correct use of causal laws of motion from mathematical hypotheses, including 'action' and 'reaction' (*DM* §69).

Finally, I interpret that Toland would defend P7 as well as Berkeley's anti-mathematicism, in the following (*Serena* §5.25.217–218, emphasis added):

[W]hen we say that finite bodies cannot exist without an infinite space, *we only say that they cannot be unless they are*: for their own solidity or their respect to other things is all their place, *abstracting from the universe* of which they are parts, of whose infinite *motion, solidity, and extension*, they finitely partake: for infinite matter is the real space and place, as well as the real subject of its own particular portions and modifications.

This clarifies Toland's pragmatist discourse on materialist *abstraction* with no 'infinite space'. Within the discourse, one can merely express the utility of mechanical causation in terms of 'finite' qualities in reality, such as 'motion, solidity, and extension'.¹⁵⁸ Indeed, the mathematicians that Toland attacks do reject P7, because local motion can be defined by absolute and infinite space, whence it is purely thought. On the contrary, Toland hammers out in the above: 'we only say that they [finite bodies] cannot be unless they are'. This double negation, on my rendering, vindicates P7 in Toland's deliberative approach to what is abstracted (even 'infinite motion') as what is always judged to be expressed on his materialist terms. This is to thwart any metaphysical implication in the cause of motion by his hypothesis of action.

Toland's discourse as such, however materialistic, has a decisive impact on Berkeley's argument similar to his. This is because Berkeley claims in the following way (*DM*, emphasis added):

§47. And just as on one hand too much *abstraction or division* of things truly inseparable renders the nature of motion perplexed, so on the other hand does *composition or rather confusion*¹⁵⁹ of things very diverse. For it is usual to confound motion with the efficient cause of motion.

¹⁵⁷ In *DM*, there are a few more *ad hominem* exceptions besides Newton; Berkeley concedes the views of Descartes and also ancient natural philosophers, especially, Aristotle and Anaxagoras. For I take Berkeley to accept the importance of νοῦς for the finite mind's pragmatic conception. Regarding as many as five elements of Cartesianism in *DM*, such as the *cogito* with reference to a human mind ('*conscientia interna* [internal consciousness]'), see Brykman 1979, 558; *DM* §§21, 25, 30, 32.

¹⁵⁸ In accord with Toland's anti-mathematicism, albeit not in *DM*, it is worth considering Berkeley's position against the mathematicians or 'Hypothetical Gentlemen', excluding experimental philosophers (*Notebooks* §406, emphasis added): 'I know there is a mighty sect of Men will oppose me. but yet I may expect to be supported by those whose minds are not so far overgrown wth madness, these are far the greatest part of Mankind. Especially Moralists, Divines, Politicians, in a word all but *Mathematicians & Natural Philosophers* (I mean only the *Hypothetical Gentlemen*). Experimental Philosophers have nothing whereat to be offended in me.'

¹⁵⁹ By the term 'composition' here, Berkeley probably meant one of Newton's two methods—resolution and composition

Assuming the Newtonian distinction between ‘division’ and ‘composition’ of bodies (analysis and synthesis), Berkeley confirms that the analytical method of abstraction is not to be confused with any metaphysical approach of efficient causation. Rather, the mathematical method on his own terms was indeed ‘inseparable’ from ‘the nature of motion’, or the principle of action, which Toland de-ontologically defended. For the two Irishmen, there is no abuse of mathematical expression when we correctly define causal terms about relative motion to the extent to which we can discourse and communicate.

To recapitulate, the reason both Berkeley and Toland objected to the mathematicians converges on the validation from P7 to the final conclusion. Thereby I see them justify their pragmatic methods to infer mechanical causation of relative motion. For them, despite the nature of mathematics, mechanical causation is never purely thought, or metaphysically reasoned, in the mechanist’s discursive practice. Hence, the two Irishmen’s anti-mathematicism can be newly appreciated in the pragmatist discourse, into which Berkeley’s argument against absolute space and motion is viably integrated.

1.4.3 Berkeley’s argument sourced in Toland’s pragmatist discourse

In the final sub-section, I will explicate why the bishop’s argument can be sourced in the Donegal heretic’s discursive thinking in consequence. In Berkeley’s argumentative context, the most striking sentence in accordance with Toland can be the following (*DM*, clarification added):

§63. Besides, determination or direction [*determinatio sive directio*] is essential to motion, and this consists in relation [*relatione*].

Berkeley holds on to a mechanical cause of relative motion as ‘determination’,¹⁶⁰ on which Toland concurs given his hypothesis of action. They can reaffirm the pragmatist thesis (P2) in Berkeley’s argument for relativity of local motion (*DM* §52). Moreover, *DM* §65 (the final section referring to absolute motion) reads: ‘from the principles of those who accept absolute motion, we cannot know from any observable fact, whether the whole fabric of things [*integra rerum compages*] is at rest or moves uniformly in some direction, then it is clear that we cannot know absolute motion by any sensible thing.’ This ‘fabric of things’ indicates a frame of reference with no implication of the essence of things, but instead we can know local motion relative to one’s definition and discourse.

(i.e. analysis and synthesis). See Newton, *Opticks*, bk. 3, pt. 1, final paragraph (‘Analysis to discover and prove the original Differences of the Rays of Light’ and ‘the Method of Composition for explaining the Phænomena arising from them’); Shapiro 2004, 191, 195–196, referencing MS Add 3970, f480v. It is noteworthy here that the method of composition is a root of confusion in Berkeley’s pragmatic method. I thank Richard Van Iten for directing me to Berkeley’s concern with these Newtonian methods.

¹⁶⁰ See also *DM* §58 (emphasis added): ‘no motion can be understood without some *determination or direction* [*determinatio aliqua seu directione*], which itself cannot be understood unless besides the moving body, our own body, or some other body be understood to exist simultaneously.’ For Toland’s discourse on the ‘determinations of motion’, see *Serena* §5.29.231–232 (quoted above in §1.3.3), §4.16.159 (‘changeable *determinations* of the *action*’), §§5.16–22, etc.

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Berkeley further defines local motion as ‘mode of existence’¹⁶¹ in ‘relative location [*loci relativi*]’ or space ‘distinguished by actions exerted on bodies’ (*DM* §64). Likewise, Toland argues: ‘action is essential to motion, since it must be the real subject of all those modifications which are called local motions, changes, differences, or diversities’ (*Serena* §5.21.202).¹⁶²

Above all, regarding how Berkeley's argument is sourced in Toland's discourse, here is good evidence in the Toland of *Serena* (§5.7.173, emphasis added):

[T]o avoid all ambiguity [...] by bodies I understand certain modifications of matter, conceived by the mind as so many limited systems, or particular quantities *mentally abstracted, but not actually separated* from the extension of the universe.

This casts light on Toland's pragmatist discourse against ‘ambiguity’, i.e. avoiding the use of metaphysically abstract terms in mechanical practice. That is, entailing nothing deeper than *action*,¹⁶³ his discourse was all meant to explain the materialist ‘universe’ grounded in action (the cause of motion) when we do ‘mentally abstract’ motion. This relates to Toland's pragmatism about truth in linguistic expression in terms of action.¹⁶⁴ If mathematicians abstracted anything essential deeper than

¹⁶¹ Berkeley differentiates the continuity (persistence) in motion (or at rest) and action. See *DM* §27 (emphasis added): ‘body continues in either *state* [*statu*], whether in motion or at rest. But this persistence [*perserverantia*] is not to be called an *action of the body* any more than its existence is called its action. Persistence is nothing other than continuation in the same *mode of existence* [*modo existendi*], which cannot properly be called an action.’ From here I take it that local motion, as determined by direction relative to location (space), consists of a transitional *state or mode* of existence, whereas ‘action’ (not metaphysical ‘persistence’) is a mathematical hypothesis or causal term whereby the mechanist can define mechanical causation (including dynamics). On the other hand, Toland and Berkeley both agree that action, encompassing a bodily determination or direction, is a cause of motion.

¹⁶² Although I take no issue here, René Descartes regarded every motion as ‘local’ and ‘action’. Besides Newton, I consider there being common greater sources for Berkeley and Toland in natural philosophy: above all, Descartes's *Principia philosophiae* (1644/1647; *CSM* I, pt. 2, §§21–25). Especially in pt. 2, §24, Descartes defines thus (emphasis original):

Motion, in the ordinary sense of the term, is simply *the action by which a body travels from one place to another*. By “motion”, I mean local motion; for my thought encompasses no other kind, and hence I do not think that any other kind should be imagined to exist in nature. [...] For example, a man sitting on board a ship which is leaving port considers himself to be moving relative to the shore which he regards as fixed; but he does not think of himself as moving relative to the ship, since his position is unchanged relative to its parts. Indeed [...] we commonly think all motion involves action.

On the similar ‘man in a ship’ example as above, being ‘quiescent, with relation to the vessel’ and moving ‘with relation to the land’, see Berkeley's *Principles* §114. Moreover, Richard Van Iten clarifies that (forthcoming, emphasis original): ‘Berkeley did not understand *motion* per se. It is a *state*, as Descartes would have it, a *mode*, not a *sensible quality*. *State* and *place* are very close kin to Berkeley's notion of a *notion* and are themselves *relational* in that to perceive or think of an object *in motion* [...]. That is, both Descartes and Berkeley understand *motion* as *relative* in that they understand *motion* to be *directional*, i.e., away from or toward a *place*, itself a *notional* entity which requires at least one other sensible object located in its own unique *place*.’ See also *Principles* §89: ‘we know and have a notion of relations between things or ideas, which relations are distinct from the ideas or things related [...] ideas, spirits and relations are all in their respective kinds.’ Regardless of Berkeley's complication of ‘notion’, I agree with Van Iten on (i) Berkeley's meaning of motion in *DM* is ‘state’ and ‘mode’ à la Descartes, and (ii) his meaning of relation (as an object in motion) to be the ‘notional entity’. On the distinction of notions (for minds and relations) and ideas in Berkeley, see also footnote 2 in §0.1.1.

¹⁶³ See e.g. *Serena* §5.4.170 (emphasis added): ‘most things are conceived by us with respect to our own bodies, and *not to their true nature*: [...] I may warrantably affirm that matter is never conceived but under some notion of action, which before I end I design to show to be as *true of rest itself*’; also §5.6.173: ‘parts are [...] only imaginary or relative, but not real and absolutely divided.’ See also Spinoza 2002, *Ethica* §2.16.2.

¹⁶⁴ Toland, *CNM* §1.17: ‘If things be deliver'd in Words not understood by the Hearer, nor demonstrated to agree with

action and extension that we can conceive,¹⁶⁵ then Toland disparaged the theological, metaphysical implicatures of their mathematics. In this respect, I construe that Toland's anti-metaphysical meaning of mental abstraction is what Berkeley pragmatically agrees on the utility of the mathematical method through the causal term 'action'. In line with Toland's, Berkeley's pragmatist discourse can be methodologically understood by his discursive thinking about mechanical causes (mathematical hypotheses) in the correct use of language relative to the human perception and knowledge.¹⁶⁶

To put it another way, their pragmatist discourses take into account the human power of imagination, or hypothetical theorisation relative to our conception in reality. This methodology opposes what the Newtonians and contemporary mathematicians approached metaphysically. In Toland, the mechanical cause of motion in Toland is relative (nothing absolute) to what we conceive as the materialist universe on the hypothesis of action. whence causal theories can be deduced and calculated. I argue that this Tolandian approach to mechanical causation pertains to mathematical hypotheses, such as 'gravity' and 'attraction', in the Berkeley of *DM*.

There, it transpires that Berkeley's argument as his pragmatist discourse can be sourced in Toland's discourse, especially in the following (*Serena* §4.17.160–161, emphasis original):

But if I be able to prove from the nature of the thing itself, and not to favour or oppose any cause, that *action is essential to matter*, that matter cannot be rightly conceived nor consequently be rightly defined without it, that nothing can be accounted for in matter without this essential action, and that it is easily shown to exist in the most heavy or hard bodies; then they may quarrel (who have a mind to it) with God or nature, and not with me, who am but their humble interpreter. [...] My only business is to prove *matter necessarily active as well as extended*, and thence to explain as much I can of its affections; but not to meddle in the disputes which others may raise about its *original or duration*.

On my reading, the last sentence is significant, where Toland refrains from arguing about the 'original and duration' of matter, i.e. the essence and metaphysical continuity of bodies, which are none of his business in the discourse of action. This is because the 'nature of the thing itself' in the first sentence is nothing but 'action', which is necessarily 'essential to matter'. This hypothesis of

other Truths already very clear, or now so made to him, he cannot conceive 'em. Likewise if the Order of Nature and due Simplicity be not observ'd, he cannot see them evidently true or false; so suspends his Judgment (if no Affection sways him) where another, it may be, receives perfect Satisfaction. [...] Hence it is that we frequently, with Indignation and Wonder, attribute that to the Stupidity and Obstinacy of others, which is the fruit of our own confus'd Ratiocination for want of having thoroughly digested our Thoughts; or by affecting ambiguous Expressions, and using such as the other has no Ideas to at all, or different ones from ours.' Daniel (1984, 192) also points to 'the importance of personal, practical experiences in the formation of the self' in Toland's methodology. This pragmatic perspective, I think, is methodologically embedded in Toland's pragmatist theory of mechanical causation by action.

¹⁶⁵ Raphson 1702; §1.3.2. See also *Serena* §5.26, which I quote and explain below.

¹⁶⁶ See the above M pyramid model; also *DM* §7 (emphasis added): 'But many are led into error because they see that general and abstract terms are *useful in discourse [in disserendo utiles]* and yet do not sufficiently understand their meaning. In part these terms were invented by common habit in order to abbreviate speech, and in part they have been devised by philosophers for instruction: not because they are adapted to the natures things, which are only singular and exist in concrete, but only as they are fit for handing down teachings since they make notions or at least propositions universal.' See also *DM* §§1–3; Chapter 3 on the pragmatist importance of correct 'linguistic usage/mode of speaking [*loquendi consuetudine*]' for making mechanical propositions true, against any prejudice rooted in the abuse of language.

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about action endorses P2 (the pragmatist thesis in Berkeley), because action *per se* is the principle of motion or the necessary condition for Toland's materialism (matter as the 'active as well as extended'). In other words, this action hypothesis, on which Berkeley also concurs, drives away any essentialism about matter, by de-essentialising the absolute or real nature of things as seen above. Thus, action can be called the 'cause' for all the local motions which are 'effects' in Toland's theory of mechanical causation.¹⁶⁷

In the above context (*Serena* §4.17), the 'others' are Toland's opponents, although he bafflingly regards himself as their 'humble interpreter'. For they rather 'quarrel' with 'God or nature' over the cause of the material 'original and duration'. Ostensibly, Spinoza may be included,¹⁶⁸ but I construe that they, in fact, they are the Newtonians or abstract metaphysicians/mathematicians. Instead of quarrelling with them regarding God/nature, Toland pursues getting his 'business' done. That is to pragmatically 'prove', or discursively apply, the necessity of 'action' for defining matter or this material universe without indulging in pure absolute metaphysics. In other words, it is for the human immediate needs and practices that mechanical causation is found to be useful or truly meaningful in his analysis of matter. To this end, one can understand the meaning of 'abstraction' in Toland's own mathematical use for mechanical causation.

As regards the abstraction from motion, which is the key to mechanical causation, I will finally examine the following (*Serena* §5.26.218–220, emphasis added):

Matter is often abstracted from motion, as motion is from matter, so are solidity and matter, motion and extension, extension and solidity, solidity and motion; each of these may be and is taken by itself without any consideration of the rest, whereas in reality the motion of matter depends on its solidity and extension, and so all of them inseparably on one another. [...] In the ingenious Mr Raphson's book of *real space*,¹⁶⁹ to whom I had an eye in the two foregoing paragraphs; though, as may be likewise learnt from his own authorities, he was neither the first broacher of this conceit, nor the only maintainer of it now. I am satisfied that most of those gentlemen did firmly believe the existence of a deity, and I charitably hope it of them all; but in my opinion their unwary zeal refined him into mere nothing, or (what they would as little allow) they made nature or the universe to be the only God: but the goodness of their

¹⁶⁷ There is a causation between action (cause) and local motion (effect). See *Serena* §4.8.140–141 (emphasis added): 'all those who have treated of the diversities that happen in matter, must have meant this *action as their cause*, or laboured to no purpose: for this being once explained, we can easily account for *local motion as its effect*, and not otherwise. The mathematicians generally take the moving force for granted, and treat of local motion as they find it, without giving themselves much trouble about its original: but the practice of the philosophers is otherwise, or rather ought to be.' See also Wigelsworth 2003, 231; Lurbe 1992, 54–55.

¹⁶⁸ There, Toland seems to invoke Spinoza's dictum: *Deus sive Natura*. See Spinoza 2002, *Ethica*, pt. 4, preface; Leask 2013, 127, n. 43: '[a]s significant as the declaration itself is the fact that it should come immediately after the sustained assault on Spinoza that makes up so much of Letter IV.' Toland's real intention, as I maintain, is not Spinoza but the Newtonians for due reason. See also Schliesser 2020, 51–56.

¹⁶⁹ See also Koyré 1957, ch. 8, regarding Raphson's Cartesian mechanics without recourse to Spinozism, which is considered more developed than that of Henry More. To clarify again, Raphson is not a Newtonian but his defender. To testify his defence, Raphson translated Newton's *Arithmetica universalis* (*Universal Arithmetick*) from Latin (1707) into English (1720).

intention ought to secure them with all men of candour from the charge and consequences of atheism.

From the first sentence, it is affirmed that matter has three essential properties: motion, extension, and solidity.¹⁷⁰ Here, Toland's critique of absolute space of the Newtonians or theological metaphysicians, specifically the mathematician Joseph Raphson, is unequivocal.¹⁷¹ That is, their mathematical but metaphysical conceptions of real or absolute space are regarded as 'mere nothing' for Toland. On this point against the meaningless or useless as opposed to Toland's discursive thinking of mechanical causation, I read that Berkeley backs him up. This is because Berkeley likewise critiques Raphson's and like-minded mathematicians' metaphysical assumption of 'absolute space' (except God) that 'participates [*particeps*]' in the 'divine attributes [*attributorum divinorum*]', such as 'eternal and uncreated' (*DM* §54).¹⁷² This is one of the 'serious prejudices' (§54) that must be excluded from Berkeley's pragmatist discourse, which is rather linguistically and epistemically clarified in his anti-mathematicist approach to causation.

Yet, for their opponents, if there is no absolute motion, then there is no relative motion.¹⁷³ Thus, they would flatly reject the two Irishmen's objections on the unobservability of absolute space and thus motion. However, as seen in the prior section, I explained that what is 'absolute' differs pragmatically from what is 'true' in the Berkeley of *DM*. This distinction as rooted in Newton's mechanics, on my rendering, accords with the Toland of *Serena*, when he confirms that relational mechanical causation is true solely from his hypothesis of action. Therefore, on the two Irishmen's *ad hominem* views, the mechanist can take the utility and truth of mechanical causation *relative*, not *absolute*, to our discursive conception of causes and effects in their relations.

To wrap up, for the two Irishmen, despite the bishop's immaterialism, what can be expressed for practical utility are manifest effects (or motions) formulated from mechanical causes (causal terms), such as 'action'. In this sense, whilst 'matter is [...] abstracted from motion', the cause of motion is also abstracted from the analysis of matter with no 'consideration of the rest' (*Serena* §5.26 above). For Toland, the 'motion' of matter is inseparable from 'solidity' and 'extension', as

¹⁷⁰ For the three distinct 'attributes' or 'ideas' (not things), see *Serena* §§5.2.166, 5.10.178, 5.29.229–231; Daniel 1984, 196.

¹⁷¹ In *De spatio reali*, Raphson does propose that: '*Spatium* est absoluè, & suâ naturâ, immobile'; '*Spatium* est actu infinitum'; '*Spatium* est purus actus', etc. (1702, 74–80, emphasis original).

¹⁷² *ibid.*, *De spatio reali*, chs. 5 and 6. For Berkeley's direct criticisms of Raphson, see *Principles* §117 ('concerning the nature of *pure space* [...] the incommunicable attributes of God'); *Correspondence* (1730, §2, 'mathematicians, one of whom, in a treatise, *De Spatio Reali*, pretends to find out fifteen of the incommunicable attributes of God in Space'); 'Of Infinites' (1707, IV, 237–238, 'I can't but take notice of a passage in Mr. Raphson's treatise *De Spatio Reali seu Ente Infinito*, chap. 3, p. 50, where he will have a particle infinitely small to be *quasi extensa*'). For more of Raphson, see above §1.3.2 and its footnote. See also Breidert 1969, 233–234; Jesseph 1992, 98.

¹⁷³ The Newtonian and other mathematicians hold the necessary condition of absolute motion for local motion in relation. This position was examined in *DM* §61 regarding the utility of infinity, such as 'infinite number' of 'straight lines' in geometry and 'rectilinear directions' in mechanics. Indeed, were there no absolute motion (and rest) at absolute space for the Newtonians/mathematicians, it would be 'impossible for the centre of gravity of any body to exist successively in single points of the periphery of a circle' or in the relation of those points. That is, any motion can be grasped in infinitely absolute space(time), whence absolute or real motion must be proven. Nonetheless, without the necessity as such, the Berkeley of *DM* does uphold the true and useful aspects of those mathematical hypotheses for causal laws, e.g. the law of gravity.

1.4 Toland's and Berkeley's anti-mathematicism in their pragmatic methods

one of the three manifest phenomena in reality, and these are solely inferred from his hypothesis of action with no essence of absolute repose. This way of mechanistic discourse in Toland is taken to be relative or relational to our conventional conception of reality, not essential to real space rooted in divine existence. Hence, in this line of Toland's anti-mathematicist reasoning, Berkeley's pragmatist theory of causation can be sourced in.

Conclusion

This long first chapter has scrutinised varied yet selected historical sources of Berkeley's pragmatist theory of mechanical causation. This was first considered from my M pyramid-model viewpoint, which has the affinity for modern logicism, not formalism, regarding Berkeley's understanding of mathematics. Then, provided Berkeley's record of reading, light was cast on one of the yet underappreciated sources, i.e. Francis Bacon's scientific method that holds on to truth and utility for our human purposes and in our capacity (e.g. *Novum organum* §1.124). This I think is incorporated pithily into Berkeley's pragmatic method, whereby spelling out the utility of causation from mathematical hypotheses in pursuit of truth. Furthermore, whilst I do not disregard the other well-known sources for Berkeley, such as Galileo, Descartes, and Leibniz, the remaining light in this chapter was cast on John Toland's appropriation of Newton in his pragmatic approach to relative motion. This, I argued, is the immediate influence on Berkeley's pragmatic method about causation. As sourced in Toland (primarily Letters IV and V to *Serena*), Berkeley's argument for relative motion (§1.3.2) intended to reject the views of contemporary Newtonians and mathematicians. In my reformulation, the argument stands to Berkeley's pragmatic method, as it shines a light on useful and truthful formulations of mechanical causation solely in relation to one's own discourse.

The upshot is that, unlike typical contrasts over religious mysteries, Toland and Berkeley have the pragmatist common ground for deliberating over the causes of motion without real or absolute entities in their discursive reasoning. Their pragmatic methods are relativist, for the mechanistic universe of discourse is represented by 'action' or the principle of motion in a perpetual flux or lacking the ontological basis. One cannot essentialise the ultimate foundation of mechanical causes, whereas one can hold the utility of them as long as they are used, or discursively thought in the mathematical deduction (and calculation). In consonance with Toland's critique, I thus champion that Berkeley maintains anti-mathematicism against the mathematicians, not against Newton. To this *ad hominem* extent (or *pro hominem* for Newton's sake), Berkeley's pragmatist theory of causation can be reconstructed historically and comparatively, incorporating mathematical hypotheses such as 'action'.

Chapter 2

Textual Analysis of ‘Causes’ in *De motu*: A Pragmatist Reading

Introduction



WHAT can we learn from the text? From the pragmatist perspective as historically reconstructed in the last chapter, this chapter conducts a textual analysis of *De motu*. Here, I will argue that Berkeley entertained two types of causation in *DM* (e.g. §§35–37): theologically metaphysical and pragmatically mechanical.¹ As will be clear, efficient causation and final one are considered in terms of a theologically metaphysical domain, though theology is not exhaustive in that domain.

My textual analysis aims at a chief objective of resolving why Berkeley treated ‘mechanical’ causation *pragmatically* behind the background of theologically ‘metaphysical’ causation in *DM*.² One can read *DM* as his critical interpretation of mechanical theories at the time, especially of the Newtonian dynamics or mathematical science that he critically admired. In his scientific discourse, however, metaphysics is given the importance for the natural sciences in relation to theology and morals. For Berkeley argues that ‘from the known laws of nature very elegant theories and mechanical practices [*praxes*] useful in life follow; from the knowledge of the Author of nature Himself by far the most excellent considerations arise, but they are metaphysical, theological, and moral’ (*DM* §42).³ ‘Only by meditation and reasoning can *truly active causes* be rescued from the surrounding darkness and be to some extent known’ (§72, emphasis added). In this metaphysical context of *DM*, I will cast light on Berkeley’s pragmatist theory of mechanical causation, because the current

¹ The text itself was thought to answer the Paris Académie’s prize question in 1720. For my archival research at the Académie des sciences in Paris (2020), see [Appendix 3](#); Oda, [forthcoming](#).

² Berkeley’s distinction of the two kinds of causation has been consistent since his earlier *Notebooks* (§855): ‘We must carefully distinguish betwixt two sorts of Causes Physical & Spirituall.’

³ Outside *DM*, see e.g. *Guardian* (no. 126, ‘The Bond of Society’, *Works* VII, 227): ‘The mutual gravitation of bodies cannot be explained any other way than by resolving it into the immediate operation of God’. For the analogy between the universal attraction in Newtonian dynamics and the invisible moral bond in the society, albeit under the power of God or the Author of nature, see also the editor Luce’s footnote to this *Guardian* essay (225). I thank Raul Veede for pointing to this Newtonian aspect.

literature lacks a fully-fledged explanation and justification of what *causes* are, or what causal terms are used and deliberated.

Specifically, I consider the account of Richard Brook (2017; 2018). Featuring the cause of phenomena or ‘the reason why they take place’ in *DM* §37, Brook explicates mechanical explanation, in which one can deduce propositions from mathematical laws, as opposed to metaphysical efficient causation. Brook’s account indeed clarifies how the mechanist works in their mathematical or scientific manner. Nevertheless, objecting to Brook’s dispelling the metaphysical formulation, I criticise the insufficiency in his account of mechanical causation. In establishing mechanical laws of motion in Berkeley’s causal paradigm, one ought to confirm the necessary condition of metaphysical causation, for his pragmatist mechanical causation cannot treat the occurrence of phenomena. Furthermore, applying a Leibnizian twofold causal paradigm to Berkeley’s own, I construct a metaphysical interweaving of efficient-final causation in *DM* §36.⁴ After all, it seems impossible for Berkeley to justify the ‘cause’ or ‘reason’ for the communication of motions without its metaphysical underpinning.

In what follows, the chapter is broken down into three sections. §2.1 is to clearly distinguish two types or domains of causation—metaphysical (theology included) and mechanical (pragmatist)—as far as *DM* is concerned. On this basis, secondly, §2.2 shall explicate the former metaphysical causes of ‘animate beings’, i.e. divine and human minds. Statistically, except for the noun in the full title, *De motu sive de motus principio & natura, et de causa communicationis motuum*, one can see 44 instances of the Latin term ‘cause’ (*causa*) in *DM*, *prima facie* various kinds. Then, in more details, §2.3 examines efficient-final causation of the divine mind in the metaphysical domain, in a way similar to Leibniz’s two kingdom analogy. Hence, on the one hand, I explain why pragmatic causes in the mechanical domain stand out for finite minds like us in the metaphysical background of *DM*. On the other, within the scope of metaphysics, one can see a possible interweaving of efficient and final causation of the incorporeal minds.⁵

⁴ This does not mean that I ignore Leibniz’s theories of causation in the mechanical domain, but my thesis will not probe into them. In fact, Leibniz’s mechanical philosophy, focusing on mechanical efficient causes, does not dismantle natural teleology or immanent final causes; rather it is idiosyncratically but tightly supported by his *metaphysical* causation. See Osler 1996, 402–403; 2001, 152–155; McDonough 2011, 186, 198; Jorati 2015, 391–392; Rey 2009; 2016; Pearce 2016. Berkeley’s interest in mechanics, on my view, relates to *extrinsic* teleology (i.e. assuming God’s purposes for things) as with those of Boyle, Newton, et al., rather than Leibniz’s *intrinsic* teleology that they criticised, although Berkeley did not exactly comment on it in *DM*.

⁵ As long as he uses the traditional terminology in his works, I presuppose that the spectrum of causation in Berkeley’s metaphysics is considered in comparison with ancient Greek, particularly Aristotelian, four types of causation (viz. material, formal, efficient, and formal causes). On the other hand, reviewing a philosophical development of causation and criticising Russell’s seminal article ‘On the Notion of Cause’ (1913), R.G. Collingwood (1937, 85–95, 101–103) proposed three senses of causation:

- (1) historically ‘proper’ sense including efficient/final causes as ‘occasions’;
- (2) means-end sense in contingent ‘practical science’ (e.g. medicine);
- (3) anthropomorphic sense to speak of ‘laws’ and their ‘instances’ in ‘theoretical science’.

When Collingwood refers to Berkeley regarding matter being ‘inert’ in God’s hands (1937, 103), I take it that there was a lack of explanation of the human mental power. However, I will consider metaphysical causation in the (1) historical sense, and mechanical causation in the (2) and (3) senses for the sake of human deliberation in *DM*.

2.1 The distinction of mechanical and metaphysical causation

2.1 The distinction of mechanical and metaphysical causation

In the original text in Latin, by my count, the term ‘*causa*’ (including the verb form) appears 44 times in *DM*.⁶ Drawing a distinction between the natural sciences (particularly, mechanics as a mathematical science) and metaphysics, Berkeley severs the task of natural philosopher, i.e. finding patterns in our ideas, from that of metaphysician, i.e. contemplating the causes of those ideas.⁷ In this first section, exemplifying pragmatic aspects of mechanical causes, I will starkly differentiate between mechanical and metaphysical causation in *DM*.⁸

In the early modern progress of natural science (particularly in the seventeenth and eighteenth centuries), it must be remarked certain historical discontinuity between mechanics and metaphysics. For instance, according to Christiaan Boudri (2002, 232), the divergence between them stems from (i) a shift about the object itself (mechanistic structure contra substantial metaphysics), and (ii) a shift in how ideas about that object are constructed (explicit foundation for mechanics *contra* implicit premisses for metaphysics).⁹ Here, one can see, by way of manifest (non-occult) explanation based on experiments and observations,¹⁰ classical/Newtonian mechanics had been scientifically detached from the traditional, speculative discipline of metaphysics. In consequence of the two shifts, Berkeley’s *DM* can be read as an early modern experimental – broadly Newtonian – case study, where mechanical causation is explicitly established in a mathematical, deductive approach behind the scenes of metaphysics. On that basis, I will interpret such mechanical causation as pragmatic, to the effect that causation pertains to the use of expressed law-propositions (i.e. formulated theories and theorems) as the finite mind confirms their truth. That is, on my reading, Berkeley’s pragmatist

⁶ For my enumeration of each instance of ‘*causa*’ in *DM*, see [Appendix 1](#).

⁷ *DM* §§37, 71, 72; Downing 2005, 234.

⁸ Early modern Europe witnessed the distinction between speculative and experimental philosophy, due to the emergence of the latter. Traditionally, metaphysics, physics, and mathematics were regarded as *speculative* natural philosophy in the early modern development. For example, mathematics was regarded as a branch of *speculative* metaphysics in Francis Bacon. Early Berkeley indeed stood on the broad tradition, stating that: ‘The two great provinces of speculative science, conversant about ideas received from sense and their relations, are *natural philosophy* and *mathematics*’ (*Principles* §101, emphasis original, see also §§118, 131; *Notebooks* §406). On the other hand, experimental natural philosophy included mechanics, which was distinguished from the speculative sciences. This relates to the operative or practical nature of experiments in relation to magic, as mechanics was at times called ‘mathematical magic’ (Anstey and Vanzo 2012, 510, referring to e.g. John Wilkins, 1648, *Mathematical Magick* [...] *Mechanical Geometry*). In construing Berkeley’s *DM*, I focus on causal theories in experimental mechanics as distinguished from speculative physics even in an expression, e.g. ‘mathematical principles of physics’ (*physicæ principia mathematica*) (§35), for mathematical (geometrical) hypotheses and abstractions are necessarily used non-speculatively but experimentally in ‘mechanics and calculation’ (*mechanica & computatio*) (§18; see also §§17, 39, 66, 70). In *DM*, thus, I take it that Berkeley’s concern with mechanics was ‘geometrical reasoning’ (*ratiocinium geometricum*, or geometrical deduction with calculation) in matters that mechanists/physicists (*physici*) treat: i.e. ‘sense, experiment, and geometrical reasoning’ (§1). For discussion, see *ibid.*, 512–518; Belfrage 2006, 203–204, n. 8; Peterschmitt, [forthcoming](#).

⁹ For a set of historical distinctions between metaphysics, physics, and mechanics through several diagrams, see Anstey and Vanzo 2012, 499–518.

¹⁰ The adjective ‘mechanical’ in the early modern period probably had the root sense of ‘manual’, or ‘getting one’s hands dirty’, regarding material objects or physical conditions (e.g. one’s use of instruments, whence the ‘geometrical’ sense). See Gabbey 2004, 12–13. This mechanical point is key to my pragmatist reading of causation for the human agent in Berkeley.

theory of causation formulated from mathematical hypotheses (causal terms) is true, solely in the human condition to define, deliberate, and deduce useful theories in mechanical practices of express confirmation. This pragmatist perspective in mechanics (given experiments and observations) is distinguished from the domain of metaphysical causes, for the latter is fundamentally rooted in God and the finite mind cannot fully deliberate on that.

2.1.1 *Mechanical causes*

To begin with, I specify several of the mechanical causes in DM, which interpretatively indicate pragmatic explanation. In the original Latin text, I count the mechanical *causa* 20 times as distinctively assumed. Above all, on my view, distinctively mechanical features are those in the following three sections (emphasis added to the term ‘cause’):

§4. By reason, however, we infer that there is some *cause* or principle of these phenomena, and that is popularly called *gravity*. But since the *cause* of the fall of heavy bodies is unseen and unknown, gravity in that use cannot properly be styled a sensible quality.¹¹

§28. For in mechanical philosophy the truth and the use of theorems about the mutual attraction of bodies remain firm, as founded solely in the motion of bodies, whether that motion be supposed to be *caused* [*causari* in Latin] by the action of bodies mutually attracting each other, or by the action of some agent different from the bodies, impelling and controlling them.

§69. In physical philosophy, however, we must seek the *causes* and solutions of phenomena among mechanical principles. Physically, therefore, a thing is explained not by assigning its truly active and incorporeal *cause*, but by showing its connection with mechanical principles, such as *action and reaction are always opposite and equal*.

I construe that these all show, in the respective aspects, how ‘we’, finite minds, *pragmatically* engages with mechanical causation formulated from mathematical hypotheses, such as gravity, for our sake. The ‘cause(s)’ in §4 are in the context of criticising Newtonian gravitation in dynamics, in the sense that the mechanist reasons or infers the cause of a phenomenon or effect. Here Berkeley argues against Newton’s theory of gravity, negatively calling it an occult quality concerning heavy bodies (*corpora*).¹² Unlike manifest, sensible qualities that we can perceive, it cannot be inferred from any occult phenomena in mechanical causation.¹³

¹¹ On the cause of gravity, see e.g. *DM* §22.

¹² On physical ‘matter’ (*materia* in Latin), Berkeley mentions only twice in *DM* (his own note 1 to §8 and §19). When he refers to the activities (such as falling) of material motions, instead of matter, he generally uses the term ‘body’ (*corpus*) except for dualistically contrasting corporeal things (*res corpora*) with thinking things (*res cogitantes*) in §25. Whether or not supposing the Berkeley of *DM* to be the immaterialist, he does not consider the matter as anything active because only the divine and human minds are truly active in this context.

¹³ Consider also *DM* §4: ‘so men would do better to let the occult quality go, and attend only to the sensible effects’. §22: ‘As for gravity we have already shown above that by that term is meant nothing we know, nothing other than the sensible effect, *the cause of which we seek*’ (emphasis added).

2.1 The distinction of mechanical and metaphysical causation

Furthermore, the ‘caused’ in §28 is a verbal form in Latin, which is the only case in the whole *DM* (the remaining cases are all nouns). This verbal case features the ‘mechanical philosophy’ or *pragmatically conditional* explanation of the collision between two bodies by the ‘agent[s]’ ourselves who are ‘impelling and controlling’. In other words, our finite minds do and can condition the extent to which we deduce true propositions about mechanical causation as our useful laws of nature. For we command theories of mechanical causation for our need or ourselves. This conditional law of nature, such as the proposition about ‘mutual attraction’ that we infer, is considered from the operative perspective of the acting agent like our minds. Finally, in §69, the ‘causes’ (in the first sentence) are utilised as the referential term in order for us to solve and deduce phenomena or effects in mechanics. This indicates a *pragmatic* explanation that ‘we must seek’, for no divine and incorporeal metaphysics seems to be involved in mathematical hypotheses and theorisations for our mechanics.

On the one hand, in the next [Chapter 3](#), I will delve into the ‘mathematical hypothesis’ as a causal term in the mechanical domain. On the other hand, the ‘cause’ in the second sentence of §69 can be illuminated as a *metaphysical* one, which I will now examine.

2.1.2 *Metaphysical* causes

Given these pragmatic or conditional aspects of mechanical causation for the human minds, the following section in *DM* is where Berkeley distinguishes the mechanical and metaphysical realms most clearly within one paragraph (emphasis on the ‘cause’ and clarification added):

§71. The physicist [in the sense of mathematical mechanist or ourselves] studies the series or successions of sensible things, noting by what laws they are connected, and in what order, what precedes as *cause*, and what follows as effect. And on this method we say that the body in motion is the *cause* of motion in the other, and impresses motion on it, draws it also or impels it. In this sense second corporeal *cause* ought to be understood, no account being taken of the actual seat of the forces or of the active powers or of the real *cause* in which they are.

Here, I take the ‘real cause’ in the last sentence to be a metaphysical one as the foundation for the laws/propositions of motion in mechanical explanation. However, the other ‘cause(s)’ in the same passage are not meant to be fundamental beyond mechanics, but rather pertain to *pragmatic* mechanical laws/principles or propositions (as seen in §69 above).

For Berkeley, moreover, in terms of the *conditional* rules and laws of motion strictly in the mechanical domain, the mechanical and metaphysical causes are demarcated as follows (emphasis and clarification added):

§66. [T]o ascertain the true nature of motion, it will be of great avail: 1° to distinguish *mathematical hypotheses* from *the natures of things* [...]. If we do so, all the famous theorems of the mechanical philosophy by which the secrets [*recessus*] of nature are *disclosed* [*reserantur*, unlocked or conditioned], and by which the system of the world is reduced to human calculation, will remain untouched; and [...] these words suffice concerning the nature of motion.

In the above sense of *conditional* inference for ourselves, the ‘mathematical hypotheses’ are deemed to be part of deductive sciences in the realm of mechanical philosophy by ‘human calculation’. By contrast, they strictly differ from the ‘natures of things’ or essences, which are rather featured in the domain of metaphysics. The two terms are disparate, but simultaneously existent as the human minds apprehend.

Inasmuch as the two domains coexist, in other words, the natural sciences (mechanics as well as the related optics and astronomy) have the limits *per se*. The Berkeley of *DM* argues as follows (emphasis added):

§42. [I]t will be more convenient, in accordance with the *use*¹⁴ *now commonly received* [*usum jam fere receptum*], to distinguish between the sciences as to confine each to its own bounds; thus the natural philosopher should concern himself entirely with experiments, laws of motions, mechanical principles, and reasonings thence deduced; but if they shall advance views on other matters, let them refer them for acceptance to *some superior science* [*superiori alicui scientiæ*].

§72. [I]f to each science its province were *allotted* [*tribuatur*], its limits *assigned* [*i*], and the principles and objects which belong to it accurately distinguished [*i*], then it could be clear [*licuerit*] to pursue our inquiries [*tractare*] with greater facility and perspicuity [*facilitas et perspicuitas*].

These are where Berkeley stresses the importance to distinguish the two worlds of causation: namely, the mechanical world that mathematical scientists treat, and the metaphysical world superior to the former. This distinction was made feasible in our ‘commonly received’ or correct ‘use’ (or practice, *usus*) of language, particularly causal terms in the mathematical science of mechanics, as opposed to the ‘abuse’ or misuse of useless terms (*DM* §23, also §§1–7). Specifically, in the very last sentence of *DM* §72, it is conditional or normative that we should ‘allot’, ‘assign’, and ‘distinguish’ the two worlds, so that we could easily and perspicuously deliberate on mechanical causation in scientific practice or discourse. This is because, if we did not ‘define the limits of physics’, or if we did not inquire within our epistemic confinements, then there should be ‘difficulties and problems’ that the mathematical science could not solve in natural philosophy and experiments (§41). This *conditionality* or normativity suggests that there must be something that experimental, mechanical (mathematical) philosophers cannot deduce propositions and notions (or knowledge) from the ‘laws of motions’ and ‘mechanical principles’ (§42).¹⁵

Therefore, Berkeley sets forth some sciences including theology as superior to pragmatic mechanics, or something beyond what we know and reason (or deduce) *for ourselves*.¹⁶ That is regarded

¹⁴ Whilst Jesseph (1992) and Belfrage (forthcoming) translate the Latin ‘usus’ into ‘practice’, the other English translators like Jessop (1952) translate it into ‘use/usage’. For my pragmatist reading, I stress the importance of this linguistically correct use or *practice* of causal terms in *DM*.

¹⁵ In seventeenth-century mechanics or mechanical philosophy, laws of nature and of motion, or mechanical laws and principles whatsoever, can be taken to be ‘par excellence the thing that wants a *reason*’, according to C.S. Peirce (CP 6.12, ‘The Architecture of Theories’, 1891, 165, emphasis added). In line with Peirce and Berkeley, it can be stated that laws of nature are what humans rationally understand by our conditioning of causal terms in the mechanical realm.

¹⁶ See *Principles* Intro 3: ‘It is a hard thing to suppose, that right deductions from true principles should ever end in

2.1 The distinction of mechanical and metaphysical causation

as the ‘first philosophy or metaphysics’, in which we humans are ‘concerned with [*agitur*] incorporeal things’,¹⁷ namely, ‘causes, truth, and the existence of things’ (§71). It should be stressed here that Berkeley is not postulating that we investigate and analyze such incorporeal things, but merely that we are ‘concerned with’ them. This implies that the human minds do not commit themselves to the metaphysical sciences that we cannot infer in our human conditions, but instead the natural and mathematical sciences like mechanics of which we are in full command. Indeed, Douglas Jesseph claims that *DM* shows ‘the hierarchy of sciences: [the sciences of] metaphysics and theology are the province of truth, while natural science tells us a useful story’ (1992, 35–36, clarification added). However, I disagree with Jesseph’s claim, because mechanical theories in the mathematical science are not merely useful but also *true* in the domain of natural science. In other words, away from the theologically metaphysical domain,¹⁸ truth-values are practically *judged* or confirmed in the mathematical, deductive inference.

On the other hand, the division of sciences (*scientiæ*) is crucial, as the divine laws of nature cannot be false but always true as the higher knowledge, whereas useful mechanical theories of motion as the lower knowledge can be either true or false.¹⁹ Then, one point here transpires: any utility of pragmatic explanation, albeit true or false for ourselves, cannot trump the divine truth that must ascertain its metaphysical causation.²⁰

Cautiously distinguished from the mechanical province, however, the metaphysical province is somewhat more complicated for Berkeley in terms of theology, the theological science. Whilst physical science is mathematically ‘confined to experiments and mechanics’, metaphysics is intended ‘to treat of the good and great God, *creator and preserver* of all things, and to show how all things depend on supreme and true being’ (*DM* §34, emphasis added). Regarding this theological metaphysics of creation and conservation (or preservation), Brook (2017, 158) presumes the ‘distinction between religion (metaphysics) and science or natural philosophy’ (the brackets original). But I contend that this kind of distinction is inaccurate, for in Berkeley metaphysics is not totally equivalent to religion or theology.

By this I mean that theology does not exhaust every single aspect of metaphysics in *DM*. For Berkeley differentiates ‘metaphysical, theological, and moral’ considerations, even though they are

consequences which cannot be maintained or made consistent. We should believe that *God has dealt more bountifully with the sons of men, than to give them a strong desire for that knowledge*, which He had placed quite out of their reach’ (emphasis added).

¹⁷ Here I referenced Luce’s translation (§71). See the other translations: ‘incorporeal things are concerned’ (Jesseph 1992); ‘one discusses incorporeal things’ (Clarke 2008).

¹⁸ I construe that truths or true propositions are not the subject matter in metaphysics for Berkeley. ‘Truth’ is strictly broken down into ‘three sorts thereof Natural, Mathematical & Moral’ (*Notebooks* §676). Hence, without metaphysical implications, he also assumes ‘Mathematical propositions about extension & motion *true* in a double sense’ (*Notebooks* §56, emphasis added; see also §§163, 755, 853, etc.).

¹⁹ *Pace* Jesseph, I construe that we theorise mechanical theories or laws as genuinely true sentences, not fictitious ones, for the sake of our needs and practice to deliberate. This comports with a pragmatist account for Berkeley’s theory of causation. In the next chapter, I will argue that the Berkeley of *DM* holds a pragmatist theory of mechanical causation that we can fully understand and judge theories or sentences to be true.

²⁰ The scientist or mechanist using a mathematical method that Berkeley depicts in *DM* is a pragmatist about true or false causal theories (law-propositions). For an instrumentalist reading that I disagree with, see Jesseph 1993; Downing 2005, 248, et. al.; Chapter 4; *DM* §§17, 18, 28.

all ‘the most excellent considerations [*considerationes*]’ derived ‘from the knowledge of the Author of nature Himself’ (§42). Unfortunately, the moral discussion is not expounded any further in *DM*. But there is room to suspect the possibility of metaphysical causes to be something derivatively distinguished from theology and morals.²¹

On the other hand, a minor point though it may be, Berkeley as an incisive commentator of mechanical philosophy criticises the Aristotelian (Peripatetic) definitions of cause and effect in *DM* (emphasis added):

§50. The Peripatetics who say that motion is the one act of both the mover and the moved do not sufficiently *divide cause from effect*. Similarly those who imagine effort or conation in motion, or think that the same body at the same time is borne in opposite directions, seem to be the sport or the same *confusion of ideas*, and the same *ambiguity of terms*.

Berkeley here supposes the epistemic ‘confusion’ and linguistic ‘ambiguity’ of the Aristotelian (and medieval) concept of cause, for the moved or effect seems opaquely attached to the first mover or God (divine cause). Thus, he first admits that there must be an abuse of scientific language. Often referring to Aristotle’s *Physics* (Bk. 8; 1984) in *DM*, Berkeley critiques its causal theory, such as ‘to say that every mover must be movable is the same as to say that every builder must be capable of being built’ (§32). On this point, Walter Ott (2009, 110–111) interprets that as with Malebranche, Berkeley detached ‘scientific explanation’ of mechanical causation (i.e. subsuming a set of phenomena under a law) from the Aristotelian theory of *scientia* (i.e. demonstrative knowledge from necessary truths).²² Indeed, in his early eighteenth-century scientific explanation, Berkeley solely treats ‘local motion’ of bodies, which one can relatively (not absolutely) measure and perceive for the discrete cause and effect in mechanics (§52). Thus, ostensibly, he regards the Aristotelian causal theory of motion as something not deducible from mechanical principles or laws of motion. On the contrary, I would disagree with Ott’s interpretation of Berkeley’s non-Aristotelian, mechanical philosophy. In fact, as will be seen, Berkeley did not completely avoid the Aristotelian causal paradigm. On my view, he neither rejects nor overthrows the half of the Aristotelian framework of causation; the next section will centre upon two of the Aristotelian four metaphysical causes, namely, efficient and final. But I would not focus on the other two, formal and material causes, because substance ontology based on the Aristotelian hylomorphism is something irrelevant, albeit innocuous, to Berkeley’s metaphysics in *DM*.

Before going into the details of metaphysical causation in the next section, I recapitulate a point of paramount importance. That is, due to the real metaphysical causation related to the divine matter, mechanical causation in *DM* is neither fundamental nor comprehensive, but pragmatic just in the condition of finite minds. Provided the correct (non-abusive) use of scientific or mathematical language that finite minds condition for our sake, pragmatic aspects are to be further discussed

²¹ On the distinction between the moral and physical laws of nature, though it may be the case within Berkeley’s *Passive Obedience* (1712), see Jakapi 2007, 60.

²² See *DM* §35; *Principles* §107.

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with the other causal terms such as ‘force’ in the sense of mechanical ‘cause’ or causal term as ‘mathematical hypothesis’ in [Chapter 3](#). On the other hand, the following two sections in this chapter shall illuminate the fundamental metaphysical aspects. On the whole, I will proceed my argument that the mathematical, mechanical causation in the pragmatist key is not sufficient. But rather, causal underpinnings from the metaphysical realm are necessary for Berkeley in fully answering the Paris Académie’s prize question—‘the principle and the nature of the motion, and [...] the cause of the communication of motions’.

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Causation is a subject matter essential to the developments in natural philosophy from Aristotelian science to early modern mathematical, mechanistic sciences, emphasising efficient causes (Allen and Stoneham 2011, 1). Berkeley’s case is no exception, indeed. Nonetheless, the term ‘cause’ in Berkeley (e.g. *DM* §22) does not necessarily pertain to efficient causation (Brook 1973, 118).²³ In effect, particularly in *DM*,²⁴ there appears to be his subtle formulation of metaphysical causes, which may not be merely efficient. In the second and third sections, my aim is to coalesce the metaphysical causes in *DM* into a unified metaphysics of causation. There are, by my count, 24 instances of metaphysical causa in *DM*. Firstly, this second section shall explain what metaphysical causes exactly mean to Berkeley, by arguing against one of the interpretations of *DM*, that of Richard Brook who takes causation as scientific explanation in the reasoning by mathematical deduction. Secondly, in more depth, the third section shall focus on the efficient and final causes in metaphysics, by associating them with a Leibnizian system of causation of two kingdoms as a similar framework.

2.2.1 ‘*Causæ verè activæ*’

To identify metaphysical causation, there should be good reason to start examining the last instance of the term ‘cause’ as was highlighted in the final section of *DM* (emphasis added):

§72. Only by meditation and reasoning [*meditatio et ratiocinium*] can truly active causes [*causæ verè activæ*] be rescued from the surrounding darkness and be *to some extent* [*aliquatenus*] known [*cognosci*]. To deal with them is the business of first philosophy or metaphysics.

One might wonder why the ‘truly active causes’ are metaphysical and plural.²⁵ On my view, this phrase is metaphysical, because mechanics (or experimental philosophy) is deemed not to go beyond the bounds in order to prove the divine truth in metaphysics, as seen in the last section. However,

²³ Dick Brook further argues that the cause in §22 ‘would have the sense of modus operandi; [...] the search for a “cause” might be considered the attempt to show that the *law* of gravity is deducible from allegedly more encompassing laws’ (1973, 118). I read that Brook subsumes Berkeley’s theory of causation under the deductive, mechanical explanation.

²⁴ For the early Berkeley before *DM*, Colin Turbayne (1956, 485–486) accounts for his reconciliation of scientific facts and common sense towards his immaterialist metaphysics.

²⁵ See also *DM* §69: ‘truly active and incorporeal cause’.

the reason why the phrase is pluralised may be contested. Here I assume that there are not only the divine, but also the other active causes in Berkeley's metaphysics. Therefore, there is some modification with the adverb *aliquatenus* ('to some extent'), indicating that we cannot fully know or cognise the metaphysics of divine mind, but certainly we can cognitively condition and reason our theories of mechanical causation, on which we can deliberate.

2.2.2 Human *mens*, *anima*, *nous*

Then, there is a question of our human existence in the metaphysical realm under the divine 'truly active causes'. Near the beginning of *DM*, a condition of human minds is suggested as follows (emphasis added):

§3. Solicitation and *effort or conation* [*nisus sive conatus*] belong properly to *animate beings alone* [*rebus solummodo animatis*]. When they are attributed to other things, they must be taken in a *metaphorical* sense; but a philosopher should abstain from *metaphor*. Besides, anyone who has seriously considered the matter will agree that those terms have no clear and distinct meaning apart from all *affection of the soul and motion of the body* [*animæ affectione quam corporis motione*].

The point is that in Berkeley's metaphysics, distinguished from the 'motion of the body', the spirit or 'mind' (*mens*) belongs to the 'animate beings' or things (*res*), which/who are active as long as they are alive or have the 'soul' (*anima*).²⁶

In addition, avoiding any 'metaphorical' sense,²⁷ our finite minds can be the active causes for deliberating on theories or propositions about their corporeal or material solicitation, conation, or

²⁶ On this point that Berkeley refers to the Latin term '*anima*' twice (the adjective and noun) in *DM* §3, Descartes's definition of the term is telling in his letter to Mersenne (21 April 1641, *CSMK* III 180): '*Anima* in good Latin signifies *air*, or *breath*; it is in a transferred sense, I think, that it means *mind* [*mens*]. That is why I said that it is "often taken for a corporeal thing" [in Meditation II; *CSM* II 18].' As the senses of bodily motion and *conatus* are connected to the *conarium* (pineal gland) or 'the seat of the common sense' by the spirits (*CSMK* III 180), Descartes and Berkeley similarly stress the corporeality of the mind (*anima*).

²⁷ As to why Berkeley abjured the use of *metaphor*, I consider his theological and philosophical conflict with two Irish bishops, Peter Browne (c.1665–1735) and William King (1650–1729), as its use relates to the use of analogy. Browne argues that 'we are not capable of any knowledge of them by direct and immediate intuition, there was no other way of revealing them to us, but by *analogy* with the things of this World' (1697, 55, *Letter* against Toland's *Christianity not Mysterious*). For Browne, the use of analogy is unavoidable 'as an analogical representation of (what is otherwise inconceivable) the divine grace or influence', whence it is 'absurd to expect that the mind of man can obtain *direct* and *immediate* ideas' of the divine attributes (*Divine Analogy*, 1733, 524, see also 478). Similarly, Archbishop King preaches that 'we transfer the Actions of our own Minds, our Powers and Virtues, by Analogy to God, and speak of him as if he had the like; so we proceed the same way in the Representations we make to one another of the Actions of our own Minds' (*Divine Predestination*, 1709; 1976, §19). In contrast to their points on figurative similitude whereby humans assimilate divine attributes, Berkeley coherently argues against such a metaphorical analogy, which is a misunderstanding, misapplication, or misuse of the medieval/scholastic term 'analogy'. According to Berkeley, the Greek term 'analogy' originally predicated or signified the similitude of mathematical proportions and then the habitude or relation of created things in the human knowledge, as 'preserving a proportion to the infinite nature of God' (*Alciphron* §4.21, in the voice of his theist mouthpiece, Crito). This is not 'metaphorical' (figurative), but 'proper' (literal or formal) analogy by which to know God, or '*analogia proprie facta*' (analogy properly formed) as paraphrased from Cardinal Cajetan's *De nominum analogia* (1498; 2009, though Cajetan never spoke of the phrase). Thus, Berkeley contends against Browne that we do imagine/think about or 'frame any direct or proper notion' of the divine attributes, such as perfection (§4.21). See Hochschild 2004, 163–166; Curtin 2014, 604–615; Pearce 2020, n. 47.

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force in mechanics. This is because the human spirit or ‘mind at will can stir and stay the movements of our limbs’ or bodies, as ‘a principle of motion, a particular and subordinate principle’, depending on the divine ‘first and universal principle’ (*DM* §25).²⁸ Here, on my view, Berkeley follows the Cartesian substance dualism between mind (*mens/νοῦς*) and body (*corpus*),²⁹ since the ‘thinking things’ (*res cogitantes*) move and animate (*animare*) ‘corporeal things’ (*res corporea*).³⁰

But more explicitly, Berkeley critically examines both divine and human minds (souls/spirits) as ‘the vital principle’ (*principium vitale*, §§33, 42, 48) or ‘hylarchic principle’ (*principium Hylarchicum*, §20)³¹ that animates their bodies for the activity and communication of motions. I consider that, resting on God (or the supreme divine mind),³² the incorporeal, but animate, finite minds are part of ‘metaphysical principles and real efficient causes of the motion and existence of bodies or of corporeal attributes’ (§41).³³

On the other hand, putting aside such a human mind as the metaphysical cause of one’s body, Berkeley further claims that God is solely the ultimate cause as called νοῦς (i.e. intellect, or more broadly, mind). Here Berkeley argues that (emphasis added):

§48. This is the source of the opinion that the same quantity of motion is always *conserved*; anyone will easily satisfy themselves of its falsity unless it be understood of the force and power of the cause, whether that *cause* be called nature or νοῦς, or whatever be the ultimate *agent* [*agens*].

²⁸ On the ‘human mind’ (*mens humana*), see *DM* §§38, 56. On freely imagining or thinking of our bodily motion, see §55.

²⁹ In effect, in *DM* §30, what Berkeley meant by substance dualism was the mind-body distinction of the pre-Socratic philosopher ‘Anaxagoras’ (Ἀναξαγόρας), not exactly that of Descartes.

³⁰ In *DM* §32, following, who allegedly first introduced the term νοῦς (‘τὸν νοῦν’, by convention ‘mind’), Berkeley brings together the theories of Plato’s *Timaeus*, Aristotle’s *Physics*, Cartesians, and Newtonians. For they all concur, according to Berkeley, that God is the principle of natural motions. That the mind is Anaxagoras’s invention is what John Toland ([Chapter 1](#)) also acknowledges (*Letters to Serena* §2.4.27):

Clemens Alexandrinus bears very hard upon him with puns [...]. ‘Anaxagoras’, says he, ‘was the first who added mind to things: but he did not preserve the dignity of the efficient cause, describing certain mindless vortexes, together with a mindlessness and inaction of the mind.’ And Aristotle compares him to a poet that brings off his hero with a miracle, when no natural cause can save him: for he affirms that Anaxagoras ‘makes use of the mind as of a machine in the formation of the world; and produces it only, when he doubts by what cause it necessarily exists: but in other matters, he assigns any other cause of the things which are made rather than the mind.’

See also Clement of Alexandria (Titus Flavius Clemens, c.150–215), *Stromateis* §2.14.2 (1991, 166); Aristotle, *Metaphysics* 1.985a18 (1984).

³¹ See similar points in e.g. Leibniz, ‘Considerations on Vital Principles and Plastic Natures’ (1705): ‘an *archeus* or a *hylarchic* principle, or other immaterial principles’; ‘souls are vital principles’. Denying the opinions of the Aristotelians, Leibniz seems to negatively allude these ‘vital principles and plastic natures’ to the theories of the elder van Helmont and the Cambridge Platonists like Henry More and Ralph Cudworth (Leibniz 1969, 587, nn. 3–4). But this does not mean, on my view, that Berkeley disagreed with their theories in a way Leibniz did. For my reconstruction of Berkeley’s objections to Leibniz and those early moderns, see [Chapter 3](#).

³² See Berkeley’s favourite quote from the Pauline doctrine about the human mind’s causal dependence on God (*Acts* 17:28): ‘*in God we live and move and have our being*’ (*Dialogues* 2.214, 3.236; *Principles* §§66, 149; *Alciphron* §4.14; *Guardian* (no. 88, ‘The Christian Idea of God’) 219; *TVV* §2; *Notebooks* §827). See also Oda 2018, 74, n. 9, for clarification on my view: this Pauline quotation by Berkeley is not the point in favour of Malebranche’s occasionalism.

³³ See Hinrichs 1950. 502–503; Wild 1936, ch. 10.

Berkeley here does not determine the ultimate agent to be the ‘nature or $\nu\omicron\upsilon\zeta$ ’, which might invoke a Spinozist (crypto-atheistic) God that Berkeley would reject. For Spinoza’s so-called God does not entail ‘intellect’ or ‘will’, whence the God is not properly called a ‘mind’.³⁴ On the contrary, Berkeley regards the ‘agent’, implying its will or intellect, as the metaphysical ‘cause’ (two instances in §48 above) that has ‘conserved’ ‘the same quantity of motion’. I assume this aspect of conservation to be crucial for efficient-final causation in the metaphysical realm. Given the limits of mechanical explanation defined and deliberated by the human mind (§§42, 67), therefore, metaphysics outside the limits plays a rôle in underpinning the existence and nature of the animate and immaterial causes, or minds.³⁵

2.2.3 Metaphysical ‘*causa*’ or ‘*ratio*’

Against the metaphysical backdrop for our human minds as above, here is one of the most thought-provoking sections in *DM* (emphasis added):

§37. A thing can be said to be explained *mechanically* then indeed when it is reduced to those most simple and universal principles, and shown by accurate reasoning to be in agreement and connection with them. For once the laws of nature have been found out, then the philosopher [*philosophus*] is to show that each phenomenon is in *constant conformity* with those laws, that is, necessarily follows from those principles. This is to explain and solve the phenomena and to assign *their cause, i.e. the reason why they take place* [*causa, id est ratio cur fiant*].

From here, I first identify that the ‘philosopher’ means ourselves, who can cognitively and scientifically, particularly mathematically, engage with experimental mechanics.³⁶ In the sense of natural philosophy of Berkeley’s day, deductively, we can prove *how* phenomena conform with their mechanical laws of nature (i.e. ‘constant conformity’) after discovering the laws/principles or conditional rules/patterns in our ideas. In this sense, we can ‘assign’ (*assignare*) or (semiotically) *use* the term ‘cause’ in the mechanical domain to ‘explain and solve’ (*explicare et solvere*) the phenomena or effects, so as to observe the conformity of nature.³⁷ However, we cannot fully (or ‘to some extent’,

³⁴ For Berkeley’s later reason to reject the Spinozist God, referring to ‘*Spinosus*’ and his contemporaries such as Hobbes, Cudworth, and Clarke, see *Alciphron* §4.16 (‘*Spinosus* held the universe to be God’, says Lysicles, a free-thinking character, not Berkeley’s voice), §6.31 (‘I believe, with *Spinosus*, that Christ’s death was literal, but his resurrection allegorical’, says Alciphron), §7.29 (‘*Spinosus*, the great leader of our modern infidels, in whom are to be found many schemes and notions much admired and followed of late years: such as undermining religion under the pretence of vindicating and explaining it...’, says Crito, a theist character, not entirely Berkeley’s voice). Here, behind the descriptions of Spinoza, one can easily assume one of his real targets: John Toland, Irish heretic and free-thinker. Nonetheless, I defended in [Chapter 1](#) that he was rather the most immediate precursor to Berkeley for their similar pragmatic, relativist approaches to mechanical causation.

³⁵ The true entities can be, according to Ian Tipton, ‘the *true* persons, the persons we never see’ as an immaterial and invisible minds or spirits (1974, 293). It is important that we be highlighting the plurality of ‘persons’ or minds, as Tipton implied.

³⁶ See the prior §36: ‘philosophers [*philosophi*]’, such as our human minds, can understand ‘experimental philosophy’ and ‘mechanical philosophy’ for ‘our knowledge of corporeal things’.

³⁷ See also *DM* §35. Here I agree with Jesseph 2018: ‘The “solution” or explanation of a phenomenon involves showing how it follows from very general principles of motion, which are the proper laws of nature.’

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§72) know or resolve the very ‘cause, i.e. the reason *why* they take place’ *before* the laws of nature are discovered and applied.³⁸ This is a fundamentally metaphysical question because, on my view, the incorporeal metaphysics is concerned with the reason or cause of every single phenomenon, or why the phenomenon occurs or emerges (*feri*). Berkeley later states that ‘we must seek the causes and solutions of phenomena amongst mechanical principles [...] not by assigning [their] truly active and incorporeal cause’ (§69). This can be properly regarded as the efficient or generating cause in the metaphysical domain. Hence, I interpret that the term ‘cause’ in the last clause of §37 should be primarily concerned with this metaphysics before our assigning or using causal terms, as distinguished from the human mind’s explanation or solution of physical effects in constant conformity.

In contrast to my interpretation, however, Brook explains the above §37 as follows (2017, 161, emphasis added):

The last sentence carefully doesn’t equate cause with *efficient cause*. And in that sense the DN structure³⁹ might appear a useful model of explanation for Berkeley since *no explicit reference is made to causes*. Yet without at least an implicit reference to causation *DM* §37 doesn’t tell us why ‘a thing’ is explained rather than merely that the belief the ‘thing’ occurred or will occur is justified.

Brook therefore accounts for Berkeley’s mathematical, mechanical principles without recourse to metaphysical causation.⁴⁰ He associates Berkeley’s mechanical explanation here to Newton’s treatment of phenomena in mechanics.⁴¹ Moreover, Brook’s account might be defended in this *DM* section:

§38. In mechanics [...] notions are premised, i.e. definitions and first and general statements about motion from which afterwards by mathematical method conclusions more remote and less general are deduced.

³⁸ According to Richard Van Iten (forthcoming, his emphasis):

[T]he *experimental method* by itself, while practically fecund, cannot yield genuine *Laws of Nature*. In short, they are not *self-justifying*. Literally put, their *raison d’être*, the answer to the question, *What qualifies them as lawful?*, takes us back to Berkeley’s conflation of the notions of *cause* and reason in *De Motu* 37. Berkeley’s answer to this question comes not by way of repeated experimental confirmation but by way of *meditation*. It is unfortunate that Berkeley has so little to say about this *method*.

On the contrary, I contend that Berkeley, fortunately, has much to say about his experimental method in *DM* pragmatically. See Chapter 3 for my reconstruction of three elements (viz. sense, experiment, and geometrical reasoning) and three steps (viz. linguistic definition, epistemic confirmation, and pragmatic expression) in geometrical reasoning. In the mathematical, mechanical reasoning I take the practice of ‘meditation’ is included by its repeatable deduction, as distinguished from another realm of metaphysical science.

³⁹ That is the deductive-nomological model or covering law, for which Brook refers to Hempel and Oppenheim 1948.

⁴⁰ For his similar argument distancing from metaphysical efficient causation or ‘why’ question, see also Brook 2018, 21–24.

⁴¹ To that end, Brook refers to Newton 1999 [1729], xvii. See Newton’s point on phenomena: ‘The main business of natural philosophy is to argue from phenomena without feigning hypotheses’ (*Opticks* [3rd ed.] 1718, Query 28). Unlike Berkeley’s metaphysics of causation, with the proposition ‘*hypotheses non fingo*’, Newton refused to supplement mechanics to a metaphysical, causal explanation of phenomena. See also Hanson 2000, 91; Peterschmitt, forthcoming.

This indeed suggests how the mechanist works in their mathematically deductive or scientific manner. In the other sections, the ‘*ratio*’ (reason) is mentioned merely for a methodological purpose. For instance, in *DM* §4, the ‘reason’ is rightly used for *mathematical hypotheses* to ‘infer that there is some cause or principle of these phenomena’ (i.e. motions of falling and accelerating or gravity). This kind of *reason* might not suggest any use of the term in metaphysics, but in mechanics. However, Brook’s reading amounts to some unwelcoming consequence for Berkeley that mechanical explanation is so sufficient for the *reason or cause* of phenomena, that metaphysical causation could be redundant in explaining the laws of nature.

As opposed to Brook’s (and even Ott’s) interpretation of mechanical causation by the mathematically deductive method, I rather uphold a more metaphysical foundation for the term ‘cause’, particularly in §37. This is because I am sceptical about the feasibility in *DM* to understand ‘reason’ devoid of metaphysical causation. For Berkeley, the mathematical hypotheses or mechanical causes cannot be established without considering theology and metaphysics (‘first philosophy’), where the reason for the occurrence of phenomena is first employed in our reasoning or meditation (§§42, 72).⁴² In other words, on my reading, the cause or reason for the human existence is first necessarily established in the metaphysical domain, in the condition of which our human minds can meditate, think, or frame ‘mathematical hypotheses’.⁴³ Therefore, we can deliberate on causal laws of motion and nature for ourselves in the mechanical or pragmatic domain.

To wrap up so far, as seen in *DM* §72, one’s practice of ‘meditation and reasoning’ can be derived from, and justified by, the metaphysical ‘truly active causes’. Mechanical causation is thus not sufficient *per se*, even if we humans can define it within the metaphysical world, This is because it still ‘remains to discuss the [truly active] cause of the communication of motions’ (§67, clarification added). Brook, indeed, argues that ‘no explicit reference is made to causes’ in deducing a theorem in pure mathematics as a non-causal explanation (Brook 2017, 160). However, the causation in mathematical reasoning could be ultimately and necessarily traced back to the metaphysical foundation of divine and human animate beings (§3).

2.3 Metaphysical efficient-final causation

Within the above metaphysical framework, this final section shall explain the more precise distinction of causes within metaphysics. On my reading, the metaphysical causes in *DM* could converge on two kinds of (traditionally Aristotelian) causes, namely, efficient and final causes.⁴⁴ Amongst the whole 72 sections of *DM*, I read the following as representing the twofold causation (emphasis

⁴² On the ‘reasoning’ and ‘meditation’, see *DM* §§4, 17, 37, 42, 43, 72.

⁴³ I will further explain them as mechanical *causal terms* in Chapter 3.

⁴⁴ For discussion of early modern developments of efficient-final causation as the ‘explanatory parity’, see McDonough 2011, 188; Carlin 2006. On the overview of disagreement amongst commentators on Leibniz’s efficient and final causation, see Jorati 2015, 395–396, n. 13. Despite the abrogation of final causes (by Bacon, Descartes, and Spinoza), the other seventeenth-century mechanical philosophers (e.g. Pierre Gassendi, Robert Boyle, Leibniz, and Newton) seem to defend final causation concerning the divine purposes in natural philosophy. See Osler 2001, 155.

2.3 Metaphysical efficient-final causation

added):⁴⁵

§36. It will be of great importance to consider what properly a principle is, and how that term is to be understood by philosophers. The *true* [*vera*], *efficient* [*efficiens*], and *conserving* [*conservatrix*] cause of all things by supreme right is called their fount and principle.

Apart from the first adjective ‘true’ that I take to be genuinely *real* in the metaphysical sense, I focus on the metaphysical ‘efficient and conserving cause’, which is the *principle* for all the existences provided by God’s supreme right. This principle pertains to, above all, Berkeley’s theology. But specifically, I take the ‘conserving cause’ as the final cause, which fulfils the efficient cause of all things created by the divine mind.⁴⁶

2.3.1 Leibniz’s two kingdoms of power and wisdom

With the above in mind, it can be rephrased with my clarificatory emphases: God is the ‘creator [*conditor*, i.e. efficient cause] and conservator [*conservator*, i.e. final cause]⁴⁷ of all things, and to show how all things depend on supreme and true being’ (*DM* §34). In effect, it is noteworthy that Berkeley does not use here the term ‘creator’ (*creator*) implying efficient causation. However, I interpret the *conditor* to be God who must work on ‘conditioning’ (*conditio*) or create at the beginning of this world, whence the efficient cause, and the *conservator* to be God who constantly work on ‘conservation (*conservatio*)’ or preservation, whence the final cause. Thus I defend that these two types of causation work together in Berkeley’s metaphysical formulation. On the other hand, as Robert Hurlbutt puts it, albeit not particularly featuring *DM*, Berkeley’s theological arguments are ‘teleological’, ‘since purpose is involved at both ends of the causal inference’ (1957, 109–110).⁴⁸ In other words, teleology in terms of the divine conservation is tightly integrated into

⁴⁵ Outside *DM*, whilst not necessarily in a scientific context, I also assume the divine twofold causation in *Alciphron* §4.14 (through the theist character Crito): ‘not a Creator merely, but a provident Governor actually and intimately present, and attentive to all our interests and motions: who watches over our conduct, and takes care of our minutest actions and designs, throughout the whole course of our lives, informing, admonishing, and directing incessantly, in a most evident and sensible manner. This is truly wonderful.’ The 1729 *Correspondence* to Samuel Johnson (*Works* II, §3): ‘the divine conservation of things is equipollent to, and in fact the same thing with, a continued repeated creation: in a word, that conservation and creation differ only in the *terminus a quo*’; ‘all things necessarily depend on Him as their Conservator as well as Creator.’ *Guardian* (*Works* VII, 225): ‘we shall [...] perceive the universe to be the work of one infinitely good and wise Being; and that the system of thinking beings is actuated by laws derived from the same divine power which ordained those by which the corporeal system is upheld.’ On my reading of these, God as the Creator is a temporal efficient cause of the mechanical world, and God as the Governor/Conservator is a final cause that conserves or upholds our finite bodies and motions. Both of the divine rôles are required for Berkeley’s theistic metaphysics. See also Tipton 1974, 298.

⁴⁶ In terms of final causation, Berkeley is not unlike the Aristotelians. For example, one of the prominent Aristotelians, St Thomas Aquinas argues that amongst the Aristotelian four causes, the final cause or ‘the end is the cause of the causality of the efficient cause, [...] the end is the cause of causes, because it is the cause of the causality in all the causes’ (*De principiis naturae* [*On the Principles of Nature*], ch. 4 §22; Bobik 1998, 60).

⁴⁷ Most translators in English that I consulted concur with the same translations of the two terms, *conditor* as ‘creator’ and *conservator* as ‘preserver’, except for Desmond Clarke (2008) translating the latter as ‘conserver’, which I think is the more appropriate. Van Iten (*forthcoming*) treats Berkeley’s God in *DM* as ‘a creator-conservator deity’. I cannot agree with this rendition enough.

⁴⁸ Berkeley’s teleological *a posteriori* inference—from effects to cause—stems from his theology with cosmological metaphysics and design argument in the Age of Reason, especially in his treatment of Newtonian science (Hurlbutt 1957,

his theological metaphysics, which stems from the divine creation or efficient causation. Therefore, I argue that several sections in *DM*, specifically §36 (and §§34–37), imply Berkeley’s teleological metaphysics of divine conservation, where the efficient cause of divine creation should be first premised in Berkeley’s Christian theology, whereby the final cause also works together with the efficient cause.

At this juncture, it would be worth examining Berkeley’s metaphysical causation from a Leibnizian perspective. In spite of disagreements with each other about matter and force (effort) in mechanics,⁴⁹ I construe that Berkeley and Gottfried Leibniz share the divine teleology to a large extent. As I argued, the Berkeley of *DM* distinguishes the metaphysical and mechanical domains in terms of causation, whereas Leibniz’s mechanics, specifically dynamics, is always and deeply involved in his metaphysical perspective.⁵⁰

However, it is chiefly Leibniz, the teleologist and the contemporary of Berkeley, who consistently argues as follows (1705; 1969, 588, emphasis added):⁵¹

These are like two kingdoms, one of efficient causes, the other of final, each of which separately suffices in detail to give a reason for the whole, as if the other did not exist. But neither is adequate without the other when we consider their origin, for they emanate from one source in which *the power which makes efficient causes*, and *the wisdom which rules final causes*, are found united.

I can find nowhere else, at least in the early modern period, that the twofold causation is more unequivocally stated. The efficient and final causal systems, or the Leibnizian *two kingdoms* of

110). See also Ardley 1968, 50–51: ‘the teleological universe’. Elsewhere, Berkeley more explicitly argues for teleology or final causation. See e.g. *Siris* §§155, 231, 251; *Principles* §§60, 62, 107; the 1729 *Correspondence* §3; *Analyst* §11: ‘final Cause or Motive’.

⁴⁹ On Berkeley’s offensives against Leibniz’s mechanical philosophy, see *DM* §§8, 19. As regards Leibniz’s contention against the ‘Irishman’ Berkeley’s immaterialism, Leibniz’s claim for the pre-established harmony of monads, etc., see his letter to des Bosses (15 March 1715; Leibniz 1969, 609); ‘Remarks on Berkeley’s *Principles*’ (winter 1714–1715; 1989, 307):

True substances are monads, that is, perceivers. But the author should have gone further, to the infinity of monads, constituting everything, and to their pre-established harmony. Badly, or at least in vain, he rejects abstract ideas, restricts ideas to imaginations, and condemns the subtleties of arithmetic and geometry. The worst thing is that he rejects the division of extension to infinity, even if he might rightly reject infinitesimal quantities.

See also Carlin 2007, 57–78.

⁵⁰ Here, I agree with Anne-Lise Rey’s reading (2009 I, 53–56, n. 27; II, 157; 2016, 47–63) that Leibniz formulates two steps of the relation between metaphysics and dynamics (mechanics) as the ‘mixed’ action. The first step is the relation between the primitive active force in metaphysics and the derivative active force in dynamics. The second step thereupon is that between the metaphysical, formal action of a substance in the conservation and the dynamical phenomenon (motor action), whence the immanent causation is perceived. This process can be reconstructed primarily from the first part of ‘Specimen dynamicum’ (1695), ‘Système nouveau de la nature’ (1695), Leibniz’s correspondence with de Volder (1698–1706), etc. See also Duchesneau 1994, 279–280.

⁵¹ Leibniz, ‘Considerations on Vital Principles and Plastic Natures’. See also e.g. *Monadology* §79: ‘Souls act according to the laws of final causes through their appetitions, ends, and means. Bodies act according to the laws of efficient causes or the laws of motion. And the two kingdoms, that of efficient and that of final causes, are in harmony with each other’ (1714; 1969, 651). In the other contexts, Leibniz does assimilate the Aristotelian four causes, although his metaphysics is not Aristotelian. See also *ibid.*, 317–318 (‘Discourse on Metaphysics’, 1686, §22), 637 (‘Principles of Nature and Grace, based on Reason’, 1714); Bobro and Clatterbaugh 1996, 418.

2.3 Metaphysical efficient-final causation

power and wisdom,⁵² are the necessary condition for each other. On this point, it is noteworthy that Berkeley also referred to ‘the wisdom, the goodness, the power of God’ (*sapientiam, bonitatem & potentiam Dei*) regarding the higher sciences of metaphysics (*DM* §34).⁵³ It is uncertain that he knew or agreed with this Leibnizian argument at all. Nevertheless, I think that it sheds the clearest light upon Berkeley’s possible, harmonious picture between the two metaphysical causes in *DM*.

2.3.2 Berkeley’s creator-efficient and conservator-final causation

In effect, Karl Popper was correct in stating, despite his non-metaphysical construal, that for Berkeley, ‘all true or real causes were... “efficient or final causes” (*Siris* §231) and therefore *spiritual*, and utterly beyond physics’ or mechanics (1953, 33).⁵⁴ Not only in *Siris*, but also in the early works, such as *Principles*, Berkeley does argue for the necessity of final causation or teleology in tandem with efficient causation. Thus, I suspect that the part of final causes is involved in *DM* with respect to the metaphysically true or real causes (especially, *DM* §37 in the last section). This is all because final causation is tightly intertwined with the other side of the coin of metaphysical causation, or efficient causation.⁵⁵

The analysis as above goes textually. By my count, *DM* offers nine instances of efficient causation, including the above one in §36, whereas the clear instance of final causation is only a few as in §36; God as ‘conservator’ in §34.⁵⁶ On my reading, not only the divine one, but all the real efficient

⁵² Identifying ‘wisdom’ with final causation is not uncommon for early modern philosophers and theologians. See another example, Archbishop King’s *Sermon* (1709; 1976, §IV, emphasis added): ‘God who has thus concerted and settled Matters, must have *Wisdom*; and having ascrib’d to him *Wisdom*, because we see the effects and result of it in his Works.’

⁵³ As stated earlier, I do not delve into moral issues of ‘goodness’ (*bonitas*) of God (§34) and ‘moral consideration’ (§42), since the mentions are just a few in *DM*.

⁵⁴ *Siris* §231: ‘The laws of attraction and repulsion are to be regarded as laws of motion; and these only as rules or methods observed in the productions of natural effects, the efficient and final causes whereof are not of mechanical consideration’; §260: ‘All things are made for the supreme good, all things tend to that end: and we may be said to account for a thing when we shew that it is so best.’ See also *DM* §§22, 35–37, 41; *Principles*, §§62, 107.

⁵⁵ See further Berkeley’s 1729 *Correspondence* §3 (emphasis and clarification added):

[T]he divine *conservation* [final cause] of things is equipollent to, and in fact the same thing with, a continued repeated *creation* [efficient cause]: in a word, that *conservation* and *creation* differ only in the *terminus a quo*. These are the common opinions of the Schoolmen; and Durandus, who held the world to be a machine like a clock, made and put in motion by God, but afterward continuing to go of itself, was therein particular, and had few followers. [...] I am not therefore singular in this point itself, so much as in my way of proving it. Further, it seems to me that the *power* [efficient cause] and *wisdom* [finite cause] of God are as worthily set forth by supposing Him to act immediately as an omnipresent infinitely active Spirit, as by supposing Him to act by the mediation of subordinate causes, in *preserving and governing* the natural world. [...] For aught I can see, it is no disparagement to the perfections of God to say that all things necessarily depend on Him as their *Conservator* as well as *Creator*, and that all nature would shrink to nothing, if not *upheld and preserved* in being by the same force that first *created* it. This I am sure is agreeable to Holy Scripture.

See also *Principles* §46: ‘For the Schoolmen [...] the divine conservation [...] is expounded to be a continual creation.’ As proposed previously (2018, n. 5), I maintain a possibility that Berkeley conceded the scholastic Durandus’s conservationism about the motion of created beings (finite minds) which is not immediately caused by God, for he can be one of a ‘few followers’ of the unpopular scholastic, bishop Durandus de Saint-Pourçain (c.1270–1334). Here, one can see no division between the medieval scholasticism, if not orthodox, and Berkeley’s metaphysics (and that of Leibniz).

⁵⁶ On efficient causation, see *DM* §§22, 29, 35 (three instances), 36, 41, 47, 69. See also the other works: *Siris* §§154–156,

causes in *DM* are to be metaphysical causes. One of the instances of ‘efficient causes’ (three times) is (emphasis added):

§35. The imperfect understanding of this situation has *caused* [*in causa est*] some to make the mistake of rejecting the mathematical principles of physics on the ground that they do not assign *the efficient causes of things*. It is *not*, however, in fact the business of physics or mechanics to establish *efficient causes*, but only *the rules* of impulsions or attractions, and, in a word, the laws of motions, and from the established laws to assign *the solution, not the efficient cause*, of particular phenomena.

This passage indicates *how* the pragmatic mechanist can mathematically and experimentally discover the causal laws of motion or conditional/normative ‘rules’ and ‘solution’ particular phenomena for themselves. However, this pragmatic framework in the mechanical domain has the constraints of its causation. Rather, in the domain of metaphysics, the real efficient causes of the bodily motion are supposed to explain *why* the body exists and is moved as the effect (i.e. explaining the ‘cause’ or ‘reason’ in §37). On the other hand, in the other sections of *DM*, Berkeley clarifies the points that the term ‘body’ means nothing about the true, efficient cause of motion (§§22, 29). This cannot be confused with the spiritual active causes of motions in the metaphysical world, for they are not attributable to the effects or phenomena (§47).

Thus, in §69, Berkeley argues that in the mechanistic or pragmatic domain, ‘a thing is explained not by assigning *its truly active and incorporeal cause*’, because ‘the *mind* [...] moves and contains this universal, bodily mass [as] *the true efficient cause* of motion [...] properly and strictly speaking, of the communication thereof I would not deny’ (emphasis added). Although he does not proceed to analyze it beyond the human pragmatist mechanical world, this efficient causation of the ‘mind’ is what Berkeley confirms. That could signify the divine active cause, not the human at this time, as finally vindicated in §72.

Overall, in tandem with the divine final cause, ‘real efficient causes’ as the ‘metaphysical principles’ are deemed to be the production or occurrence of the ‘motion and existence of bodies’ (*DM* §41). As Lawrence Carlin rightly points out, not only does Berkeley’s God operate the efficient cause of all beings in the phenomenal or perceived world, but also has the final cause to meet his *truly explained* conditions of intelligibility (2006, 155–156, n. 8).⁵⁷ In other words, crucially from §41 based on §§34–37, Berkeley does indicate the two types of efficient and final causation as the real ‘metaphysical principles’ of God. What I mean by that is a valid extent to which the divine efficient causation is fully corroborated with the counterpart of final causation, as the unified metaphysical principles. However, one might worry that there still exists a problem of the involvement of the incorporeal, finite, *human* minds (§§25, 38, 56) in the causal paradigm of divine metaphysics. My interpretative solution here is that *qua* ‘animate beings’ (§3), the human minds reside in the realm of

231, 247, 251; *Principles* §§53, 69, 102, 105, 107; *Dialogues* 2.217; The 1729 *Correspondence* §2, etc.

⁵⁷ Whilst this chapter cannot go deeper, Berkeley intended for science to construct an instrumentalist standpoint on the regularities of matter and motion (Carlin 2006; Jessep 1993; Downing 1995b; 2005, et al.). This instrumentalist reading I object to in Chapter 4.

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metaphysics, but they would not primarily explain the efficient-final causes of the communication of material motions. However, this point excludes the direct causation of our own bodies, which we can free think about, imagine, or frame (§55).

In closing the final section, I stress that it is this metaphysical world that I made explicit as Berkeley's causal system in a pragmatist direction of mechanical causation.⁵⁸ In the metaphysical background including animate existences of finite minds, the divine twofold (efficient-final) causation works. However, our finite minds can distinguish or define the boundary between such a causation in the metaphysical world, on the one hand, and mechanical causation in a pragmatist world, on the other. Our finite minds can think about the latter causation by reasoning or meditation, whereby taking the utility of mechanics to the extent to which we humans know. The next chapter shall explicate the latter pragmatist causation with respect to causal terms in mechanics, or mathematical hypotheses.

Conclusion

Consequently, I have distinguished the two types of causes, i.e. theologically metaphysical and pragmatically mechanical, in Berkeley's pragmatist causal paradigm in *De motu*. My argument in this chapter was to re-appreciate the fundamental metaphysical causation, including the divine and human minds, through the pragmatist prism of Berkeley's early modern mechanical philosophy. However, my approach might be undermined at least in two ways: (1) if one suspends the feasibility of distinguishing metaphysical and mechanical causes, and (2) if one postulates multiple metaphysical causes more than two kinds (real efficiency and teleology). The first objection can be raised if one properly affirms only metaphysical causes. Nonetheless, I consider that mechanical causes are differently, pragmatically upheld for the human practical deliberation. The second objection can be raised if one entirely dismantles the Aristotelian causal system. Nonetheless, I confirm the half of the fourfold causes applied to Berkeley's causal paradigm. Certainly, this chapter did not analyze every single argument about his metaphysical meanings of the term 'cause', such as the 'vital principle' or 'hylarchic principle'. However, I parsimoniously hope that my construal of causes has viably modified a systematic relationship between metaphysical causation, in which we reside, and mechanical causation, which we can pragmatically define and reason within our epistemic conditions.

⁵⁸ Consider the logicist Bertrand Russell's critical remark: 'The logical extreme of the other conception [of knowledge than that of Leibniz's mirroring but non-interacting monads] is pragmatism, which was first promulgated by Marx in his *Theses on Feuerbach* (1845): "[Thesis 2] The question whether objective truth belongs to human thinking is not a question of theory, but a practical question. The truth, i.e. the reality and power, of thought must be demonstrated in practice. [... Thesis 11] Philosophers have only *interpreted* the world in various ways, but the real task is to *alter* it"' (Russell 2009, 371–372, clarification added); Marx 2010, 3–9. However Russell disparages Marx's 'incomplete' argument lacking 'non-inferential knowledge' (sourced in sensation and memory) about 'connections between facts' (2009, 372), and however ideologically different to Marxist materialism and atheism, I read that there must be a connection between Marxist pragmatism and Berkeley's pragmatist theory of causation in view of the finite extent of human knowledge and the utility to deliberate its truth in scientific practice or discourse.

Chapter 3

Mathematical Hypotheses in *De motu*: Berkeley's Pragmatist Discourse on Mechanical Causation

Introduction



ARE there any causes for the ‘mechanist’¹ to explain phenomena? This chapter spotlights ‘mathematical hypotheses’ as mechanical causes, or *causal terms (vocabula)* in *DM*, and explains why they are essential to Berkeley’s pragmatist theory of mechanical causation. My pragmatist reading will advocate the mechanist’s discourse or discursive thinking by which one can confirm the truth of law-propositions in a correct use of language. The confirmation of true (or false) laws of motion indicates Berkeley’s deliberative approach to causation. Whilst the last chapter explicated causation primarily with reference to the term ‘cause’ in both theological metaphysics and pragmatic mechanics, the current chapter shall narrow down to the identity of causal terms in the latter mechanics in more details, such as ‘force’, ‘gravity’, ‘impetus’, and especially ‘mathematical hypothesis’. In other words, I will further identify all-inclusive mechanical *causes* to be pragmatic under the umbrella phrase ‘mathematical hypotheses’. These, I argue, can be regarded as ‘suppositions’ and depend on the framing of mathematical ‘abstractions’ or deductions from phenomena. This deductive approach to causation by mathematical hypotheses concerns geometrical reasoning, i.e. one of the following three elements in Berkeley’s pragmatist discourse in *DM*:²

Element 1 ‘Sensation’ (*sensus*);

Element 2 ‘Experimentation’ (*experientia*);

¹ For the term ‘*mechanicus*’ (*DM* §39), I continue to translate it into ‘mechanist’, unlike ‘mechanician’ (Luce 1951; Jesseph 1992, et al.), for I think the former is more tinged with early modern natural philosophy. In addition, I include the meanings of ‘mechanistic philosopher’ and ‘geometer’ in the ‘mechanist’.

² *DM* §§1, 4, 21, 36, 40, 71. In these sections, the three elements are brought to light.

Element 3 ‘Geometrical reasoning’ (*ratiocinium geometricum*) or ‘reason’ (*ratio*).

Providing the three elements and zooming in on the third one, I will textually consider how mathematical hypotheses are framed as causal terms in the process of Berkeley’s pragmatist discourse on mechanical causation for utility.

In what follows, I will divide the chapter into three sections. §3.1 initially distinguishes two linguistic entities, terms (including phrases) and propositions (theories and laws), and clarifies why terms are components of true law-propositions. Specifically, causal theories are law-propositions of which the truth-values are predicated or judged by the human agent. Within Element 3, I further reformulate that Berkeley’s mechanistic, pragmatist theorisation of causation consists of a discursive thinking in three steps:

Step 3.1 Linguistic definition of causal *terms*;

Step 3.2 Epistemic confirmation of true (or false) law-*propositions*;

Step 3.3 Pragmatic expression of *them* (3.2) for our needs/practices (operational mechanics).

Given the term-proposition distinction by the three steps, the next §3.2 continues to reinforce the identity of mathematical hypotheses in geometrical reasoning in this pragmatist key (fulfilling the third step). This aspect will be considered with medieval theories of ‘supposition’, which I think can be associated with Berkeley’s pragmatist theory of mechanical causation. For this purpose, finally, §3.3 textually delves into how mathematical hypotheses are framed by the mechanist in Berkeley’s argument (specifically in *DM* §20). This I will call his discursive argument for mechanical causation, as I take it to be established on his discursive thinking to express causal terms and propositions in the pragmatist key. Drawing stark contrast with metaphysical views of his opponents (especially, the Cambridge Platonists, Borelli, and Leibniz), I will distinguish that argument of Berkeley from the opponents’ metaphysically pure thinking. Overall, what I aim to do in this chapter is reconstruct a new yet feasible understanding of what Berkeley meant by ‘mathematical hypotheses’ for pragmatic causation in the mechanical domain that treats mathematical abstractions, not metaphysical ones.

3.1 ‘Mathematical hypotheses’—causal terms in propositions

Initially, I will introduce the distinction between terms and propositions in the mechanical domain, for it pertains to the basis of my interpretation of causal terms in causal laws, theories, or propositions. Causal terms are assumed to be linguistically and logically pre-propositional (on the term-level),³

³ My use of ‘pre-propositional’ does not contradict e.g. W.E. Johnson’s classical definition in his *Logic* (1921–24 I): ‘although propositions may be ranged into higher and higher orders, adjectives predicable of propositions are of only one order, and will be called “pre-propositional”’ (ch. 4, §1). ‘A proposition is that of which truth and falsity can be significantly predicated’ (ch. 1, §1). Here one can see that a term is a ‘pre-propositional’ element (like the adjectives ‘true’ and ‘false’ or truth-values) in ‘only one order’ where it is only predicable or predicated of (or sayable/said about) an object, whilst a proposition (a collection of declarative sentences) is formulated into ‘higher orders’ where a term, particularly the truth-value, predicates of the proposition in which it occurs. In the truth-functional succession of orders, when ϕ is a proposition, ‘ ϕ is true’ and ‘ ϕ is false’ are secondary propositions. Assuming this aspect of predicate

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whereas they are formulated, i.e. framed, to occur in the propositions about laws and rules (on the sentence-level). This process of formulation from terms to law-propositions will be highlighted in this section.

3.1.1 Three elements: sensation, experimentation, and reasoning

On my reading, Berkeley’s pragmatist theory of mechanical causation signifies a theoretical, rather geometrical, process of three steps: (3.1) linguistically defining, (3.2) epistemically or deliberately confirming, and (3.3) pragmatically expressing causal laws for one’s needs and practices (operations). On the other hand, whilst integrating this process in a geometrical manner, I view that Berkeley adheres to three overarching elements in his pragmatist discourse: ‘sensation [*sensus*, or sense], experimentation [*experientia*, or experiment], and geometrical reasoning [*ratiocinium geometricum*]’ (*DM* §1). These fit in one’s ‘mechanical demonstrations [*demonstrationes mechanicæ*]’ (§28)⁴ and ‘mechanical practices [*praxes mechanicæ*]’ (§42), whereby the effect of force can be ‘known and measured’ (§10). Textually focusing on the final step of geometrical reasoning, I will start off with the three elements.

From the very beginning of the treatise, one can recognise the three elements in Berkeley’s pragmatist discourse of mechanical causation. They consist of the mechanist’s discourse in their ‘mode of speaking [*loquendi consuetudine*]’ (*DM* §1):⁵

Element 1 ‘Sensation’ (*sensus*), which distinguishes manifest and occult qualities, the latter of which are referred to by abstract general terms (phrases),⁶ ‘mathematical hypotheses’ (e.g. ‘force’, ‘gravity’, ‘attraction’, ‘impetus’).

logic, I will focus on causal terms (abstract general terms) that predicate of causal theories and law-propositions. For predication of general terms, see also Quine 2013, 87–90; Ayer 2004, 187–191.

⁴ See also *DM* §18: ‘calculation and mathematical demonstrations [*computationi & demonstrationibus mathematicis*]’.

⁵ As Chapter 1 examined his and Toland’s critiques of Newtonian terms of ‘absolute’ space, time, and motion (*DM* §§52–66), Berkeley began the offensive against the authoritative Newtonian mechanics by way of this admonition (*DM* §1, emphasis/clarification added):

[N]o one’s authority ought to rank so high as to set a value on the person’s words and terms inasmuch as nothing clear and certain can be *confirmed* [*comperiatur*, or verified] in them.

Thus, on my pragmatist reading, Berkeley prioritises the importance of confirming terms in one’s ‘linguistic use’ (*loquendi consuetudine*, or mode/custom/habit of speaking) over ‘the authority of philosophers’ (*philosophorum auctoritate*) (§1). See also Walmsley 1990, 178; Jesseph 1992, 5.

⁶ On my view, whilst Berkeley expunged the Cartesian/Lockean doctrine of abstract general *ideas*, it is not the case for those *terms* and *notions*. Regarding ‘ideas’, one can see Berkeley’s nominalism about particular ideas with determinate content (such as an idea of a triangle, *Principles* Intro §§13–18). See a poignant remark of Wilfrid Sellars (1978, §147, emphasis original): ‘After all, his task, as he saw it, was to explain how we come to be able to think of all items of a generic sort. To Berkeley [...] it is the *generic* or determinable that poses the problem.’ Indeed, the Berkeley of *DM* does negate abstract ‘terms’ and ‘notions’, if they are useless and unintelligible (*DM* §§4, 7, 23). However, I will defend that, by way of abstract general *terms*, Berkeley was pragmatically able to explain (or solve) the *notions* of mechanical causation about mathematical entities in geometrical reasoning. See §67: ‘Mathematical entities [*entia mathematica*] have no stable essence in the nature of things: they depend on the notion [*notione*] of the definer: whence the same thing can be explained [*explicari*] in different ways.’ Here the ‘notion’ or useful meaning, whereby the definer can explain ‘in different ways’, is their definition in abstract general ‘terms’. This does not mean the abstract or obscure ideas detached from the terminological definition.

Element 2 ‘Experimentation’ (*experientia*), which proves ‘mathematical hypotheses’ (causal terms) abstracted from effects (phenomena); ‘proper experiment’ (*propria experientia*) fortifies the ‘mind’ in reasoning (*DM* §§25, 31).

Element 3 ‘Geometrical reasoning’ (*ratiocinium geometricum*) or ‘reason’ (*ratio*),⁷ which frames ‘mathematical hypotheses’ in law-propositions (sentences) by deduction for our needs and practices.

The mechanist’s mode of speaking, more aptly, *discoursing*, converges on the three elements.⁸ I argue that these elements set forth a broad *framing* of Berkeley’s pragmatist discourse on mechanical causation.

In particular, the distinction of qualities and thus of hypotheses is of paramount importance for Element 1. As opposed to *occult* qualities that mathematical hypotheses refer to,⁹ *manifest* qualities are referred to by (the terms of) ordinary empirical hypotheses, such as ‘mass’, ‘figure’, and ‘colour’. In line with Bob Schwartz (2020, 155),¹⁰ I uphold that (i) Berkeley distinguishes two types of hypotheses—ordinary empirical and mathematical—and that (ii) the difference between them is the latter mathematical being syncategorematic. The ‘syncategorematic’, away from the Aristotelian categories, indicates that such terms refer to non-existent beings, or anything occult, but they are meaningful in sentences in which they occur. For instance, ‘Santa Claus’ in ‘Santa Claus is bald’, and ‘sake’ in ‘I argue for Nicholas’s sake’ are the cases. However, *stricto sensu*, I contend against Schwartz (and his reading of ‘pragmatic instrumentalism’) that, textually, both types of ‘hypotheses’ must refer to the terms, not the sentences, and thus they are not truth-apt for themselves or do not have truth-values. On my pragmatist reading, the term ‘hypothesis’ in *DM* is first theorised or defined, so that they occur in sentences (theories or laws, e.g. $F = ma$) that have truth-values.

⁷ Here noteworthy is *DM* §21 (emphasis added):

By the help of sense we know the extended things, solid, mobile, figured, and endowed with other qualities which meet the senses, but we have known by a certain *internal consciousness* the sentient, percipient, intelligent thing [*rem vero sentientem, percipientem, intelligentem, conscientiâ quâdam internâ cognovimus*].

I consider this ‘internal consciousness’ to be a part of the human ‘reason’ (geometrical reasoning) distinct from the senses, for the reason relates to what is intelligible (‘intelligent’) by introspection or meditation. Hence, there can be external (outer or embodied) consciousness by the senses, the knowledge of which is taken via our personal experiment (experience) into the internal reason, in my interpretation of the three Elements: sensation, experimentation, and reasoning. For discussion of the *distinction without difference* about the term ‘consciousness’, I thank David Berman (email/skype, 2021). Outside *DM*, there is one sentence contradicting my construal. That is *Notebooks* §578: ‘Consciousness, perception, existence of Ideas seem to be all one.’ In this unificatory sense, there is no distinction (without apparent difference) between the perceiving ‘sense’ and ‘consciousness’. On the other hand, regarding ‘two sorts of Potential consciousnesses Natural & praeternatural’ (*Notebooks* §202), I read that Berkeley excludes the former natural state of consciousness as reason from the latter *praeternatural* or *supernatural* consciousness. Then, one can ‘reason’ empirical/mathematical hypotheses in one’s natural state of mind. See also Berman 2021, ch. 2; Hill 2022, 68; *Principles* §89 (‘inward feeling or reflexion’ to comprehend one’s own existence; ‘reason’ to comprehend that of other minds, though not relating to mathematics).

⁸ These are recursively distinct, three components in the treatise. See *DM* §§1, 4, 21, 36, 40, 71.

⁹ In [Chapter 5](#), mathematical hypotheses are more aptly taken to be *quasi*-referential expressions, rather than (genuine) referential ones, because they describe *quasi*-objects that have no manifest qualities but occult ones. See also [§0.1.2](#) for the distinction between two types of mechanical causation: one from empirical hypotheses that describe manifest qualities, and the other from mathematical hypotheses that describe occult qualities.

¹⁰ I also thank Bob Schwartz for email correspondence (December 2020).

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Therefore, the meaning of causal terms—mathematical hypotheses—is abstracted from the effects (deduced from the phenomena) for utility.¹¹

In addition to Element 3 of deductive reasoning, I will later argue that Berkeley does take his empirical, inductive method regarding causal terms, following ‘what sense and experiment tells us, and reason that *rests upon them*’ (*DM* §21, emphasis added). My pragmatist reading here reinforces the point that Berkeley first empirically and inductively formulates mechanical theories in causal terms like ‘force’, which are then deductively reasoned for the human mind’s temporal needs and practices.¹²

3.1.2 Tripartite definition of a pragmatist theory of causation

In my thesis (q.v. [Chapter 4](#)), I propose that the mode of discourse based on the three elements essentially implies Berkeley’s pragmatic method about mathematical hypotheses. This discoursing mode integrates the following definition, containing three generic ingredients, into Berkeley’s pragmatist theory of mechanical causation in *DM*.

Definition. A pragmatist theory of causation is one which holds that:

- ① Causal terms are indispensable in scientific deliberation for their *usefulness*; they cannot be eliminated [*contra* reductionism].
- ② What a cause is is defined by one’s temporal deliberative practices, independent of atemporal structure that theories hold [*contra* structuralism].¹³
- ③ Causal laws (theories and theorems formulated in causal terms) are genuinely *true*, not *fictitious*, when one confirms and deduces them [*contra* instrumentalism].¹⁴

¹¹ See *DM* §§17, 28, 40; also [Chapter 1](#) for the M pyramid model, which structured mechanical causation from the logical and semantic levels to the pragmatic level of objects.

¹² In the process of *induction* from sensation and experimentation, one can infer the approximate truth about mechanical causation in Berkeley’s Inference to the Best Explanation, which I label BIBE. This is abductive, for unobservable and unobserved effects, such as ‘infinity’, are referred to by mathematical hypotheses within the scope of correct inference that makes us confirm the law-propositions from our senses and experiments (whence deductive geometrical reasoning). For a similar reading with causation, see R. Schwartz 2020, 145, 152–153; *Dialogues* 2.223; *Siris* §228. This BIBE shall be fully articulated in the next [Chapter 4](#), whereas the current chapter illuminates deductive reasoning in mathematics and mechanics.

¹³ Nowhere in Berkeley can I find any statement that the structure of causal theories continues independently of one’s sense perception. On my view, in *DM* after the 1707–1708 *Notebooks*, Berkeley is still concerned with the finitude of life to the extent of one’s knowledge, as regards the notion of time for the finite (limited) and infinite (eternal) minds, respectively. See *Notebooks* §590: ‘T. No broken Intervals of Death or Annihilation. Those Intervals are nothing. Each Person’s time being measured to him by his own Ideas’. For the other entries with the letter T (time) and those with the + (plus) sign, if not positive, see *Notebooks* §§1–16, 39, 48, 92, 118, 127, 129, 130, 194, 390, 460, 647, 655; *Principles* §§97–98, etc.

¹⁴ The *syādvāda*, Jaina seven-valued logic, may distinguish my pragmatist reading from the other readings, especially those of instrumentalism. For this logic disambiguates Berkeley’s pragmatist ‘mode of speaking’ ‘in the pursuit of truth [*ad veritatem*]’ (*DM* §1). According to Jaina logic and metaphysics, if a non-empty set is assumed to describe reality, then seven ‘conditional’ (*syāt*) propositions are exhaustively proposed to express their true (*asti*, *t*), false (*nāsti*, *f*), and non-assertable (inexpressible, *avaktavya*, *i*) predicates (operators). The following are the seven modes of predication: ‘perhaps it is’ (*syāt*) ‘certainly’ (*eva*) (1) $\{t\}$; (2) $\{f\}$; (3) $\{t, f\}$; (4) $\{i\}$; (5) $\{t, i\}$; (6) $\{f, i\}$; (7) $\{t, f, i\}$. If $\wp(S)$ denotes the powerset (set of all subsets) of S , then the cardinality of $\wp(t, i, f) = 2^3 = 8$. Since the empty set is

By justifying a sound inference to this definition, which are not separate from one another but unified as a set, I will object to three rival readings—reductionism, instrumentalism, and structuralism—in contradistinction to my vindication for Berkeley’s pragmatism in *DM*. On my pragmatist reading, a corollary of the above tripartite definition is that mathematical hypotheses on the level of causal terms are to be fully formulated into causal laws, theories, or propositions in pursuit of *truth* of their *utility* for ourselves.

3.1.3 Three steps in geometrical reasoning

Before criticising the above-bracketed three readings in the next chapter, here, I will textually recount Element 3 of ‘geometrical reasoning’ in particular. Thereby his pragmatist discourse of mechanical causation about mathematical hypotheses as causal terms shall be clarified. In my reformulation, the third element can be further broken down into three steps:

- Step 3.1** Linguistic definition: *theorisation* by mathematical imagination or abstraction, i.e. the first *framing* of causal terms into law-propositions (*DM* §§33, 38, 39, 66, 67, etc.).
- Step 3.2** Epistemic confirmation: *deliberation* by judging the truth-values of theorised law-propositions in which causal terms occur (*DM* §§20, 28, 31, 38, 40, 67, etc.).
- Step 3.3** Pragmatic expression: *locution* of law-propositions from mechanical causation for utility by mathematical deduction, followed by calculation (*DM* §§7, 28, 38, etc.).

These three steps by the ‘geometrical reasoning’ or ‘reason’ are, in a narrow sense, taken to be *framing* of causal terms in the mechanic philosopher’s discursive thinking. Within the broad three-element framework of Berkeley’s discourse, the three-step framing of causal terms is essential to *deducing* (and *computing*) pragmatic expressions of causal theories (law-propositions) to the end of human utility.

Provided the above overview of Berkeley’s pragmatist discourse of causation (i.e. causal terms and theories), I will begin with the following gobbet about his analytic, deductive, and mathematical method in mechanics (emphasis/clarification added):

§38. The human mind [*mens humana*] delights in extending and expanding its knowledge [*scientia*]. For this purpose general notions [*notiones*] and propositions [*propositiones*] must

excluded (i.e. at least one element is included), $\wp(\{t, i, f\}) - 1 = 7$. See Priest 2008, 265–266; Balcerowicz 2014, 31–32; Oda and Galanos 2021. Berkeley could admit (4) concerning divine metaphysics. However, in asserting or confirming law-propositions about mechanical causation, he does not opt for (4) to (7) since the predicates cannot be non-assertable *i*, whether or not the sentences are true or false. This is because he abjures ‘the useless [*inutili*] matter of disputing [*disputare*] without ideas and abusing [*abuti*] terms [*nominibus*] expressing nothing distinctly’ (*DM* §23, emphasis added; see also §§1–7). Avoiding the non-assertability of scientific language, on my reading, the pragmatist Berkeley is concerned with only (1) and (2) as the sentences are assertable (*vaktavya*) either way. That is, the definition of useful law-propositions is confirmable to be either true or false, in which causal terms properly or accurately occur. By contrast, instrumentalist readings of many commentators not only take (1) and (2) but also (3), because useful propositions as assertable *fictions* can be (3) both true and false, or undecidable of truth and falsity. Then, the instrumentalist Berkeley does not care about truth-apt sentences. These instrumentalist, as well as reductionist and structuralist, readings are misleading as I will argue in Chapter 4.

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be formed [*efformandæ*, step 3.1], in which particular propositions and knowledge [*cognitiones*] are in some way contained [*continentur*], which are then, and only then, believed to be understood [*intelligi creduntur*, step 3.2] *with the latter propositions continuously deduced from the former*.¹⁵ *This is well known to geometers*. In mechanics also notions are premised [*præmittuntur*], i.e. definitions [*definitiones*] and first and general statements [*enunciationes*] about motion [step 3.1], from which [through step 3.2] more remote and less general conclusions are later deduced [*colliguntur*] by the mathematical method [step 3.3]. And as by the application of geometrical theorems the particular magnitudes of bodies are measured, so also by the application of the universal theorems of mechanics the motions of any parts of the mundane system, and the phenomena which depend upon these motions, become known and are determined [*innotescunt & determinantur*, step 3.1]: and this is the only goal at which the physicist [i.e. mechanist] should aim.

From here, the sentence that we must first understand is: ‘This is known to geometers [*Hoc Geometris notissimum est*].’¹⁶ On this point, interpretatively, I hold a view that mathematical, deductive propositions are taken to be so true that the applicability or utility can be ‘known and determined’. This relates to the theoretical definition of causal terms in step 3.1, followed by the two other steps. This is to fulfil the mechanist’s mathematical demonstration with practical bearings in step 3.3. Indeed, deduced conclusions in the final step must be inferentially or linguistically ‘more remote and less general’ than the firstly formulated law-propositions (*enunciationes*). In this discursive process, the conclusions from the framing of mathematical hypotheses are meant to be ‘useful in theories and propositions, as also in calculations about motion’ (*DM* §39).

Moreover, I argue that the process of the geometrically-oriented mechanist’s reasoning (*DM* §38) is the grounding of logical and pragmatic necessity for law-propositions in our scientific knowledge. In other words, for Berkeley, logical truths in geometrical reasoning must be defined, confirmed, and expressed in their mode of mathematical deduction. This is a correctly deliberated use of mathematical notions and law-propositions or statements, inasmuch as the human mind *knows*. Here, for a moment, let us consider Berkeley’s later text, *TVV* §35 (emphasis added):

The work of science and speculation is to unravel our prejudices and mistakes, untwisting the closest connexions, distinguishing things that are different, instead of confused and perplexed, giving us distinct views, gradually *correcting our judgment*, and reducing it to a philosophical exactness. And [...] it is extremely difficult, if at all possible, to escape the snares of popular language, and the being betrayed thereby to say things strictly speaking *neither true nor consistent*. This makes thought and candour more especially necessary in the reader. For, language being accommodated to the prænotions of men and *use of life*, it is difficult to express therein the

¹⁵ The phrase ‘with the latter propositions continuously deduced from the former [*cum ex primis illis continuo nexu deducuntur*]’ appears in the first 1721 edition, unlike the 1752 edition (*A Miscellany*, London) omitting it. This I include for clarification. See Belfrage, [forthcoming](#), who treats the phrase as a subordinate clause: ‘when we have deduced them step by step from the former’.

¹⁶ I thank Richard Van Iten (email correspondence, 2021) for directing me to this particular sentence.

precise truth of things, which is so distant from *their use*, and so contrary to our pre-notions.

Although the *Theory of Vision Vindicated* (1733) was published a dozen years after *DM*, the above passage casts a clearest light on Berkeley's coherent justification for the 'correct', or *truly* confirmed, use and utility of language. This concerns the above-stated definition of Berkeley's pragmatist theory of causation in the sense of *truth in use*, as it were, by 'correcting our judgement'. For a true judgement of propositions would lead us not to be 'betrayed' about vulgar pre-conceptions of 'precise truth of things'.¹⁷ This is not to expunge the meaning of truth at all. On my view, Berkeley rather aimed at making our use of language 'use'-ful to the life of ordinary people by his method of philosophical engagement in 'science and speculation'. This is because, for Berkeley, it is pragmatic to hold 'a true maxim that a man should think with the learned, and speak with the vulgar. [...] All our discoveries and notions are in themselves true and certain' (*Alciphron* §1.12, in the voice of Euphranor, Berkeley's mouthpiece).¹⁸ Put differently, if we can express the utility of our formulated notions and propositions, then they are not only useful but also 'true and certain' *in themselves*. Hence, in accordance with our rational and discursive activities in natural philosophy (scientific knowledge), especially geometrical reasoning in the context of *DM*, we can judge sentences of vulgarly pre-conceived ideas to be both useful and true (or false) law-propositions.

In steps 3.1–3.3 of geometrical or mathematical deduction that Berkeley intended for the truth in use, I do not distinguish between 'propositions', 'statements' (enunciations or locutions), and 'definitions'.¹⁹ All of them are propositionally capable of being judged to be either true or false, or having the truth-values as 'theories' in step 3.2 (epistemic confirmation). By contrast, in step 3.1 (linguistic definition), geometrical and mechanical causal terms (and phrases), such as 'forces',

¹⁷ Earlier on, Berkeley referred to Isaac Barrow's phrase (1709/1732, *NTV* §36): '*seclusis prenotionibus et prejudiciis*' (remote pre-conceived notions and prejudices); Berman 2010, 11. In addition to *TVV* §35, Berkeley was concerned by the correct 'use of language' or 'mode of speaking' (*DM* §§1, 26, 69). In defence of Berkeley's argument for the convention of language, with which I cannot but agree for my pragmatist reading, see Pearce 2017a, 237, n. 16; 2017b, 566, n. 22; 2017c, 157–171 (ch. 8, 'the Nature of Truth'); *Siris* §296; *Principles* §§38–39, 52.

¹⁸ The phrase 'think with the learned, and speak with the vulgar' is a medieval scholastic maxim '*sentendum ut pauci, loquendum est ut plures*'. This I think is pragmatic for ordinary people to communicate, in the sense that they can take on scientific knowledge that the *learned* or abstruse philosophers theorise. See also *Principles* §51; White 1955, 173; Van Iten 2015, 84. From this maxim, Achille Varzi infers 'Berkeleyan fictionalism', because we 'just have to realize that it's all a fiction, a game of make belief, and if we really need to make that clear, we can just say so' (2013, 136–137). However, I contend that Berkeley does not subscribe to the fictionalism as such, for truths of mathematically framed notions and propositions are not necessarily fictions, but they are certainly at work or so useful that ordinary people can conceive of them as part of the reality in their discursive practices. That is, my pragmatist reading is inclined to scientific realism.

¹⁹ It is true that propositions and sentences are distinct in the sense that a proposition refers to the truth-value of any sentence in the same fixed meaning, not solely that of a particular sentence (Ayer 2004, 208–210; Whitehead and Russell 1925–1927, vol. 1, 14; W. Johnson 1921–24, vol. 1, ch. 1). However, in my construal of Berkeley's text, I define my use of law-propositions as sentences about causal laws or regularities; I see no difference between propositions and sentences in mathematics and mechanics. On the other hand, I exclude 'eternal sentences' that are *atemporally* true or false (Quine 2013, 177) from my reading of Berkeley's pragmatist theory of causation, because the confirmation of the truth-value of mechanical explanation is temporally restrictive in the epistemic condition of the *finite* mind who judges for their own utility. For the more detailed distinction of linguistic entities, such as declarative sentences, propositions (e.g. objectionable 'Sätze an sich [sentences-in-themselves]' in Bolzano 2014, vol. 1, §22), theories, thoughts ('Gedanken'), statements, states of affairs, facts, etc., see Morscher 1987, 242–245, 255; Nuchelmans 1973; 1983, 147–154 (on Berkeley's use of propositions and terms).

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‘attractions’, ‘motion’, and ‘mathematical hypotheses’, stand or supposit for their ‘notions’ or ideas. However, the terms themselves are never true or false on the pre-propositional level, or in the pre-theoretical state before step 3.1.²⁰ On this point, Berkeley states that ‘general and abstract terms [...] make notions *or* at least [*vel saltem*] propositions universal’ (emphasis added, *DM* §7). This disjunctive (‘or’) qualification is suggestive of his distinction of linguistic entities or objects (viz. ‘terms’, ‘notions’, and ‘propositions’). Given the above §38 context, on my reading, the §7 statement suggests that whatever might be interpreted about notions on the pre-propositional level, general and abstract terms allow us *at least* to deductively express the truth of less general propositions (conclusions) in step 3.3 (pragmatic expression).

Hence, from the context of *DM* §38, I construe that causal terms are defined (step 3.1) as the components of true (or false) propositions, insofar as they are deliberated (step 3.2) and thus deduced (step 3.3) by the human mind in scientific discourse.²¹ In the light of Berkeley’s pragmatist theory of causation, a causal term (mathematical hypothesis), such as ‘attraction’, is deliberated or confirmed as part of true theories and theorems (provable formulae) in *DM* (clarification added):

§28. [I]n mechanical philosophy the truth [*veritas*] and use [*usus*] of theorems about the mutual attraction of bodies remain firm [step 3.2], [...] whatever is deliberated [*quaecumque tradita*]²² of the rules and laws of motion, and also of the theorems deduced [*deducta*] from them, remains unshaken [step 3.3].

In this way, the truth of mechanical theories is deliberately confirmed, whereby expressing the laws and rules (theories).²³ By ‘speaking strictly and accurately [*strictè & accuratè loquendo*]’ (*DM*

²⁰ From the medieval perspective of scholastic logic in Latin, to which I argue Berkeley’s *DM* may be related, signification (*significatio*) concerns a pre-propositional semantic level of terms that stand for notions, whereas supposition (*suppositio*) concerns a propositional level of the relation between terms and notions that the terms stand or supposit for. Supposition or *hypothesis* occurs only after the first process of signification or when terms already have meanings. See Dutilh Novaes 2007, 18, 31: ‘to use Ockham’s own terms, what is asserted by a proposition [*denotatur*] is determined by the supposition of its terms.’ See also Appendix 2.

²¹ See also *Alciphron* §7.10 (in the voice of Euphranon, clarification/emphasis added):

I presume, you allow there are very evident *propositions or theorems* relating to [the term] force, which contain *useful truths*: for instance, that a body with conjunct forces describes the diagonal of a parallelogram in the same time that it would the sides with separate. Is not this a principle of very extensive use?

Including this *Alciphron* remark of ‘useful truths’ in my construal of Berkeley’s *DM*, I consider that *theorems* as provable formulae (formulations or propositions) in mathematics are formally brought together with theories in mechanics by the deductive method. See also Gödel 1992, 37–41; Whitehead and Russell 1925–1927, vol. 1, 14ff.

²² The translations of *quaecumque tradita* differ in the following: ‘whatsoever things have been laid down’ (Wright 1843); ‘traditional formulations’ (Luce 1951); ‘whatever is said of’ (Jesseph 1992); ‘whatever is taught about’ (Clarke 2008); ‘in what terms they are formulated’ (Belfrage, forthcoming). The Latin verb *tradere* literally denotes trading or handing over objects including propositional knowledge, which requires the judgement by trading people. Assuming this epistemic condition, I interpret the *tradita* as ‘deliberated’ in the sense of being carefully formulated whereby orally propounded.

²³ See also *DM* §26: ‘if the proposition is confirmed to be true [*si res ad verum exigatur*]’. Unlike many commentators who imply the truth (*verum*) as a ‘real’ (authentic or genuine) entity or object, such as Jesseph 1992 (‘if the matter is expressed truthfully’), I take it to be a ‘true’ sentence, *distinctively propositional*. To this end, I interpret that *res* in the singular form (§26) is a general proposition as a causal law, not a general thing that has no truth-value. That is, law-propositions are deliberately confirmed or ascertained (*exigatur*) towards the truth (*ad verum*) by the agent,

§26), Berkeley confines his discourse to mechanical causation about physical phenomena, such as ‘passive motion’ and ‘percussive bodies’, for the sake of the human mind who frames the laws of motion. In his scientific discourse as such, it is the human agent that deliberates whether law-propositions should be true or not (false), such that what are true are confirmed to be at work or in use. To this pragmatist operational end, theories or law-propositions, comprising causal terms, are true for geometers and mechanists to deliberately deduce less general propositions and ‘knowledge’ (*cognitiones*). This mechanical causation is first formulated in the process of exercising one’s mental power, i.e. ‘imagining’ or inventing (*comminiscuntur*, *DM* §24) in step 3.1, whence being deliberated (3.2) and expressed (3.3). Therefore, it is initially crucial for Berkeley to define our imaginable and epistemic limits of terms and propositions (both linguistic entities), whereby we can ‘define the limits’ of mechanics (§41). This is for the sake of human ‘knowledge’ (*scientia*) that the finite mind enjoys (‘delights’, §38).

3.1.4 The term ‘hypothesis’ *qua* causal term, not sentence

In this linguistic and thus epistemic practice, the mind or scientific agent is assumed to correctly define and confirm their deducible or expressible mechanical theories, laws, ‘definitions’, or ‘statements about motions’ (§38), by framing causal terms within the limits of scientific knowledge (*scientia*). In this specific context, objecting to a majority view that ‘hypotheses’ are truth-apt sentences (e.g. R. Schwartz 2020, 154–155), I consider ‘mathematical hypotheses’, the epistemic and pragmatic objects in *DM* to be collectively represented as causal terms (or phrases),²⁴ not hypothetical sentences.²⁵

who judges that e.g. a proposition ‘an inert body acts just as a moving body’ (§26) is true. This effect (*phenomenon*) of bodily inertia is observed and deduced as the above sentence by the human agent truthfully (*ad verum*), in Berkeley’s Newtonian sense that ‘the force of inertia is the same as impetus’. Therefore, the inertia and passivity of bodies depend on the agent’s propositional judgement or confirmation of truth-values. Contrastingly, in the next section (§27), it is false that ‘we imagine, being deluded by its empty [or deceptive] appearance [*fingimus vana species delusi*], the resistance that we perceive [*sentimus*] in stopping a body in motion to be its action’ (clarification added). In this way, the agent deliberates whether deduced (and induced) propositions should be confirmed to be true or not. For Berkeley’s mission about a correct use of language against its abuse, see §§1 (*loquendi consuetudine*, ‘mode/custom of speaking’ or ‘deliberative practice’), 23 (*nominibus nihil distinctè exprimentibus abuti*, ‘abuse of words that express nothing distinctly’), 26 (*strictè & accuratè loquendo; exiguntur*), 28 (*tradita*, ‘deliberated’), 69 (*proportiè & strictè loquendo*), etc. Above all, *DM* §2: ‘it is truly [*vero*] necessary that these [causal terms such as Leibnizian ‘solicitation of heaviness [*gravitatis*], ‘conatus’, ‘dead forces’] be accurately discussed [*accuratè discutiantur*] in the interests of [mathematical, theoretical, or propositional] truth [*veritatis gratia*], not in pursuit of refuting others’ (clarification added).

²⁴ Ordinary empirical hypotheses, as distinguished from mathematical ones, are not sentences, either, on my view. See an earlier footnote about my (dis)agreement with Schwartz on the empirical-mathematical distinction.

²⁵ Certainly, outside the context of *DM*, there are something called ‘hypothetical propositions’. *Prima facie*, such compound sentences are not clearly truth-functional. For example, counterfactually, the validity of the proposition ‘had I not read Berkeley’s *De motu*, I would not have disagreed with instrumentalism’ appears to be free from the falsity of its antecedent clause (Ayer 2004, 46). Whether or not wholly depending on the truth-value of compound propositions (truth-functional or not), the hypothetical are logically deemed to be if-sentences. A.A. Luce, eminent Berkeley scholar, explicates this logical point (1958, 57):

The Hypothetical Proposition consists of two predications, of which the one is stated as a *supposition* or *hypothesis* or *condition* [emphasis added], and the other as a consequence; e.g. If A is B, C is D. The supposition (A is B) is called the Antecedent; for it often comes first to the mind and first on the tongue; but the order of expression is neither here nor there. The other predication (C is D) is called

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My reason for that is textual, as the following *DM* section reads (emphasis/clarification added):

§28. For indeed these words [*voces*, such as ‘action’ and ‘reaction’] are to be understood in the same way as the word ‘attraction’; and just as this is only a mathematical hypothesis and not a physical quality, the same should be understood of these words, and for the same reason.

This spotlights a mathematical hypothesis qua a ‘word’ or term, such as ‘attraction’, as Berkeley asserts. In other words, the mathematical ‘hypotheses’ are causal terms, including ‘forces’, ‘gravity’, ‘impetus’. These are pre-propositional linguistic entities, in such a way that they are the constituents of *of* and *before* theories (i.e. theorised law-statements of causation) that one can judge to be either true or false.

However, in view of Berkeley’s entire *works*, one may raise a possible objection that the following two questions are not clear-cut for him:

- (i) Is the ‘hypothesis’ as term distinct from the ‘theory’ as proposition?
- (ii) Does the ‘hypothesis’ have no truth-value?

In response to the first question, I answer in the affirmative. For example, in *Siris* §283 (clarification added): ‘that theory or hypothesis [about microscopical observations of life in Plato’s *Timæus*] is not alone sufficient to explain the phenomena, without the immediate action of a mind.’ I read the above ‘theory *or* hypothesis’ disjunctively, not equivalently. I uphold that Berkeley beware that hypotheses are not yet formulated into fully-expressed theories, whereas both of them require the human mind’s definition (linguistic ‘action’) to explain the effects (phenomena). On the other hand, one may still suppress my view by the second question, with *Alciphron* §7.23 (in the voice of Crito, emphasis added):²⁶ ‘Whatever abstracters, refiners, or men prejudiced to a *false hypothesis* may pretend, it is, if I mistake not, evident to every thinking man of common sense, that human minds are so far from being engines or footballs, acted upon and bandied about by *corporeal objects*.’ Although this ‘hypothesis’ is regarded as ‘false’ indeed, I do not take it as a logically false sentence but a wrong term predicable of ‘corporeal objects’ on the pre-propositional, terminological level. In other words, when theories as law-propositions have truth-values, I defend that Berkeley neither judges nor confirms hypotheses to be true. Therefore, despite some complex references,²⁷ I keep focusing on Berkeley’s consistent use of ‘hypothesis’ *qua* term in *DM*.

the Consequent; it is logically dependent on the Antecedent, and often follows it.

My concern, however, is Berkeley’s specific identification of mathematical hypotheses (i.e. suppositions or conditions in Luce’s sense) with causal terms, such as ‘force’ and ‘attraction’, in the context of *DM*. On my pragmatist reading that distinguishes abstract general words and propositions for utility, I contend with most commentators who facetiously and non-textually presume the term ‘hypothesis’ to be propositional (sentential) in *DM*. Consider more *DM* §28.

²⁶ It is difficult to tell to what extent Crito, the theist character in *Alciphron*, reflects Berkeley’s own view (unlike the other character Euphranor as Berkeley’s full mouthpiece). I take at least this quotation not in disagreement with his view.

²⁷ On Berkeley’s use of ‘hypothesis’ including the above quotations, see *Siris*, *Works* V, 29 (Author’s table of contents: ‘Newton’s hypothesis of a subtle aether’), §§209 (‘by hypothesis’, probably equivalent to *ex hypothesi*), 228 (‘to frame a hypothesis’), 233, 234 (‘a mathematical hypothesis’), 250 (‘mathematical hypotheses for real beings’), 251 (‘Democritic hypothesis, saith Dr. Cudworth’), 283, 285, 293 (‘such phantoms as corporeal forces, absolute motions, and real spaces do pass in physics for causes and principles...yet are they in truth but hypotheses, nor can they be the ob-

On this terminological account of mathematical hypotheses and causal theories, playing the three-step (3.1–3.1) rôle in mechanics as *defined* by and *expressed* for the human mind (§41), Berkeley does not commit himself to the theological metaphysics of causation. Instead, he argues that mechanical (and experimental) causation is not intended for any *real* efficient-final causation in the metaphysical (speculative) domain.²⁸ This is because, in my reformulation, causation in the mechanical domain is framed into *genuinely or determinately true* causal laws *within* our discursive thinking (i.e. defining, confirming, and expressing). For example, a section in *DM* reads (emphasis/clarification added):

§67. We have now to discourse [*disseramus*]²⁹ the question of the cause of the communication of motions [steps 3.1–3.3]. Certainly, all forces [*vires omnes*] attributed to bodies are as much *mathematical hypotheses* [*hypotheses mathematicæ*] as are attractive forces in the planets and the sun. Mathematical entities [*entia*], however, have no stable essence [*stabilis essentia*] in the nature of things [*res*]: they depend on the notion of the *definer* [*definiens*, step 3.1].

Defining scientific terms by the human *definer* is key to understanding Berkeley’s theories of mechanical causation by mathematical framing (abstraction) in step 3.1.³⁰ Put another way, one’s knowledge of mechanical philosophy depends on one’s scientific definition. As we define causal terms where using, our practical knowledge (i.e. operational mechanics) of what are true of the world depends upon our own definitions, rather than upon appropriate definitions that are given by the world itself (which is metaphysical).

That is, ‘mathematical entities’, not physical entities (*DM* §28), are abstracted as scientific causal terms for propositions correctly defined by the human mind. Those propositions are, then in step 3.2, deliberately confirmed to be true (or false) causal theories within which the effects or phenomena can be ‘known and measured’ (*cognosci & mensurari*), whereby ‘concluded’ (*concludere*) for our utility in step 3.3. This deliberative practice leads to the pragmatic expression

jects of real science’, 295 (‘he frames his hypothesis’); *Alciphron* §§4.14 (‘metaphysical hypotheses’), 7.33 (‘framing hypotheses’); *Principles* §§102 (‘hypotheses and speculations’, emphasis original), 133 (‘the supposition of matter [...] were proposed only as an hypothesis’), *Dialogues* 2.209, 214 (‘absurdities of the common hypotheses’, ‘hypotheses in the sciences’), 3.229 (‘hypothesis of material substance’), 3.242, 255, 259, 260 (‘hypothesis of the materialists’); *NTV* §§14 (‘an hypothesis framed by the mathematicians [...] in a geometrical way’), 33, 77; *Notebooks* §§19 (‘ye immaterialist hypothesis’), 272, 477 (‘a Cartesian [...] folly of the hypothesis’), 406 (‘Mathematicians & Natural Philosophers (I mean only the Hypothetical Gentlemen)’); ‘Anniversary Sermon’, *Works* VII, 118 (‘no absurd Hypothesis, or no improbable Guess... any Suppositions or Conjectures’); *Analyst* §27, §50: *Qu.* 27, *Qu.* 28 (‘the shifting of the hypothesis, or (as we may call it) the *fallacia suppositionis* [...] both in the mechanical philosophy and in the abstruse and fine geometry’); *Defence* §20; *Arithmetica* (Berkeley’s first publication, 1707, *Works* IV, 190 (‘*ex hypothesi*’); *Miscellanea Mathematica*, *Works* IV, 212, etc.

²⁸ See my distinction of the three models of causation, one metaphysical and two mechanical, in §0.1.2; Chapter 2.

²⁹ The Latin verb *disserere* can be translated into English as ‘dissert’/‘dissertate’ (in the sense of *dissertation*) or more generally ‘argue’ (in the sense of *argument*), both of which I argue bear the meaning of rational ‘discourse’ for utility, or discursive and deliberative thinking that expresses usefulness in mechanics. For the other references of this term, see *DM* §§4 (*disserendum utile*), 7 (*disserendo utile*), 21 (*disserere nil iuvat*), 44 (*disserunimus*), 55 (*disseruntur*).

³⁰ Here I concur with Whitehead and Russell that every causal term is *defined* only in a certain context, as it is an ‘incomplete symbol’ without its ‘definite description’ (intro to *Principia Mathematica*, 1925–1927, vol. 1, 66). In this respect, I take it that for the Berkeley of *DM*, causal terms or symbols in mechanics bear no independent meanings of their own (of course, no truth-values), but they are understood in the framework of *true* propositions or theories in which they are determined to occur.

3.2 Pragmatist causation from mathematical hypotheses based on abstraction

by and for the finite mind inferring law-propositions without ‘infinite’ conditions (*DM* §10).³¹ Here it should be stressed that there is a temporal limit for us, the users of causal terms, given the linguistic and mathematical limits of defining for our sake. This is because, supposing the finitude of our knowledge or understanding (*scientia*), the mechanist measures finite quantities of phenomena/effects by ‘acute and repeated meditation [*acri atque iteratâ meditatione*]’ or reasoning (*DM* §13),³² i.e. mathematical abstraction and thus deduction. By this mathematical method in Berkeley’s pragmatist discourse (steps 3.1–3.3), therefore, propositions composed of causal terms are to be causal laws that we can deliberate and thereby express as they are true in our deductive reasoning.

To wrap up this first section, I have explained a stepping-stone to understanding Berkeley’s pragmatist theory of mechanical causation as a pragmatist discourse in the three steps of linguistic theorisation, epistemic deliberation, and pragmatic locution (3.1–3.3). These steps in geometrical reasoning are also deemed to be one of the three overarching elements (1–3) in his pragmatist discourse. Given the process of mathematical framing, I have strictly distinguished causal terms (phrases) and propositions (theories/laws) in the context of *DM*, because mathematical hypotheses are defined as the former. Therefore, the human mind can express causal laws as clearly framed from the terminological level of mathematical hypotheses for one’s needs and mechanical operations. However, this is solely feasible to the extent to which one knows that the formulations are true within one’s framing (i.e. geometrical reasoning). As lastly shown, this process bases itself on one’s linguistic and thus pragmatist discourse. The next section will delve into the perspective on mathematical hypotheses as causal terms: framing as abstraction.

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Assuming his linguistic approach and pragmatist discourse, I will now argue that the scope of causal terms in Berkeley’s mathematical mechanics are determined with a specific term, ‘hypothesis’. As announced above, causal terms in the mechanical domain are not restricted to the term ‘cause’ itself, but also include mathematical (geometrical) and scientific terms in Berkeley’s pragmatist discourse that defines, confirms, and thus expresses mechanical causation (in three steps).

There is a nuanced shift from the geometrisation to the mathematisation of nature in the

³¹ Berkeley objects to an infinite quantity of force (such as percussion), for every force can be measured and calculated finitely, or proportionately to effects. In other words, in Berkeley’s eyes, there is no measurement of a Leibnizian ‘dead force’ as it has no effect, nor is there a Borellian ‘expansive force’ (*DM* §§16, 19). See *DM* §10: ‘it is not necessary [*oportet*] to take any positive quantity as infinite because it exceeds by an infinite ratio [*ratione infinita*] a null quantity or nothing.’ On Berkeley’s view that one can measure cognised qualities *qua* calculable qualities of effects, which bear causal terms such as ‘force’ and ‘motion’, see also *DM* §§5, 14, 38, 66.

³² I have no objection to reading the terms ‘reasoning’ and ‘meditation’ as equivalent in Berkeley’s philosophical use, pointing to a broad sense of framing in one’s mental activity by ostension. On the use of ‘meditation’, see *DM* §§4, 43, 72.

development of early modern science. The former was to be replaced by the latter.³³ This is because Euclidean geometry, to which Galileo and Descartes subscribed, tried to ontologically capture and understand the nature of things in reality by the deductive method, whereas mathematical mechanics, primarily due to the invention of differential and integral calculus (after Bernoulli, Newton, and Leibniz), began to analytically elaborate the infinity in the nature, overthrowing its ontological-geometrical foundation. This turned out obvious in the new mathematical approaches of algorithms and algebra in the analytical mechanics of Joseph-Louis Lagrange and J.C. Maxwell.³⁴ Then, I construe that this mathematical shift also concerns the Berkeley of *DM* (1721) because he takes no ontological and realist basis for his mathematisation of natural phenomena.³⁵ What he means by mathematical hypotheses (mechanical causal terms) have ‘no stable essence’ (*DM* §67) in the actual observation and deduction; ‘we cannot regard any positive quantity [*quantitatem ullam positivam*] as infinite because it exceeds, by an infinite ratio, a zero quantity or nothing [*quantitatem nullam sive nihil*]’ (*DM* §10).

3.2.1 ‘*Fingere*’: framing or imagining

On my reading, causal terms in mechanics converge on the phrase ‘mathematical hypothesis’, in short ‘hypothesis’, as it includes ‘motion’, ‘force’, and ‘attraction’ in the non-empirical senses. This specific yet collective term will be clarified in this section: specifically (i) it bases itself on mathematical ‘abstraction’ and (ii) it can be identified with determinate ‘supposition’ from a medieval perspective connected to Berkeley’s logic.

Following the last section, I interpret that the ‘hypotheses’ that Berkeley means in *DM* are not propositions (statements) capable of being true or false, but they remain causal *terms* (*words*) that are components of *true* propositions. The propositions or theories containing ‘(mathematical) hypotheses’ can be held true, as long as we humans formulate and thus confirm them within our practical use. This is due to the mental power in our capacity to ‘frame’ (*fingere*) or ‘imagine’ (*comminiscor*) by ‘mathematical abstraction’ (*DM* §§24, 39).³⁶ Here one can identify the mathematical ‘reasoning’ (*ratiocinium/meditatio*) with imagination or ‘framing’ (*fingitque/finguntur*)

³³ This is the view of Michel Blay 1993, 11–24, esp. 22; 2001, 116–118.

³⁴ See also Roux 2010, 332.

³⁵ Berkeley criticises the question of infinitesimals, which are nothing, in the method of fluxions or calculus in ‘Of Infinites’ (1707), *Analyst* (1734), etc. (*Works* IV).

³⁶ The Latin translation of *comminiscuntur* (twice in *DM* §§24, 39) differs in the following: ‘attribute/devise’ (Wright 1843); ‘maintain/make use of’ (Luce 1951); ‘talk of’ (Jessop 1952, only §24 as abridged); ‘imagine/contrive’ (Jesseph 1992); ‘invent’ (Clarke 2008); ‘find/use [...] devices’ (Belfrage, forthcoming). See also Peterschmitt, forthcoming. Partially following Jesseph, Clarke, and Peterschmitt, I interpret that the term *comminiscor* expresses the human power of ‘imagining’, which includes contriving, inventing, and creating in a mathematical way of reasoning. For the terms ‘imagination’ or ‘framing’ including the verb and adjective forms, see also *DM* §6 (*imaginatione*), 27 (*fingimus vana*), 33 (*fingunt*), 39 (*fingitque/finguntur*), 40 (*fingitur*), 50 (*fingunt*), 53 (*finagamus/imaginationem aut intellectu*), 55 (*imaginationem/imaginamur*), 59 (*imaginationem concipi*), 66 (*imaginibile*). For Berkeley’s mathematical use of ‘imagining’ about the infinity and infinitesimals, not a general meaning of imagining as ‘conceiving’ through the senses, see *Notebooks* §§321, 415, 417, 418, 600 (‘Tis not to be imagin’d w^t a marvellous emptiness & scarcity of Ideas that man shall descry who will lay aside all use of Words in his Meditations’), etc. However, many of the entries on the infinity and infinitesimals are left with a ‘cross’ sign, indexical of Berkeley’s negative treatment.

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in the mind, as *DM* §39 reads (clarification added):

[T]he mechanist employs [*adhibet*] abstract and general terms, and frames [*fingitque*, step 3.1] force, action, attraction, solicitation, etc. in bodies, which are very useful for theories and statements [*enunciaciones*], and also in calculations [*computaciones*] about motion [step 3.3], [because those causal terms are] no less than those [linguistic entities] which the geometers frame [or imagine] by mathematical abstraction [*quæ à geometris per abstractionem mathematicam finguntur*, step 3.1].

The verb ‘fingere’ (twice here, *fingit* and *finguntur*)³⁷ is crucial as it denotes what the human mind can frame or imagine ‘mathematical hypotheses’ *qua* abstract terms, such as ‘force’ and ‘attraction’, by mathematical abstraction. This is what geometers and mechanists engage in their primarily deductive mode in deliberative practice. Here I construe the mathematical abstraction in Berkeley’s linguistically pragmatist sense. That is, causal phenomena (e.g. activity/passivity of bodies) are abstracted (become general/universal) as causal terms (‘action’, ‘impetus’, etc.), such that the terms are framed in law-propositions and theorems as useful for ourselves.³⁸ The geometer’s deductive reasoning—framing—from general propositions to less general ones (*DM* §38) occurs in this process of abstraction. Certainly, *fingere* is traditionally translated to ‘feigning’ in Newton scholarship (Pearce 2017c, 95). However, *pace* Kenny Pearce, I consider this translation to be unsound because ‘feigning’ connotes falseness or falsity,³⁹ even fictitiousness, in mathematical deduction and abstraction. Rather, I defend that Berkeley regarded the Latin verb as merely equivalent to the English extensional verb ‘frame’ in his English writings, as referring to or defining/designating the range of reference that the idea/object signifies in the inferential process of mathematical abstraction.

There, I view that a framed mathematical ‘hypothesis’ depends on the term ‘abstraction’, whereby we can frame, ‘form’ (*efformare*), or define notions and propositions (step 3.1), and deduce conclusions by the mathematical method (step 3.3) (*DM* §38). This process in the context of Berkeley’s pragmatist discourse is called ‘mathematical abstraction’ for the ‘geometer’ and the ‘mechanist’ (*DM* §§35, 39). Put differently, I read that mathematical abstraction is the geometrical, deductive reasoning of (general to particular) law-propositions and theorems, in which abstracted hypotheses occur as causal terms owing to the correct use of language and mathematical rules. As

³⁷ Whilst Berkeley before *DM* negatively treated abstract ideas as incomprehensible to ‘frame’ in the mind, I take it that he uses this English verb importantly as the mind’s function or power. On the verb ‘frame’, see *Principles* Intro §§7–11, 13 (‘the faculty of framing in his mind such an idea of a triangle’), Intro 14–16, Part I §§6, 23, 27, 33 (‘our sensations [...] exist in the mind, or are perceived by it, as truly as the idea of its own framing [...] the creatures of the mind’), 34, 46, 47, 60, 62, 81, 98, 100, 108, 114, 116, 141, 143, 151; *MI* §§7, 9, 11, 18, 23, 34 (‘frame the Proposition Melampus is an Animal’), 45; *Dialogues* 1.177, 182, 185, 193, 194, 200, 2.211, 218, 222, 3.229 (Philonous: ‘I do not pretend to frame any hypothesis at all’, which reminds Newton’s renowned proposition, *hypotheses non fingo*), 243, 246, 247 (‘ideas I frame in my imagination’); *Notebooks* §§14, 92, 123, 127, 130 (‘to frame in his mind’), 148, 253, etc. Berkeley indicates the mechanist’s geometrical, mathematical imagination (*fingere*) in a sense similar to ‘inventing’/‘devising’ (*comminiscuntur/comminiscor*) (*DM* §§24, 39). See also the last footnote.

³⁸ *DM* §70: ‘abstract mathematics’, not ‘the real nature of things’.

³⁹ See Carey 2012, 20–23. I read that the pragmatist Berkeley regards theories or formulations in causal terms as *true*, *not false*, when confirming and expressing their utility in one’s mechanical practices. If he is committed to no false framing (*fingere*) of hypotheses for causal theories, then his stance is rather close to Newton’s *hypotheses non fingo*.

regards the mathematical abstraction in *DM*, Geneviève Brykman (1993, 330–331)⁴⁰ argues that one can abstract a ‘pragmatic content’, not a fictitious one, only in two respects: (i) abstractions as operational notions in calculation and (ii) those as figures extracted from animistic analogy. Putting aside the latter respect concerning abstractions in the metaphysical domain, I strongly agree with Brykman on the former operational notions in the sense of causal terms in the mechanical domain. However, from this pragmatist perspective, I disagree with her view that mathematical abstractions are partially, if not entirely, fictitious (‘fictives’ in French)⁴¹ as the means (‘moyens’) of a formal calculation detached from the sensible reality of the nature. This is because, to the extent to which we correctly deliberate on abstracted causal terms as mathematical hypotheses (step 3.2), we frame true propositions—laws of nature—in no fictitious use of language. That is, in Berkeley’s strict, accurate, and proper manner (*DM* §§26, 69, *strictè & accuratè loquendo; propriè & strictè loquendo*), this deliberative practice (*DM* §1, *loquendi consuetudine*) defuses both fictitious linguistic entities and false sentences in correctly inferring law-propositions.⁴² This, I think, is the marrow of Berkeley’s pragmatist discourse by the mathematical abstraction of causal terms.

3.2.2 ‘*Hypothesis mathematica*’ and ‘*suppositio*’ in *De motu*

Here, in relation to the operational abstractions, it is high time that we counted all the instances of the phrase ‘mathematical hypothesis’ within the purview of *DM*. Including two instances in §§28 and 67 above in the last section, the term ‘hypothesis’ appears six times in *DM* (emphasis/clarification added):

§17. As for attraction, it is clear that this was employed by Newton, not as a real and physical quality, but only as a *mathematical hypothesis*.⁴³

§40. Whatever is *framed* [*fringitur*, imagined or defined, step 3.1] beyond these should be *judged* [step 3.2] to be of the same sort as other *mathematical hypotheses and abstractions*.⁴⁴

⁴⁰ For her more expanded discussion on *DM*, see Brykman 1984 (PhD thesis), 434–444 (esp. 443), nn. 88–124.

⁴¹ Michel Blay (2010, 90) holds a similar view that the nature of mathematical hypotheses is entirely fictive (‘toute fictive’) on the side of efficiency, not on the side being either true or false. However, I disagree with this reading, even though hypotheses have no truth-values as causal terms. This is because propositions formulated from hypotheses in mathematical deduction are on the side of truth, because the hypotheses *used* for abstraction are not independent of the propositions or arguments for utility. See *DM* §7 below.

⁴² On the quotation of *DM* §7 in full, see §0.1.1. In my interpretation, unlike the majority of people who error, mechanistic ‘philosophers’ can express the value of abstract causal terms, such as ‘force’ and ‘impetus’, in their argument or mathematical, deductive reasoning to deduce the utility of law-propositions that have values or truth-values. These values or meanings are nothing fictitious or empty, for they do not lead philosophers into error in the correct use of language, i.e. mathematical rules of abstraction.

⁴³ Berkeley must be concerned with Newton’s specific comment on Definition 8 of the *Principia* (1962, 5): ‘I here design only to give a mathematical notion of those forces, without considering their physical causes and seats [...] considering those forces [such as attractions and impulses] not physically, but mathematically.’ Here one can read that unlike physics, mechanics proper is a mathematical science for Newton, and also for Berkeley insofar as following Newton’s above comment. See also Jesseph 1992, 80; Peterschmitt, *forthcoming*.

⁴⁴ Luce 1951, Jesseph 1992, and Belfrage, *forthcoming* translate the phrase *hypothesibus & abstractionibus mathematicis* as ‘hypotheses and mathematical abstractions’, whereas I read that the adjective ‘mathematical’ modifies both ‘hypotheses and abstractions’ (in line with Wright and Clarke). In the latter sense, as with the term ‘hypotheses’, I read that abstractions are also causal *terms*, not *propositions*, because only after abstracting linguistic and mathematical entities in our

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this should be impressed deeply in the mind [*anima*].

§61. Just as a curve can be considered as consisting of an infinity of right lines [step 3.1], even if actually [*revera*] it does not consist of them but because this *hypothesis is useful* [*utilis*] in geometry [*ad geometriam*, step 3.3], in the same way a circular motion can be regarded as resulting from an infinity of rectilinear directions [step 3.1], because that *supposition* [*suppositio*]⁴⁵ is useful [*utilis*] in mechanical philosophy [*in philosophia mechanica*, step 3.3].

§66. From what has been said it is clear that in perceiving [*perspiciendam*] the real [*veram*] nature of motion, it will be exceedingly useful [*summopere juvaturum*], 1° to distinguish between mathematical hypotheses and the nature of things [element 1 ‘sensation’]; 2° to beware of *abstractions* [element 2 ‘experimentation’]; 3° to consider motion as something sensible, or at least *imaginable* [*imaginabile*],⁴⁶ and to be content with relative measures [element 3 ‘reasoning’].

As the above quotes stand similarly, the term ‘hypothesis’ of Greek origin (*ὑπό* or ‘under’; *θεσις* or ‘positing’) primarily relates to geometry, thus mathematics,⁴⁷ which enables deductive abstraction or framing (step 3.1).⁴⁸ In the broad framework of Berkeley’s pragmatist discourse, this mathematical

mental activity (reasoning) can we formulate law-propositions about mechanics. In other words, both hypotheses and abstractions (e.g. ‘forces’) are pre-propositional in the linguistic, pragmatic process of making ‘statements [*enunciations*]’ truth-apt (*DM* §§38–39). On the term ‘abstraction’, which Berkeley does not discard in the mathematical method and inference in contrast with the essence of things in the metaphysical domain, see *DM* §8 (‘As long as they indulge so far in abstractions, it is necessary that even the greatest men pursue terms [*voces*] endowed with no signification and which are mere shadows of scholastic things’, though Berkeley does not discard the term and mental power of ‘abstraction’ in mechanics), 11, 16, 17, 39, 40, 47 (‘too much abstraction or division of things’), 66; *Siris* §§234, 323, 354, etc. On some sweeping account of abstraction and as many as four types of abstract ideas (and notions) in Berkeley, see Pappas 2000, 40–49.

⁴⁵ Clarke (2008) translates *suppositio* as ‘assumption’, and Wright (1843) regards both *hypothesis* and *suppositio* as ‘hypothesis’ in the same sentence. I do not think that their interpretations are mistaken. Referring to the allegedly most celebrated instance of ‘hypothesis’ in the heliocentric theory of Copernicus, Gerd Buchdahl defines as follows (1969, 288, emphasis added):

The expression ‘mathematical hypothesis’ had long been used to denote those scientific assumptions which (for one reason or another) were believed to *lack physical significance or reference to any physical reality*, whilst at the same time being capable of ‘accounting for’ observable phenomena. The view [...] regards theories as purely formal or abstract instruments for prediction, i.e. deduction of testable propositions

Although this definition is largely supportive, I supplement Buchdahl’s rejection of ‘physical reference’ for hypotheses, in the sense that they are rather linguistically treated as suppositions that determine the range of reference within the premisses and conclusion in hypothetico-deductive inference.

⁴⁶ On Berkeley’s earlier distinction between the ideas of sense and those of imagination, see *Principles* §30 (clarification added): ‘The ideas of sense [excited by the Author of Nature] are more strong, lively, and distinct than those of the imagination [of human wills].’ See also *Principles* §§33, 75; *Dialogues* 1.194, 204 (‘suggested to the imagination by the colour and figure, which are properly perceived by that sense’), 2.215, 3.235, 247, 255; *Notebooks* §657a (‘properly speaking, Idea is the picture of the Imagination’s making’), etc. I take it that the latter ideas by imagining or framing in the mind (step 3.1) are mathematically abstract knowledge in geometrical reasoning in the context of *DM*.

⁴⁷ More precisely, geometry is a mixed or applied mathematics in Berkeley’s earlier definition (*Notebooks* §770): ‘Qu: whether Geometry may not be properly reckon’d, among the Mixt Mathematics. Arithmetic and Algebra being the only abstracted pure i.e. entirely Nominal. Geometry being an application of these to Points.’

⁴⁸ I read that the case for abstraction in *DM* does not contradict Berkeley’s previous offensive against abstract ‘ideas’, in e.g. *Principles* Intro 6: ‘the opinion that the mind has a power of framing *abstract ideas* or notions of things’. This is because for Berkeley, abstraction cannot be denied in the process of mathematical reasoning or ‘imagination’ (§40)

abstraction of hypotheses defined as causal terms in geometrical reasoning is feasible due to the three elements of the senses, experiments, and reason (*DM* §66). In other words, all the three elements enable us to distinguish mathematical abstractions of causal terms in operational mechanics from metaphysical abstractions of entities in nature.

Specifically, I argue that the term ‘supposition’ (*suppositio* in Latin) is the most important to understand what mathematical ‘hypothesis’ is like. Indeed, as §61 above shows, there may be a difference regarding to which domain these terms contribute: geometry and mechanics. Nonetheless, one can read that if ‘hypothesis’ is proper to geometry or mathematics, then ‘supposition’ is also proper to mechanics or the mathematical science dealing with ‘hypothesis’.⁴⁹ This is because, due to the etymology of *hypo/sub* or ‘under’ and *stasis/positio* or ‘positing’, these Greek and Latin terms are actually equivalent as given the rôle in deductive arguments, for they both occur in those mathematical law-propositions.⁵⁰ Moreover, both terms are identical with each other as long as they are ‘useful’ in the discourse by mathematical abstraction based on geometry or mechanics.

In this context, at first, one may assume the influence of Newton’s use of the term ‘supposition’.⁵¹ Nonetheless, if it is exactly the same as ‘hypothesis’, then Newton must have likewise treated the term as *suppositiones non fingo* (‘I feign or frame no suppositions’).⁵² On the contrary, for

in the mind, whereas abstract *ideas* detached from the mind’s perception can be. This concerns the distinction between abstract *terms* and *ideas* (*notions*) in Berkeley. Linguistically, mechanistic philosophers do not reject the former terms, considering their useful values in ‘argument’ to deduce universal law-propositions and notions in the deliberative practice of mathematical reasoning. Whereas, epistemically, they do reject the abstract notions (*ideas*) if they represent ‘the natures of things, which are only singular and exist in concrete’ (*DM* §7, see the earlier footnote for the full quotation). Distinguished from the linguistic concern, Berkeley’s epistemic stance in *DM* is consistent with his anti-abstractionism in the earlier works. See Pappas 2000; Rickless 2012, Peterschmitt, [forthcoming](#), etc. On this distinction, I side with Kenny Pearce (2020, his clarification): ‘Berkeley believes that his opponents “would upon looking narrowly into their own Thoughts, find they wanted [i.e., lacked] it [the faculty of abstraction] as much as [Berkeley]” (*MI* §11). Berkeley’s main aim, therefore, is to direct his readers’ introspection in the right direction. To this end, he carefully distinguishes *abstraction properly so-called* (emphasis added) from the kind of “compounding and dividing” of ideas that he admits to be possible (*Principles* Intro §10) and he warns the reader not to confuse ideas with words (*Principles* Intro §§22–24).’

⁴⁹ For the uses of *ὑπόθεσις/suppositio* from Aristotle’s *Posterior Analytics*, see Wallace 1981, 74 (as much as 12 types of ‘supposition’); also [Appendix 2](#).

⁵⁰ Since the Middle Ages towards Berkeley’s age, ‘supposition is the property of terms (occurring in propositions) of standing for [i.e. suppositing for] things, so that these things can be talked [or deliberated] about by means of propositions’ (Dutilh Novaes 2011, 1230, clarification added). Dutilh Novaes argues against a conventional connection between medieval theories of supposition and the contemporary (Fregean) theory of reference, for there is ‘no exact modern counterpart – one must attempt to understand them in their own terms’ (2011, 1230), instead suggesting the medieval theories as ‘formal theories of semantic analysis – of algorithmic hermeneutics’ primarily in Ockham’s case (2007, 52). However, this dispute is arguable because there should be a rôle of reference in theories of supposition. As Elizabeth Ashworth puts it, supposition theory ‘tells us whether terms are properly distributed and whether they have the same range of reference in both premisses and conclusion’ (1974, 78). Crucially, supposition is distinguished from medieval theories of significance (or Fregean ‘sense’), another property of terms, which is the first step of a semantic relation between things and terms assigned to them on a pre-propositional level (P. King 1985, 35; Dutilh Novaes 2007, 18). On my view, supposition, albeit also pre-propositional itself, works as reference or denotation in the second step of a semantic relation between things and assigned terms that have already meanings, thereby terminologically contributing to a propositional level.

⁵¹ For example, on my reading, Newton’s use of ‘supposition’ does not imply a property of terms, but it is limited to a propositional assumption or premiss in mathematical deduction, which must be quite similar to his use of ‘hypothesis’. See e.g. *Principia* (1962, 425): ‘the supposition that the earth is of a spherical figure’. I do not read Berkeley’s use in that way.

⁵² Newton’s (in)famous proposition, *hypotheses non fingo*, in Book 3, General Scholium of the second and third editions

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Berkeley, the human mind does ‘frame’ (*fingerere*) or imagine, albeit not feigning with its connotation of falseness, mathematical hypotheses/suppositions in one’s deliberative, scientific discourse (*DM* §40). This is because a causal term ‘mathematical hypothesis’, such as ‘motion’,⁵³ is taken to refer to ‘something sensible, or at least imaginable’ (§66) or framable when referring to occult qualities. To be clear, Berkeley is not a straightforward realist here; for him, mathematical abstraction in the geometrical reasoning solely treats what are imaginable or framable, not necessarily sensible or manifest. He is rather an anti-realistic pragmatist about mechanical causation in framing or abstracting mathematical hypotheses that refer to non-sensible qualities. In this mathematically abstract sense, we humans, in the spirit of mechanic philosophers, can formulate causal laws of motion in a correct reasoning that we geometrically frame hypotheses (in the three steps). Therefore, for the pragmatist Berkeley in *DM*, the terms ‘hypotheses’ or ‘suppositions’ can be a necessary condition to formulate mechanical theories or propositions (and calculations), whereby one confirms true causal laws of motion at work in the deliberative practice (*DM* §1: ‘mode of speaking’ or ‘linguistic use’).

Accordingly, I argue that causal terms in *DM*, excluding metaphysical ones, are meant to be hypotheses or suppositions in the human mind’s deliberative practice. On one hand, they might be taken to be assumptions, something granted for the sake of argument. On the other hand, albeit implying the rôle of assumption, hypotheses/suppositions are not judged to be true or false on the level of causal *terms*. This should answer why they are necessary components of true (or false) propositions that express mechanical causation. This is because, on my reading, Berkeley’s use of the term ‘supposition’ (i.e. hypothesis) reveals a non-Newtonian, rather medieval,⁵⁴ understanding

of the *Principia* (2nd ed, 1713; 3rd, 1726; 1962, 547) seems not his own conception, though it is infamous as he did formulate or frame hypotheses in his *Principia* and other works. Regarding nine ‘Hypotheses’ in the first edition (1687), the last six of them turned out Phaenomena and two were renamed Regulae philosophandi in later editions, but one survived contradictorily. I uphold a possibility Toni Carey suggests that Newton’s said proposition originated with Henry Oldenburg, the first Secretary (executive director) of the Royal Society, who commended members in 1667 for ‘neither feigning nor formulating hypotheses of nature’s actions, seek[ing] out the thing itself’ (Oldenburg 1965–86, vol. 3, 415; Carey 2012, 20–23). Although this text of Oldenburg is originally in Latin, I take it that Newton understood as the above English translation. I also agree with Carey that, whilst avoiding vituperative controversies over hypotheses (of light, especially with Robert Hooke), the greatest reason for asserting *hypotheses non fingo* can be to avert the reader’s attention from Newton’s own commitment to alchemical hypotheses, his real enthusiasm. See also Newton’s letter to Oldenburg (2 June 1672): ‘the best and safest method of philosophizing seems to be, first diligently to investigate the properties of things and establish them by *experiment*, and then seek *hypotheses* to explain them. For *hypotheses ought to be fitted merely to explain the properties of things and not attempt to determine them*’ (Newton 1962, 673, emphasis added). This indicates in Newton that hypotheses themselves do not determine truth, since they are not sentences or propositions that do have truth-values. Therefore, hypotheses are pre-propositional terms, whereas I take them to be determinate suppositions as components of true propositions in the context of Berkeley’s *DM*.

⁵³ The term ‘motion’ can be an ordinary empirical hypothesis that refers to sensible things, depending on the context. See R. Schwartz 2020. But I construe here that it is mathematical, in relation to e.g. ‘gravity’, which one abstractly frames in geometrical and dynamical ‘theorems of mechanical philosophy’ and ‘human calculation’ (*DM* §66). See the earlier footnote on the empirical-mathematical distinction of ‘hypotheses’.

⁵⁴ I hold a view that Berkeley is not a distinctive early modern philosopher of his age, but a philosopher standing on pluralistically scholastic and medieval traditions rooted in Platonism, Aristotelianism, and Stoicism (or Stoic Ramism). For example, on the Ramist curriculum that had been dominant since the early seventeenth century at Trinity College, Dublin, see Boran 2001, 198–199; Daniel 2001, 502–505. On a valid connection between the Ramist natural dialectic and Berkeley’s linguistic method regarding the judgemental (axiomatic) truth of a proposition, though I disagree with Steve Daniel’s disregard for the use of abstraction in Berkeley, see *ibid.*, 498–501. For the textbooks that Berkeley actually learned at Trinity College, Dublin, such as those of Burgersdijk, Le Clerc, and Smiglecki containing Zabarella’s

of it in formulating true propositions at work for the human mind to deliberate.

Although most Berkeley scholars might doubt my connecting between the medieval supposition theory and Berkeley's use of the term 'supposition'/'hypothesis' in *DM*, I will show due reason as follows. Whilst that Latin term (noun) *suppositio* appears three times in the whole *DM*,⁵⁵ I consider that §61 above greatly lends itself to Berkeley's pragmatist theory of causation; it reads here again (emphasis added):

§61. Just as a curve [*curva*] can be considered as consisting of an infinity of right lines, even if actually it does not consist of them but because this *hypothesis is useful in geometry*, in the same way a circular motion [*motus circularis*] can be regarded as resulting from an infinity of rectilinear directions, because that *supposition is useful in mechanical philosophy*.

This section is telling regarding the utility of suppositions, or causal terms, in the geometrical reasoning (involving abstraction)⁵⁶ in mechanics. *Prima facie*, in the above context, the 'supposition' does not remind us of the medieval technical use of supposition. It sounds more of a contemporary meaning of assumption, or something granted for the sake of argument. In response to this objection, it is worth further considering what are specifically called causal *terms* in the name of 'supposition' or 'hypothesis'.

In the case of geometry, the useful hypothesis is the subject 'curve' in the proposition 'a curve [...] consist[s] of an infinity of right lines, even if actually it does not consist of them'. In the case of mechanics, that is the subject 'circular motion' in the proposition 'a circular motion [...]

Aristotelian logic, see Jones 2021, chs. 2 and 3; Sgarbi 2013, 51, 68; McDowell and Webb 1947, 13–19; 1982, 32, 45–48; Appendix 2. Here, one can consider that the nature of Berkeley's education at the college was to favour the reasoning of abstraction reinforced by an anti-Ramist, Zabarellian Aristotelian-scholasticism, over the abstraction in the sense of representing or epistemically singling universal abstract ideas of Descartes, Malebranche, Locke, et al., that Berkeley critically learnt. The logic course at Trinity College, however, had been loathed to the extent to which a logic textbook of Burgersdijk (Burgersdicius) was 'burnt according to annual custom at Molesworth's Fields near the Gallows' (the place for execution in Dublin). See the Dublin Evening Post, 6th November, 1733, cited in Maxwell 1946, 138–139, 149, n. 23; J. W. Browne 1979, 116–117.

⁵⁵ There are two other instances of the noun 'suppositio' in *DM* (clarification added):

§15. [E]veryone sees that this opinion [about proportion that forces are as the squares of the velocities] supposes [*supponere*] the force of a body [*vim corporis*] to be distinguished from momentum, motion, and impetus, and it collapses when this supposition [*suppositione*] is removed.

§55. ('We may sometimes be deceived by the fact that when in imagination [*imaginatione*] we remove all other bodies, we still suppose [*supponimus*] our own body [*nostrum*] to remain. On this supposition [*suppositio*] we imagine [*imaginamur*] the freest motion of our limbs on every side.

The 'suppositions' in the two sections are the subjects 'bodily force' (§15) and 'our own body' (§55), which I take to be primarily *mathematical hypotheses* in our imagination. They are not merely ordinary empirical hypotheses, for they concern mass that are geometrically *sine qua non* for framing the other hypotheses of force, attraction, motion, etc. into law-propositions. For instance, the 'mass' can be a mathematical hypothesis in the proposition 'the square of the velocity [is] multiplied by the mass [*moles*]' (§16).

⁵⁶ One may disagree with my interpretation of three elements (§3.1) because, for Berkeley, abstraction is involved in a process of perception. Therefore, abstract ideas will not be metaphysical ideas in a specific sense. Otherwise, mathematics would be a part of metaphysics. To this objection, I respond that the abstraction as mathematical imagination or linguistic framing (step 3.1) is the first part of 'geometrical reasoning', which is different to but following the other two elements of 'sensation' and 'experimentation'. That is, Berkeley's mathematical thinking in *DM* is distinct from his epistemology from sense perception.

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result[s] from an infinity of rectilinear directions' (§61). That is, these terms/phrases 'curve' and 'circular motion' are suppositions, or properties of causal terms, which are necessarily abstracted for formulating law-propositions in mathematical reasoning and calculation. As mathematical hypotheses, such suppositions are rationally believed to be useful—for calculating forces and trajectories in mechanical philosophy. This is because, in my reconstruction of the three elements and three steps, framing or suppositing for mathematical hypotheses enables us to confirm inference to approximately true sentences about unobservable effects from observable ones,⁵⁷ such as 'an infinity of right lines' and 'an infinity of rectilinear directions'. This is linguistically and thus mathematically practised in the correct assigning of abstract terms in law-propositions.

3.2.3 Medieval perspectives on the terms 'hypothesis'/'supposition'

Here, though scratchily, I propose that the term 'hypothesis' is necessarily suppositing for in law-propositions, by taking into account Berkeley's medieval (scholastic) to early modern logical understanding of 'supposition'. A default 'supposition' of a term, which I think is appropriate to Berkeley's use, is called *determinate* supposition.⁵⁸ Within the use in *DM*, I take Berkeley's term 'supposition' (e.g. the subject 'motion' in *DM* §61) to be determinate in the medieval logic.

As a mode in common supposition, 'determinate supposition' is to supposit for a whole bunch of entities, unlike 'discrete supposition' that supposits for a certain entity that exists, such as the subject 'George' in the sentence 'George drinks a gallon of tar water' (Priest 2016, 69; Read 2019). This is because mathematical hypotheses can be treated as determinate suppositions, such as 'circular motion', 'curve', and 'force', when they do not supposit for many, but for one and every suppositum of which they can be *truly* or *falsely* predicated in propositions.⁵⁹ I read that in *DM*, hypotheses/suppositions supposit for no particular suppositum, because that would amount to discrete supposition. Rather, for example, the supposition 'our own body' (*DM* §55) does not denote any discrete or specific body of ourselves, but a universal condition that we have a body as humans who can imagine (i.e. all its *supposita*). By contrast, the hypotheses that Berkeley means are not restricted to any particular existent entities, for causal terms 'hypotheses' supposit for universal entities or phenomena by mathematical abstraction. This supposition is not confused but determinate for the human mind who empirically perceives (i.e. elements of sensation and experimentation), but then rationally deliberates on mechanical phenomena in geometrical reasoning (the third element in the broad framework of three elements).

Moreover, the truth of mechanical causation is inferred from a general proposition to a far remote particular conclusion (*DM* §38, see the last section). According to medieval standard rules, 'if a sentence was unquantified, or if it was a particular affirmative sentence, then both subject and

⁵⁷ The next Chapter 4 will argue this inference as Berkeley's Inference to the Best Explanation (BIBE).

⁵⁸ On tabulated distinctions of medieval theories of supposition, such as determinate or confused supposition, particularly in the cases of Buridan and Ockham, albeit not comprehensive, see Priest 2016, 69–73. See also Read 2019; Ashworth 1974, 77–100, 207–213; Nuchelmans 1983, 225–226; Dutilh Novaes 2007, 48.

⁵⁹ 'The sense in which [a term with determinate supposition] is true of one, rather than many, is that the proposition is true if true of one' (Read 2019, clarification added).

predicate were said to have determinate supposition' (Ashworth 1974, 209–210). In other words, technically, propositions including mathematical hypotheses, or causal terms with determinate supposition, are not the conclusions of a valid ascent (i.e. inference of a quantified proposition from a set of singular propositions), but those of a valid descent (i.e. inference of a set of singular propositions from a quantified proposition).⁶⁰

In this way of valid descending, the deductive reasoning is deployed by the mathematical method of abstraction in *DM*. To this end, mathematical hypotheses/suppositions as causal terms are meant to be determinate in the use of mathematical mechanists or human minds, so that they can deliberate on and express true propositions of motion—laws of nature. This is because causal terms (mathematical hypotheses/suppositions) and abstractions for law-propositions are never meant to be fictitious, but they play the rôle of determinate components in mechanical theories that are true within the use of reasoning. That is, we humans can pragmatically frame (finger) those causal terms, so that we can theorise determinately true propositions for our deliberative needs to the extent of geometrical deductive reasoning. Hence, I uphold that this final point of determinate supposition is applicable to the entirety of mathematical hypotheses in *DM*, such as dynamical 'force' and 'action'.

To summarise this section, I have narrowed down to the identity of causal terms in the operationally mechanical domain in *DM*, namely, mathematical hypotheses or suppositions. Firstly, I explained that those causal terms are dependent on mathematical 'abstractions' for deducing general and less general law-propositions. Secondly, I newly argued that the medieval, somewhat scholastic, implication of determinate supposition best fits and augments his pragmatist theory of mechanical causation. By using the causal terms 'hypotheses', i.e. determinate components of true theories, we humans can analytically deduce and mathematically abstract law-propositions and knowledge to particular conclusions (*DM* §§38–39). This leads to our pragmatist understanding of causation in Berkeley's discourse or discursive thinking by the mathematical or deductive method in our correct use of language. There, his pragmatist discourse is not devoid of objection from his contemporary philosophers. Providing a possible objection that causation is framed in metaphysical-mechanical continuity, the next section will draw a contrast between metaphysical and mechanical causation in Berkeley's argument. By his argument as such, it transpires that his discursive thinking of causation is not metaphysical but pragmatically mechanical.

3.3 Berkeley's pragmatist discourse

This is the final section in which I will contrast Berkeley's discursive thinking with metaphysical thinking of his opponents (Leibniz, Borelli, and the Cambridge Platonists) in framing mathematical

⁶⁰ On the (medieval) theory of ascent and descent (inferential relations), see Ashworth 1974, 213; Read 2019. See also a medieval source, such as Ockham's *Summa logicae*: 'Determinate supposition occurs when one can descend to singular [propositions] by some disjunctive proposition, such that this is a valid inference: "a man is running, therefore this man is running, or that man etc". The name "determinate supposition" is employed because by such supposition, it is asserted that the proposition is true for some singular [proposition]' (Ockham 1998, 200; Dutilh Novaes 2007, 50).

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hypotheses for mechanical causation. In this contrast, I argue that Berkeley does not mix up two types of causation—metaphysical and mechanical. This I will reformulate as an argument for his pragmatist discourse on theorising mechanical causation. The argument implies that his discursive thinking of causation is not metaphysical but pragmatically mechanical, as one of the premisses criticises the views of contemporary metaphysicians (*DM* §20). To this effect, I will posit an objection from the opponent metaphysicians and Berkeley's response to it. Thus, one can see how and why mathematical hypotheses as causal terms are necessarily integral to his pragmatist theory of causation in *DM*.

3.3.1 Berkeley's argument for pragmatic mechanical causation

To start with, I will reconstruct a specific argument for Berkeley's pragmatist discourse in *DM*, which prioritises what is linguistically defined, deliberately confirmed, and thus pragmatically expressed (*dixisse*) over what is purely thought about (*cogitasse*). This discursive thinking (*dixisse*) is the correct⁶¹ mode of speaking (*loquendi consuetudine*) of mechanical causal terms, namely, mathematical hypotheses, in his geometrical reasoning as I have argued. Moreover, on my reading, what are being expressed or discoursed (*dixisse*) are contrasted with what are being purely thought about (*cogitasse*), which are the views of his opponents put in jeopardy by Berkeley.⁶² As will be clear, I reformulate this *dixisse-cogitasse* contrast in the following argument, chiefly from *DM*:

§20. All those who in explaining the cause and origin of motion make use of the Hylarchic principle, or the need of nature, or its appetite, or lastly of a natural instinct, are to be judged [*censendi*] as having said something [*dixisse*] rather than to have thought anything [*cogitasse*]. [...] For indeed all of these either say nothing particular and determinate, or if it were something [*si quid sit*], it would be as difficult to explain as that very thing which it was adduced to explain [*explicandi causâ adducitur*].

From this passage and *DM* §53,⁶³ I regiment Berkeley's argument for pragmatic mechanical causa-

⁶¹ By the adjective 'correct', I make it imply that statements are accurate, proper, and free from error for a finite mind in accordance with facts or truths.

⁶² His preceding opponents will be obvious *anon*. However, I must here note that *DM* §20 excludes the greatest target that Berkeley criticised, even though admiring: namely, Newton's metaphysics of absolute motion, time, place, and space. These absolute notions are purely imperceptible unlike what are relative for Berkeley. See *DM* §§52–65; Newton, *Principia* 1:6–7; Jesseph 1992, 19–24; Chapter 1 for Berkeley's and Toland's *pro hominem* discourse for Newton. The point is Berkeley's rejection of absolute conceptions by the Newtonians and contemporary mathematicians. Gary Thrane summarises that Berkeley opposes the Newtonian absolute space because it is '(1) imperceptible, (2) unimaginable, (3) incoherent, and (4) useless' (1982, 130). The last 'uselessness' should be underscored in contrast to Berkeley's pragmatist discourse or discursive thinking.

⁶³ *DM* §53 (emphasis added):

[Extension] escapes *pure intellect* [*intellectum purum*], since that faculty is concerned only with spiritual and unextended things, such as our minds, their states, passions, powers, and such like. Therefore let us take away merely the words from absolute space, and nothing will remain in sense, imagination, or intellect; therefore they designate *nothing, except pure privation or negation, that is, mere nothing* [*merum nihil*].

See also my regimentation of Berkeley's argument for relative motion in §1.3.2.

tion, thus:

1. Mechanical causation⁶⁴ expresses the cause and origin of motion, which are mathematical hypotheses. [§20]
 2. Whatever expresses mathematical hypotheses is discursively thought by deliberation (*dixisse*), not purely thought (*cogitâsse*). [§§20, 53]
- ||– Mechanical causation is discursively thought, not purely thought.

In this valid argument, if the ‘cause’ and ‘origin’ as causal terms are explained mechanically,⁶⁵ then one’s practice of ‘speaking [*dixisse*]’ about them is favoured over ‘thinking [*cogitâsse*]’ about them. In other words, in his pragmatist theory of causation, what are expressed are more useful or deployable for us than what are merely thought or understood. I consider that the latter thinking is a metaphysically pure reasoning, not pragmatically mechanical, in the sense that metaphysical abstraction of spiritual entities is independent of Berkeley’s pragmatist discourse in the three steps. Metaphysical entities in nature, such as abstract spiritual substances, denote ‘nothing particular and determinate’ in the senses and experience, or they are ‘difficult to explain’ as the abstractions are obscure to be ‘adduced’ or referred to (*DM* §20). That is, those entities are not to be clearly demonstrated in geometrical reasoning with mathematical hypotheses (i.e. mechanical causal terms). Therefore, sentences involving the terms referring to metaphysical entities are judged to be false as mechanical causation, whence they are purely unintelligible or inexpressible for utility. Here, the agent’s mechanical practice is deliberative or confirmative, for the causes of motion as mathematical hypotheses, such as dynamical ‘forces’, are deemed to be epistemically ‘judged [*censendi*]’ (*DM* §20) about truth-values of law-propositions in which they occur. This implies that the agent’s correct ‘mode of speaking’ (*DM* §1) of mathematical hypotheses is aligned with their deliberative practice, by detaching itself from any metaphysical, abstract or pure thinking. Thus, I argue that this implication relates to Berkeley’s pragmatist discourse on mechanical causation, entailing P2, the premiss of deliberative practise (part of the three steps).

3.3.2 Metaphysicians’ objection

In fact, the above argument is contextualised in the setting where Berkeley criticises metaphysical theories of his day, such as the ‘Hylarchic principle’ of Henry More and a similar view of Ralph Cudworth (*DM* §20). They are the Cambridge Platonists, whose abstract metaphysics about realist causation—the hylarchic and plastic principles of created nature, also called ‘the need of nature’,

⁶⁴ By ‘mechanical explanation’ I am concentrating on Berkeley’s pragmatist discourse to *express* the laws of motion in *DM*. For his generic and immaterialist criticisms of the mechanical explanation of his precursors (Descartes, Locke, and Newton) in relation to the primary-secondary-tertiary qualities, corpuscularianism, divine causal intervention, etc., see e.g. Maull 1982, 99–100; Atherton 1991, 47; Pearce and Oda 2020b.

⁶⁵ Mechanical explanation, on my rendering, comprises a set of law-propositions with theorems about particular effects (phenomena). See *DM* §36: ‘These laws of motion are conveniently [*conmmodè*] called principles, since from them derive both general mechanical theorems and particular explanations [*explicationes*] of the phenomena [τῶν φαινομένων].’ The explanation is paraphrased with ‘solution’ (*solutio*) in *DM* §35. See also Jesseph 2018.

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‘natural appetite’, and ‘natural instinct’—were unintelligible and thus repugnant to Berkeley's pragmatist theory of causation.⁶⁶ In this context, dealing with mechanical causation, the Cambridge Platonists as well as Borelli and Leibniz (those metaphysical philosophers mentioned in *DM* §20) are Berkeley's opponents. Expected as it may be, they would undermine P2 in the above argument. For these opponents, whilst all taking mathematical methods, it is necessary to first understand the metaphysical, spiritual foundations to explain and adduce mechanical phenomena. For example, even though metaphysically similar to Berkeley's efficient-final causation as discussed in the last chapter, Leibniz's metaphysics inseparable from mechanics, such as dynamical forces,⁶⁷ is a great representative of the views opposing Berkeley. Likewise, a metaphysical theory of Giovanni Alfonso Borelli (1608–1679) is set against Berkeley. Their metaphysical theories are represented in the above concerned section, respectively:

§20. ‘[T]he parts of earth are self-moving, and there are even spirits implanted in them corresponding to forms’ in order to assign a cause for the acceleration of falling heavy bodies; or he who said that ‘in body beyond solid extension there is need to posit something else from which the consideration of forces might arise’.⁶⁸

The first quotation is from Borelli (Prop. 87 of *De vi percussiois*, 1667, 180–181), and the second is from Leibniz (‘Specimen dynamicum’, *GM* 6:241; 1989, 124). In line with the Cambridge Platonists, Borelli and Leibniz would also object to P2 of Berkeley's pragmatist argument above, because the premiss may be falsified by metaphysical causal terms that supposit for *pure thought*.⁶⁹

According to their metaphysical theories, the following modified premiss is true:

2* Whatever expresses mathematical hypotheses is purely thought metaphysically, and thus mechanically.

This P2* implies metaphysical continuity of entities from the realist and teleological foundations to mechanical phenomena, such as the above ‘self-moving’ causes, ‘spirits’, ‘body beyond solid

⁶⁶ Berkeley's criticism of the mathematicians' abstract metaphysics closely resembles that of John Toland, which he read at the beginning of the eighteenth century. For more, see [Chapter 1](#). Toland's influence on Berkeley, such as his critique in *Letters to Serena*, was pointed out by Stuart Brown (2008, 233). More's ‘Hylarchic Principle’ or ‘Spirit of Nature’ and Cudworth's ‘Plastic Nature’, albeit slightly different in view of substantial extension, are metaphysical hypotheses about final causation that sustains the relation intermediating between God and the natural or mundane world. Berkeley possibly adopted this reference from Leibniz's criticism that More's doctrine was ‘archaeus’ (too ancient or too unintelligible), albeit sympathetic to his contemporary (Christian-Kabbalistic) neo-Platonists. See Hutton 2015, 149; Jesseph 1992, 81–82; Leibniz 1969, 441 (‘Specimen dynamicum’, 1695), also 288, 499, 587. Furthermore, despite his positive reception of Francis Bacon's pragmatic method, Berkeley might have criticised his account of corporeal *spiritus* (pneumatic matter) at the beginning of *DM* §42 in relation to §20. See Bacon, *Novum organum* II 40 (2004); Breidert 1969, 227; Rusu 2018, 445, n. 2.

⁶⁷ There are two steps of metaphysical-mechanical (dynamical) causation in Leibniz, according to Anne-Lise Rey (2009, 52–54; 2016, 40–41; correspondence, 2020). That is, from the first relation between primitive active force and derivative one, to the second relation between the formal action of substance and its phenomenon, through the modifications of schema.

⁶⁸ This passage is an omitted part in the *DM* §20 quotation at the beginning of §3.3.1.

⁶⁹ Those opponents may well undermine P1 also. This can be understood as a *reductio* argument, where they stipulate \neg P1: ‘mechanical explanation cannot express the cause and origin of motion that are *necessarily* mathematical hypotheses.’ For we may have mechanical explanation out of the metaphysical necessity without deploying mathematical hypotheses. Therefore, trivially \perp (*ex contradictione quodlibet*: any proposition follows from the contradiction).

extension’, and ‘something else from which [...] forces might arise’. These spiritual reasons or abstract causes are the prerequisite for mechanical explanation for these metaphysical philosophers. In particular, for Leibniz, this metaphysical thinking presupposes the metaphysical-mechanical continuity of causation from the perspective of pure intellect.⁷⁰

Because ‘body does not have true unity’ and ‘its unity arises from our perception’, body is ‘a *being of reason*, or, rather, of *imagination*, a *phenomenon*’ (GP 6:625; 1989, 263, emphasis original).⁷¹ Therefore, there must be a foundational continuity from the reason, or pure intellect, to the senses and imagination. This imagination through the senses is not to be confused with the imagination or mathematical abstraction that the Berkeley of *DM* upholds.⁷² Instead, according to Leibniz, the mathematical reasoning in mechanics is rendered ‘intelligible and distinct’ through the senses *and* the rational understanding of the pure intellect (GP 6:502; 1989, 188).⁷³ In other words, Leibniz holds a realist view that mechanical phenomena are to be understood through the metaphysical thinking rooted in the pure reason. This I regard as the metaphysicians’ pure thinking or abstract understanding (*cogitâsse*), which I contrasted with Berkeley’s discursive thinking (*dixisse*) in the argument. As a whole, the metaphysicians like Leibniz justify the above P2* and revoke the validity and soundness of Berkeley’s pragmatist argument. For them, mathematical hypotheses must be abstractions in the pure thinking from spiritual metaphysics.

In response to their objection, the pragmatist Berkeley contends that assuming the realist metaphysical-mechanical continuity of causation is not necessary, since there should be a clear distinction between the metaphysical and mathematical (mechanical) abstractions.⁷⁴ He can validly and soundly deduce the conclusion in the above argument that frames mathematical hypotheses as causal terms in the deliberative practise, such that P2* is false and redundantly unintelligible. Then, sentences involving metaphysical abstractions, such as the hylarchic principle and spiritual extension, are false and thus quashed. In defence of his pragmatist discourse, Berkeley’s argument can be revised as follows:

⁷⁰ See also Pearce 2016, 7, 13; Favaretti Camposampiero 2010, 141–144; e.g. Leibniz’s ‘Letter to Queen Sophie Charlotte of Prussia’ (1702, GP 6:514): ‘S’il m’avoit fait l’honneur de s’informer de mes sentimens, il auroit trouvé que j’établis un rapport exact entre l’ame et le corps, et je crois que même les pensées les plus abstraites sont représentées par quelques traces dans le cerveau’. That is, ‘the most abstract thoughts’ in the brain are identified with the imagination of the (Cartesian) pure intellect on the human part. See also GP 3:466, 6:626. In passing, this correspondence is Leibniz’s argument against the anti-spiritualist or materialist (naturalist) position of John Toland (‘il’ in the French quote), who, like Leibniz, enjoyed the Hanover court of Sophie and Sophie Charlotte.

⁷¹ The quotation is from Leibniz’s draft ‘Entretien de Philarète et d’Ariste’ (1712/1715). See also Philarète (Leibniz’s stand-in): ‘action cannot originate from a modification of matter. Therefore, both motion and thought must come from something else’ (GP 6:625; 1989, 263).

⁷² I read that the imagination as ‘mathematical abstraction’ in Berkeley’s geometrical reasoning is distinct from sense perception, whence different elements. See *DM* §40. By contrast, for Leibniz, e.g. ‘there must be an internal sense in which the perceptions of these different external senses are found united. This is called *imagination*’ (GP 6:501; 1989, 187, emphasis original).

⁷³ This letter to Queen Sophie Charlotte (1702) is one of a few works in which Leibniz intended to criticise Toland’s Lockean view. Hence, I construe that Toland’s mechanical philosophy against ‘occult qualities’ (GP 6:499–500; 1989, 186–187) in Leibnizian metaphysics was formative of Berkeley’s pragmatist theory of mechanical causation in the Anglo-Irish context (Chapter 1).

⁷⁴ *DM* §§42, 72, *Notebooks* §855 (‘We must carefully distinguish betwixt two sorts of Causes Physical & Spirituall’), etc. See also the last Chapter 2.

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1. Mechanical causation expresses the causes or mathematical hypotheses, *not spiritual metaphysical causes*.
 2. Whatever expresses mathematical hypotheses is discursively thought, not purely *or spiritually* thought.
- ⊢ Mechanical causation is discursively thought, not purely thought.

Hence, deflating metaphysically realist causes that teleologically postulate the existence of abstract entities, Berkeley's pragmatist theory is rather tuned in his deliberative, discursive thinking of mechanical causation in the three steps. Thereby the agent can correctly 'assign [*assignment*]' the causes of motion (causal terms), such as 'acceleration of falling heavy bodies' (*DM* §20), in law-propositions as defined *and* confirmed. This is because his deliberative approach to causation does not require the understanding of a fundamental, metaphysical nature of reality in its pure thinking.

To conclude, through the contrast with the opponents' metaphysical views, one can better see that mathematical hypotheses are the integral component of law-propositions about mechanical causation. This approach is not metaphysical but pragmatic. For Berkeley, mathematical hypotheses in mechanical philosophy cannot be purely thought in the metaphysical abstraction, but discursively thought in his pragmatist key. That is why I maintain the three steps of geometrical reasoning in Berkeley's pragmatist discourse on mechanical causation. Refuting the approaches of the metaphysical philosophers like Borelli and Leibniz, Berkeley's mechanic philosopher can engage the discursive thinking in the correct mode of speaking (*dixisse* in three steps of geometrical reasoning).⁷⁵ This does not necessitate the pure thinking or understanding (*cogitâsse*) about the abstract nature of things. But rather, supposing his pragmatist discourse, mathematical hypotheses and their abstractions are correctly framed in pursuit of pragmatic truths to the extent of human knowledge.

Conclusion

As a result, I have argued that we, in the spirit of mechanistic geometer, can pragmatically infer or reason mechanical causation to be true in our correct framing of mathematical hypotheses as causal terms. That is Berkeley's 'mode of speaking' (*DM* §1) in 'mechanical practices' (§42). Firstly, I textually corroborated that we (3.1) linguistically theorise and (3.2) epistemically deliberate causal terms so as to (3.3) pragmatically express causal laws (propositions) for our linguistic needs and operational mechanics in the three steps of element 3, geometrical reasoning. This is regarded as a part of the three elements—sensation, experimentation, and reasoning—in the larger framework

⁷⁵ See *Principles* §108 (deleted part in the 1734 edition, emphasis added): 'to me, those men who frame general rules from the phenomena, and afterwards derive the phenomena from those rules, seem to be *grammarians*, and their art the *grammar of Nature*. Two ways there are of learning a language, either by rule or by practice: a man may be well read in the language of Nature, without understanding the grammar of it, or being able to say by what rule a thing is so or so. And, as it is very possible to write improperly, through too strict an observance of *general grammar rules*: so in arguing from general laws of Nature, it is not impossible we may stretch the analogy too far, and by that means run into mistakes.' For Berkeley, Newton's *Principia* is '[t]he best grammar of the kind we are speaking of [...] acknowleg'd to be a treatise of mechanics' (*Principles* §110, also deleted part).

of Berkeley's pragmatist discourse. Moreover, as distinguished from law-propositions, the use of mathematical hypotheses as causal terms is operationally pragmatist by means of mathematical abstraction. Secondly, I ventured to interpret from the perspective of medieval logic that the collective term 'hypothesis' is better understood as determinate supposition and this is of paramount importance in Berkeley's *DM*. Thirdly, I contrasted the argument for his pragmatist discourse with the objection from metaphysicians. Being distinguished from purely metaphysical abstractions, the argument shined a light on how mathematical hypotheses as causal terms are integrated into his discursive, geometrical thinking of law-propositions for utility.

Chapter 4

Berkeley's Pragmatist Argument against Three Readings

Introduction



OW we shall see a set of philosophical objections to my reformulation of Berkeley's *De motu* thus far.¹ In contrast to objections, the fourth chapter defends that he develops a pragmatist theory of mechanical causation in *DM*, in the scope of his eighteenth-century natural philosophy. In this short treatise, Berkeley clearly severs the task of the natural scientist (finding causal laws, e.g. of gravity and attraction, by ourselves) from that of the metaphysician (contemplating the causes of those ideas founded in God), such that the two tasks do not contradict each other (*DM* §§35–37). On my rendering, the two domains of mechanics, which is pragmatic, and metaphysics, which is theological, deal with different matters (*DM* §71). In the prior Chapters 1 to 3, historically and textually, I argued for the crucial distinction and relationship between two different—metaphysical and mechanical—notions of the term 'cause' in Berkeley. In this chapter, I will put aside theologically 'metaphysical' (efficient and final) causes, and elaborate more on pragmatically 'mechanical' causes in *DM*, which include causal and theoretical terms like 'force', 'gravity', 'attraction', or *mathematical hypothesis*.²

By pragmatism about mechanical causation, I will explain how Berkeley saw law-propositions formulated from the terms of mechanical causes as indispensably true, requiring analysis or definition from a deliberative viewpoint on human temporal needs or practices. There are epistemic limitations bounded in physics (e.g. *DM* §§41–42), within which human agents are not atemporal as finite minds when we deliberate on mechanical causation. Although the conformity of metaphysical causes with laws of nature cannot be absolutely comprehended with respect to divine

¹ I critically incorporate varied translations, e.g. Jessop 1952 (abridged) and Belfrage, [forthcoming](#), into my rendering of Berkeley's original text in Latin, *DM*. See [Abbreviations](#).

² Whilst this chapter keeps concerned with theoretical, causal terms or mathematical hypotheses in *DM*, Berkeley's later work *Siris* coherently identifies 'force' as a mathematical hypothesis: 'what is said of forces residing in bodies, whether attracting or repelling, is to be regarded only as a mathematical hypothesis, and not as anything really existing in nature' (*Siris* §234). See the full quotation in [§0.2.1](#).

will (in the metaphysical, theological domain), causation itself is pragmatically indispensable in scientific discourse or deliberation for Berkeley. Specifically, I integrate two key facets into Berkeley's pragmatist theory of causation in mechanics: (1) causal deliberation and (2) inference to the best explanation. Firstly, in his scientific discourse, mechanical causation is assumed to be what is at work, or in use, from the human perspective as a *deliberator* who confirms truth of the law-proposition. That is, causal laws are required to be true in our linguistically correct, discursive *deliberation*.³ Within the purview of Berkeley's discourse on natural philosophy, I argue for his pragmatist theory of causation. This is because we humans (finite agents) deliberate on, or infer, mechanical theories and theorems in causal terms towards actual explanation. In my reformulation, for the Berkeley of *DM*, the deliberation of causation is identified with step 2 of epistemic confirmation, which is a part of what he meant by 'geometrical reasoning'. This is what I explained in §3.1.3 that the mechanist had the reasoning for discursive thinking in three steps: linguistic definition, epistemic confirmation, and pragmatic expression. I will defend the second step in more depth.

Secondly, for the Berkeley of *DM*, our actual explanation or definition of mechanical causation can reliably make us believe the truth within scientific discourse. This is because, hypothetically, Inference to the Best Explanation is taken inductively (or abductively)⁴ from a limited (not infinite) set of evidence to the *approximate* truth. This induction is principally pragmatic to understand the truth of scientific explanation from observable causes to unobservable causes, as advocated by Peter Lipton (2004, 200). Thereby I interpret Berkeley's inductive inference from observation of observables (i.e. descriptions of sensible bodies in motion or at rest) to approximate truth of unobservables (i.e. theories from mathematical hypotheses) in *DM* as BIBE: Berkeleyan Inference to the Best Explanation.⁵ In fact, Berkeley largely relies on a mathematical, deductive inference of phenomena from 'their cause, i.e. the reason why they take place' (*DM* §37) followed by calculations. However, before the deduction or geometrical reasoning (*ratiocinium geometricum*), which is element 3 (Chapter 3), I read that there are two other elements in *DM*: sensation (*sensus*) and

³ On the *deliberative* process of causal talk, see Price 2007, 262, 288. According to Alison Fernandes (2017, 690–691), (her version of) deliberative approach to causation has at least three features: (i) causation is 'tied to *inference*' in its evidential, epistemic structure, (ii) causal talk from evidence to fundamental laws is not committed to the metaphysical nature of causation, and (iii) a middle-ground can be recognised between first-order realist (interventionist/reductive) accounts of causation and standard agent-based (subjectivist/anti-realist) accounts.

⁴ Cheryl Misak (2017, 28) identifies IBE as 'abduction': a scientific reasoning ('hypothesis') that the pragmatist Peirce carved out as the first inquiry before induction and deduction. This identification is another issue beyond the limit of this chapter, but for an objection to it, see e.g. Yu and Zenker 2018, 579.

⁵ On Berkeley's IBE in the divine visual language argument, whilst not primarily focused on *DM* (but on Alciphron dialogue 4), see Jessephe 2005, 188:

[I]nference to the best (as opposed to merely better) explanation typically considers a number of alternative hypotheses, and the conclusion of the inference will be that some unobserved entity exists precisely because the supposition of its existence best explains observed phenomena.

The final section of this chapter will reconstruct BIBE precisely in *DM*. For a similar view, see Ott 2019. As with *DM*, I read BIBE in the other works, e.g. Berkeley's letter to his friend Thomas Prior, published together with *Siris*. There he insists that, through his experiences and experiments, he infers to the best explanation of drinking tar-water as panacea, even though 'I may be mistaken, but it is worth trial: for the chance of so great and general a benefit [...] I do not say it is a panacea, I only suspect it to be so; time and trial will shew' (*Works* V, First Letter of 19 June 1744, §§11, 22).

experimentation (*experientia*). Berkeley does take his empirical, inductive method regarding causal terms (of body and soul), following ‘what sense and experiment tells us, and reason that *rests upon them*’ (*DM* §21, emphasis added).⁶ That is, in *DM*, the deductive reasoning (meditation) follows Berkeley’s inductive approach to mechanical causation in BIBE, which is based on the sensation (senses) and experimentation (personal experiments) that reliably make us believe true theories. Indeed Berkeley confesses: ‘I speak of things known; for of the unknown it is useless to speak’ (§21). However, in the whole context of *DM*, Berkeley deploys useful causal terms (mathematical hypotheses) to infer effects of the unobservables from the observables in his scientific discourse or deliberation. Therefore, it is my view that, for Berkeley’s pragmatic method in three steps of geometrical reasoning (Chapter 3), BIBE scaffolds the utility and success of scientific explanation of physical, sensible qualities to unobservable, occult qualities.

In what follows, this chapter is broken down into five sections in defence of my argument that Berkeley has a pragmatist theory of causation. On the whole, *De motu* is Berkeley’s scientific commentary of physical theories at the time, especially Newtonian dynamics and mechanics that he admired and criticised regarding absolute space, time, and motion. However, as he also pays attention to ‘metaphysical, theological, and moral’ considerations in relation to mechanical laws of motion (*DM* §42), Berkeley’s apparently complex treatments of causation in both metaphysics and mechanics shall be initially clarified. This is reconstructed on the grounds of my earlier discussion in Chapter 2. Thus, in §4.1, my explanatory focus is upon his distinction of causal and theoretical terms between metaphysics, including theology, and mechanics, including dynamics.⁷ In particular, I will expound the utility of mathematical hypotheses for mechanical theories or causal laws as possessing truth with regard to truth-values of the law-propositions.⁸

Before finally defending my pragmatist reading in §4.5, I critically review three major interpretations of Berkeley’s theory of causation in *DM* on offer.⁹ Given the background of causation from

⁶ According to Newton’s ‘experimental philosophy’ in his *Principia* (1999, 943), which Berkeley critically admired, ‘propositions are deduced from the phenomena and are made general by induction’; generalising the rules of experimental philosophy, a set of inductive arguments was ultimately supposed to find ‘the impenetrability, mobility, and impetus of bodies, and the laws of motion and the law of gravity’. See also Miller 2009, 1052–1054, n. 1; Anstey 2011, 163, n. 43.

⁷ On the relationship between classical mechanics and dynamics in eighteenth-century natural science, including Berkeley’s case, I regard causal talk of forces in dynamics as part of classical or Newtonian mechanics. See Boudri 2002, 32, n. 2: ‘Force occupies a central position within classic mechanics. Seventeenth-century mechanics had restricted the use of forces to statics and the laws of impact (other motions being regarded solely as kinematic), but after Newton, mechanics linked forces and motion almost by definition’, such as d’Alembert’s *Mécanique* (1765).

⁸ I define *truth* in the sense that formulated propositions or theories are to be confirmed or assented by the agent. See e.g. Pearce 2017c, 158: truth is ‘a norm on assent: one assents correctly if and only if the sentence to which one assents is true’.

⁹ There are diverse interpretations of Berkeley’s theory of causation in *DM* that this chapter cannot fully consider. These include the following (see also *ibid.*, 157–159; 2021):

④ **Fictionalism** regarding causal terms as useful fictions, but this construal can be associated with instrumentalism when make-believing or quasi-asserting theories of unobservables is *not necessarily* asserting the *truth* of the postulates (see Vienne 2004, 63–65; Yablo 2001, 74–75; Field 2016).

⑤ **Conventionalism** similar to Henri Poincaré’s version of not grounding causal terms on the empirical nature, but this construal can be associated with structuralism (see Peterschmitt 2008,

mathematical hypotheses in the first section, §§4.2–4.4 examine the respective readings:

- ❶ **Reductionism** one can eliminatively translate theoretical notions like forces in dynamics into observation notions about motions of bodies in kinematics (Hinrichs 1950; Myhill 1957; Brook 1973).
- ❷ **Structuralism** [structuralism realism, in other words] one can dismiss theoretical entities such as occult qualities, but not the theoretical structure of them for scientific progress (Stoneham and Cei 2009; Cei 2010).
- ❸ **Instrumentalism** one can empirically hold the utility of dynamics for calculating bodily motions, even if mathematical hypotheses are fictitious, or their theories are potentially false (Popper 1953; Buchdahl 1969; Newton-Smith 1985; Downing 2005, et al.).

Especially, my pragmatist reading criticises the ❸ instrumentalist reading that causal talk of theoretical terms like forces is not confirmed, or even committed, to be true for utility in mechanical practices.¹⁰ Clarifying why we cannot favour any of the three, finally, §4.5 vindicates my philosophical rationale for Berkeley's pragmatism about mechanical causation in *DM*. My argument then explicates two features: the deliberative approach and BIBE as a reliable method to approximate truth of causal laws.

Specifically, on my reading, there are three generic ingredients in a pragmatist theory of causation, as defined earlier in §3.1.2:

Definition. A pragmatist theory of causation is one which holds that:

- ❶ Causal terms are indispensable in scientific deliberation for their usefulness; they cannot be eliminated [*contra reductionism*].
- ❷ What a cause is is defined by one's temporal deliberative practices, independent of atemporal structure that theories hold [*contra structuralism*].
- ❸ Causal laws (theories and theorems formulated in causal terms) are genuinely true, not fictitious, when one confirms and deduces them [*contra instrumentalism*].

Following this tripartite definition, within the context of *DM*, I object to the other three construals. Thereby we will newly understand Berkeley's pragmatic method or his pragmatist theory of causation in scientific discourse. Light shall be shed on the tenet that statements formulated in causal terms must be true as long as we define and reason them within our temporal deliberation. Finally, I reinforce my reformulation by Berkeley's Inference to the Best Explanation (BIBE) in *DM*: from descriptions of sensible bodies in motion (or at rest) to approximate truth or theories about occult qualities by mathematical hypotheses. After all, for Berkeley, the formulation of mechanical causation can reliably and pragmatically make us believe the truth within scientific discourse.

31).

¹⁰ Therefore, never shall I conflate instrumentalism and pragmatism, unlike e.g. R. Schwartz 2020; Morgenbesser 1969, 200, 209. For, on my view, the pragmatist does judge truth-values of law-propositions for utility unlike the instrumentalist. Also see the footnote on Jaina seven-valued logic in Chapter 3 for my distinction between the two positions.

4.1 Mathematical hypotheses for causal laws in Berkeley's metaphysical settings

4.1 Mathematical hypotheses for causal laws in Berkeley's metaphysical settings

The first section will explain what the Berkeley of *DM* thought about mechanical theories, including theorems, in the light of my defence of his pragmatist theory of causation in the mechanical domain. On the other hand, I also expound the relationship between the mechanical and metaphysical domains. Not only does his theory of causation stem from the term 'cause' (as we saw in my textual analysis in [Chapter 2](#)), but it also hinges on theoretical terms, such as 'force', 'gravity', 'action', 'attraction', 'solicitation', and 'mathematical hypothesis' (*DM* §§4, 17, 39).

On the whole, Berkeley differentiates three linguistic categories or *tiers* of scientific terms and sentences in *DM*. This is evidenced in *DM* §39:¹¹

Tier 1 Abstract and general 'terms [*voces*]' (words), or *mathematical hypotheses* (e.g. 'force', 'action', 'attraction', 'solicitation');

Tier 2 'Theories and formulations [*theoriae & enunciationes*]' (statements or law-propositions);

Tier 3 'Calculations [*computationes*]'.¹²

The first tier of causal terms, generally labelled mathematical hypotheses, all contribute to the second tier, i.e. Berkeley's unique rationale for the utility of causal laws (or laws of nature) effective in the mechanical domain (followed by the third tier, calculations therefrom).¹² It is crucial to grasp that tier 1 does not bear truth-values, that is, causal vocabulary or terms are not *truth-bearers*. Whereas tiers 2 and 3 do bear truths or falsities in expressing the mathematical utility of formulated sentences. On the other hand, the scholarly interpretations of causation via mathematical hypotheses differ substantially. Before dealing with each candidate theory of causation in *DM* in the following sections, this section is to define an essential relationship between the metaphysical and mechanical (scientific) causes in Berkeley's argument. From the *DM* final section, I will go back and reflect further the significance of his realist fundamental metaphysics, wherein mechanical theories are grounded.

4.1.1 The divine 'true, efficient, conserving cause'

In the final section, *DM* §72, Berkeley concludes that those who engage in mechanical principles and theories ought to beware of 'truly [or really] active causes [*causæ verè activæ*]' accessed only by means of 'meditation and reasoning [*meditatio & ratiocinium*]' (clarification added).¹³ It is

¹¹ See Peterschmitt 2003, 188; my textual analysis in [Chapters 2](#) and [3](#).

¹² See [§1.1.1](#) for the pyramid model that put forward Berkeley's pragmatist theory of mechanical causation.

¹³ *DM* §72 (emphasis added): 'Only by *meditation and reasoning* can truly active causes be brought to light from out of the enveloping darkness, and to some extent known. But to treat of them is *the concern of first philosophy or metaphysics*. And if to each science its province were allotted, its limits assigned, and the principles and objects which belong to it accurately distinguished, we could treat each with greater ease and perspicuity'. On the 'reasoning [*ratiocinium*]', see *DM* §§17, 37, 42, 72; on the 'meditation', §§4, 43, 72. On my reading, Berkeley treats both terms in a very similar sense of one's mental and rational exercise of inference, and the reasoning including meditational or theoretical activities does bridge between the two domains of metaphysical and mechanical sciences.

stressed there that such a reasoning about the causes is rooted in ‘the concern of first philosophy or metaphysics’ (*DM* §69), as distinguished from ‘mechanical science’ (*DM* §71). In effect, the true (or real) active causes are to be identified as divine, or the divine mind that bears ‘the true efficient cause of motion’ (*DM* §69). In particular, the divine mind, in the domain of metaphysics, is supposed to possess ‘the *true, efficient, and conserving* cause of all things [...] most rightly called their source and principle’ (*DM* §36, emphasis added). The three factors of the divine cause, namely,

I. truth, II. efficiency, and III. conservation

are essential to the metaphysical background that sustain mechanical principles and theories in Berkeley’s interpretation. In particular, borrowing the Aristotelian terminology, the latter two factors are identified as the divine efficient (activating) cause and final (teleologically conserving) cause.¹⁴ On the other hand, the content of Berkeley’s metaphysics is not that simple, as the human mind is deeply involved therein.

4.1.2 The human cause in the mechanical domain

The human, finite mind/spirit/*νοῦς* is another essential part of Berkeley’s metaphysics of science.¹⁵ Towards a pragmatist reading that humans are to deliberate on true/real causes or causal terms, Berkeley’s distinction between the divine mind and human mind should be clarified. In *DM* §§30–33, Berkeley’s Anaxagorean (and also Cartesian) distinction between thinking things (*mens/νοῦς*) and extended things (*corpus*) may direct the reader to what is in question for the minds or our human minds that can think. More directly, in this section of *DM* (emphasis added):

§25. Besides corporeal things there is another class, that of thinking things. And that in these there is *a power of moving bodies* we have learned from our own experiment [*propria experientia*], since our souls may at will excite and stop the motion of limbs [*membrorum motus*], whatever the ultimate explanation of this may be. This much is certainly agreed, that bodies are moved at the will of the mind, and it can thus quite appropriately be called *a principle of motion; a particular and subordinate one indeed, and one which itself depends on the first and universal principle.*

This passage sheds the clearest light in *DM* on the fact that the finite mind does have the ‘power of moving bodies’ in one’s personal physical experiment or experience, and that we human minds are the ‘particular and subordinate’ principle of motion, even though depending on the divine first principle. That is why the divine mind, on the supreme level, effectuates its own ‘true, efficient, and conserving cause’ for the human mind within this metaphysical picture. Thereby, on my view, the ‘cause, truth, and the existence of things’, including ‘incorporeal things’, are befittingly ensconced in the domain of divine *and* human ‘spiritual’ or incorporeal metaphysics (*DM* §§42,

¹⁴ If strictly following the definition of the Aristotelian four causes, we may call the first factor *truth* the divine formal cause in the domain of metaphysics. [Chapter 2](#) textually examined Berkeley’s metaphysical, efficient-final causation.

¹⁵ On the *mens* or *νοῦς*, see [§2.2.2](#).

4.1 Mathematical hypotheses for causal laws in Berkeley's metaphysical settings

71).¹⁶ In this sense, mechanical formulations, namely, causal theories formulated from mathematical hypotheses, refer to the realist fundamental metaphysics of the divine mind because the natural or mechanical philosopher cannot solve it. However, the latter natural philosopher or human agent formulates another type of causation in the domain of mechanics concerning the laws of motion from mathematical hypotheses (*DM* §§65–67). Here I hold the view that, apart from the Berkeleyan divine metaphysics, the human mind must have a particular and subordinate principle of motion for themselves (as shown in *DM* §25).

4.1.2.1 Useful and true law-propositions from the hypotheses

As to mathematical hypotheses distinguished from the Berkeleyan metaphysics,¹⁷ then, what are accurately taken to be hypothetical, causal terms that lend themselves to formulating mechanical theories?¹⁸ According to Berkeley, 'mathematical hypotheses' or causal terms—force, gravity, impetus in the laws of motion—theoretically refer to unobservable entities called 'occult qualities' (*DM* §§4–6, 23). These mathematical hypotheses can refer to qualitatively occult phenomena or something unobserved/unobservable without their effects manifesting in bodies (*DM* §10).¹⁹ Accordingly, Berkeley states that 'it is clear that [attraction] was employed by Newton, not as a true [or real] and physical quality, but only as a mathematical hypothesis' (*DM* §17, clarification added).²⁰ In other words, causal terms like 'attraction' and 'gravity', which the mechanical philosopher formulates, are the mathematical hypotheses as non-physical (immaterial), occult, unobserved qualities. On the other hand, no matter how unobservable they are, Berkeley clearly identified such hypotheses as 'useful' (*utiles*) terms for theorising causal laws.

The utility of formulations from mathematical hypotheses is supposed to account for 'phenomena' or appearances, as causal terms such as 'forces' just contribute to the establishment of mechanical and dynamical theories (and rules of calculation) that *deduce* the prediction (*DM* §§35–38, 69).²¹ On my pragmatist reading, by employing mathematical hypotheses, the truth of a theory can be

¹⁶ Consider *DM* §42:

Those who derive the principle of motion from spirits understand by the term 'spirit' [*spiritus*] either a corporeal or incorporeal thing: if they mean a corporeal thing, however subtle, yet the difficulty recurs.

My pragmatist reading here distinguishes the domain of *corporeal* mechanical theories from the domain of *incorporeal* metaphysics, whereas the former succumbs to the latter metaphysical necessity. This is because Berkeley's natural philosopher (*philosophus naturalis*) can readily accept the reference to the metaphysical domain, when it must differ from metaphysical matters in the causal deliberation of mechanical causation. Accordingly, 'whatever [the natural philosopher] may advance on other matters [than mechanical causation], let them refer to a superior science [of theological and moral metaphysics] for acceptance [*acceptum*]' (§42, clarification added).

¹⁷ *DM* §66: 'in investigating the true nature of motion, it is of the greatest importance: first, to distinguish mathematical hypotheses and the actual natures of things [*hypotheses mathematicas & naturas rerum*].' The latter *naturas rerum* or essences are proper to the domain of metaphysics, which I do not problematise in this chapter.

¹⁸ For example, mechanical theories (or formulations/law-propositions) that Berkeley interprets are Newton's third law of motion 'that action and reaction are always contrary and equal' (*DM* §69), compared with similar theories of Borelli and Torricelli (§67).

¹⁹ *DM* §10: 'it must be allowed that no force is immediately felt by itself, nor otherwise known and measured except by its effect.'

²⁰ On Berkeley's reading of the term or hypothesis 'attraction' from Newton's *Principia* (1.5), see Jesseph 1992, 80, n. 11.

²¹ See also Peterschmitt 2003, 186–187; Downing 1995a, 214; 2005, 248–253.

maintained to the extent of the capacity of prediction for the human mind, there being nothing to do beyond explaining that extent. This correct use of the causal terms relates to a non-Newtonian point in Berkeley's theory of mechanical causation, in which mathematical 'hypotheses' are the foundation for his admired Newtonian mechanics and dynamics unlike Newton's conception.²² In fact, Newton himself eschewed any hypothetical commitment as stating '*hypotheses non fingo*' (I do not feign hypotheses) in his *Principia* (1999, 943).²³

4.1.2.2 Berkeley's ultra-Newtonianism

However, in contrast to Newton's own method, borrowing Luc Peterschmitt's wording (2003, 197), Berkeley can rather be an 'ultra-Newtonian' about mechanical causation in using mathematical hypotheses or such causal terms, unlike his 'anti-Newtonian metaphysics' in view of his argument against Newtonian dynamical realism (from efficient, incorporeal causes, e.g. *DM* §§35, 42). This is because he defends Newtonianism against its own metaphysical phantoms, which sneak into mechanical philosophy and constantly jeopardise the scientific validity. Putting aside the metaphysical nature of things that mechanics cannot reveal (or deliberate), therefore, Berkeley champions (Newton's) 'clearest theorems of mechanical philosophy' that can unveil 'secrets of nature' under 'human calculations' (*DM* §66; see also §71). Therefore, one can deliberate on true (or false) law-propositions in mechanics that one can deliberate or confirm within the use of causal terms.

In Berkeley's ultra-Newtonian discourse of science to explain the truth of mechanical theories, both in general and in particular, the causal terms or mathematical hypotheses are exceedingly 'useful [*utiles*]' for one's 'argument [*disserendum*]' (*DM* §7); 'reasonings and calculations [*ratiocinia* & *computationes*]' (§17); 'theories, formulations, and calculations [*theoriae, enunciationes, & computationes*]' (§39) about motion and moving bodies; 'geometry and mechanics [*geometria & philosophia mechanica*]' (§61); and 'life [*vita*]' through 'mechanical practices [*praxes mechanicæ*]' (§42).²⁴ Accordingly, in the context of *DM*, the utility of mathematical hypotheses is one of the essential factors in formulating mechanical theories in one's own practice.²⁵

²² On the distinction between mechanical, dynamical, and substantial causes in Newton, see Janiak 2013, 404.

²³ By the term 'hypothesis', differing from Berkeley's use, Newton negatively meant an improper reference to the physical properties of phenomena (Iliffe 2017, 318, 351–353). He states in one draft 'that Hypotheses are nothing more then imaginations, conjectures & suspicions & ought not to be propounded as Truthe or Opinions nor admitted into Philosophy as such until they are *verified* (emphasis added) & established by experiments' (the 'Waste Book', CUL Add. Ms. 3968 fols. 436v, 437v; in *ibid.*, 352, n. 63). This also suggests that Newton's experimental philosophy was directed to 'truth', which I think differs from Berkeley's pragmatist conception of truth formulated in his geometrical reasoning. See also Chapter 3.1.3.

²⁴ The last association of mathematical hypotheses with usefulness in 'life' or practical utility should be noted cautiously, as to the exact phrases in *DM* §42: 'from the knowledge of the laws of nature follow the most beautiful theories and mechanical practices [*praxes mechanicæ*] in life.' I take it that the laws of nature Berkeley meant here are validly formulated from mathematical hypotheses, which are fundamentally useful.

²⁵ Earlier on, according to Berkeley's mouthpiece Philonous (*Dialogues* 3.243), the 'laws and methods of Nature' were considered conducive to 'useful and entertaining' knowledge in natural philosophy. On the utility of mathematics and sciences, see also *Notebooks* §§207, 471, 853, etc.

4.1 Mathematical hypotheses for causal laws in Berkeley's metaphysical settings

4.1.2.3 Pragmatic and/or truth-values of law-propositions

In accordance with this utility in his ultra-Newtonianism, the point in question is whether Berkeley considers that mechanical theories—formulations/statements from mathematical hypotheses—are either of them:

- (a) law-propositions possessing truth-values (i.e. stating the utility implies either true or false), or
- (b) genuinely fictitious ones (i.e. useful without truth-values) in our mechanical theorisation.

I take the former view (a) that formulations from mathematical hypotheses can be true (or false), insofar as useful theories are confirmed in our causal inference or deliberation²⁶ From this deliberative or pragmatic standpoint, I will later propose my reading of Berkeley's pragmatist theory of causation.

By contrast, many of the *DM* commentators seem to take the latter view (b) that theorising from mathematical hypotheses are useful irrespective of having truth-values. For instance, Eric Schliesser (2005, 56–57) argues that mathematical hypotheses do not refer to a 'true and physical quality' (*DM* §17); they convey no fixed meaning or 'geometers' *fictions*' (*DM* §39, emphasis added), for such mathematical entities have 'no stable essence in the nature of things' (*DM* §67).²⁷ Moreover, why one may formulate theories from mathematical hypotheses without truth-values, even staying fictitious, can be understood in W.H. Newton-Smith's interpretation (1985, 149):

[T]he aim of the scientific enterprise is merely the production of theories that are empirically adequate in the sense that they give successful observational predictions. *The question of the truth of the theoretical postulates of science simply does not arise* (emphasis added). The only proper concern of the scientist is that those postulates give rise to correct predictions.

This indicates that problematising the issue of truth-values stemming from mathematical hypotheses appears irrelevant to the scientific practice of 'successful observational predictions'. This account leads to Newton-Smith's reading of (semantical) instrumentalism, according to which 'the theoretical sentences are held not to have been provided with the kind of meaning that gives them truth-values [...but they] are not hypotheses which are either true or false' (1985, 150). This further indicates that if theories are used instrumentally for successful predictions or explanations of the utility, then one does not have to postulate statements containing mathematical hypotheses to be true. Thus, such theoretical statements can be fictitious, or merely false, as long as they direct us to observational success. On the whole, including Newton-Smith and Schliesser, a number of commentators have taken their versions of instrumentalist readings of Berkeley's theory of causation in

²⁶ *DM* §38: 'believed to be understood [*intelligi creduntur*]'.

²⁷ See also similar views of instrumentalism in Jesseph 1992, 36–37; Popper 1953, 29.

DM.²⁸ Nonetheless, construing *true* law-propositions defined or confirmed by the finite mind (i.e. not fictitious),²⁹ I will argue against the instrumentalist reading (as well as the other two readings).

Thus far, it should be clear that Berkeley's ultra-Newtonian position vis-à-vis causation in metaphysics of science tells us about primarily two points in the context of *DM*. Firstly, there is a causation in the domain of Berkeley's realist fundamental metaphysics, to which extent the divine mind is causally true, efficient, and conserving, and the human mind subordinately has the particular and subordinate principle for moving bodies. Secondly, as distinguished from this Berkeleyan metaphysics, there is another type of causation in mechanical theories as formulated from mathematical hypotheses or causal terms like 'gravity'. However, in this domain of mechanics, theoretical sentences are problematised as to whether they possess truth-values for their utility in successful scientific predictions and explanations. On my reading, true formulations or statements from mathematical hypotheses must be pragmatically confirmable in deliberation (i.e. not fictitious), whereas the other readings—especially instrumentalism—do not necessarily consider so. On the other hand, as to whether one can regard the mathematical hypotheses as causal terms at all, the next section will first examine a reductionist reading.

4.2 Reductionism undermined

Granted the above metaphysical-mechanical distinction and mathematical hypotheses, it is first worth examining the reductionist (or reductivist) reading. According to that, Berkeley's analysis of causation in *DM* is eliminatively reducing theoretical statements in dynamics involving causal terms (like forces) to observation sentences in kinematics describing terms for observable motions of bodies. On this reading, within mechanics, the dynamical concept of cause is to be *translatable* to an empirically observable explanation, particularly just about kinematics of the motion and rest (Downing 2005, n. 51). I will consider if this reductive *translatability* incurs an unfavourable problem of dynamical, causal terms.

First and foremost, the reductionist reading directs us to Berkeley's standpoint that scientists ought to treat motion (and rest) of matter by employing appropriate language and terms. On this point, Gerald Hinrichs considers that it is better to avoid 'language too abstract and of doubtful reference—for example, the attraction of gravity, effort, latent forces, and the like—which make otherwise learned writings unintelligible' (1950, 492). In effect, this reading appears textually valid, as Berkeley at the beginning of *DM* claims that (*ibid.*, 491):

§§1–2. In the pursuit of truth we must beware of being misled by terms which we do not rightly understand. That is the chief point. [...] In works on motion by the more recent and

²⁸ On the readings objecting to Berkeley's instrumentalism, see e.g. Peterschmitt 2003; 2008; Ott 2019.

²⁹ As proposed in Chapter 1.1.1, defining truth-values of mechanical theories and judging them either true or false concern the semantic and epistemic levels in the M pyramid model. Furthermore, Chapter 3.1.3 set forth the process of Berkeley's geometrical reasoning in *DM*, step 3.2 of which is epistemic confirmation or deliberating on truths of causal laws.

4.2 Reductionism undermined

sober thinkers of our age, not a few terms of somewhat abstract and obscure signification are used, such as *solicitation of gravity*, *urge*, *dead forces*, etc., terms which darken writings in other respects very learned.

Those causal terms in dynamics, above highlighted, seem unintelligible or unknown by the senses in our scientific practice, to the effect that Berkeley ‘speak[s] of things known, for it is *useless* to speak of things unknown’ (*DM* §21, emphasis added). Avoiding this uselessness, on the reductionist reading, the utility of mathematical hypotheses for mechanical theories comes about through observation sentences or formulations. Therefore, when explaining the causes of motion in physical science or mechanics, Hinrichs argues that it is inappropriate and misleading if one uses the following causal terms (*ibid.*, 492):

[T]he pull of gravity, effort, force, corporeal force, primitive active force, first entelechy, soul, substantial form, the infinitely great force of the least impact, latent force, gravitation, hylarchic principle, natural need, appetite, natural instinct, self-moving bodies, spirits functioning as the form within bodies, bodies conceived as the source of forces.

These causal terms in *DM* are all suggestive of metaphorical meanings if they are used in a scientific context about mechanical theories. As Berkeley claims, ‘these terms “dead force” and “gravitation”, although they are supposed to signify by metaphysical abstraction something distinct from what moves, what is moved, from motion and rest, yet *in truth this is nothing at all*’ (*DM* §11, emphasis added).³⁰ Thus, those dynamical terms should be reduced to empirically observable terms and description.

Furthermore, John Myhill argues in another reductionist manner (1957, 147, clarification added):

Suffice it to say that by reduction to experiential content [Berkeley] disposes of many pseudo-problems in the philosophy of physics, and that despite this the real content of mathematical physics he asserts again and again to be untouched by his criticism.

This passage, by the word ‘reduction’, indicates that Berkeley obviates such pseudo-problems as dealing with unobservable, occult entities (*DM* §4) in his empirical, mechanical approach, whence material motion and rest can be theorised. Myhill’s focus upon reduction here leads to a restrictive understanding of kinematical terms of motion and rest. In the context of Berkeley’s argument against Newtonian absolute motion, Myhill further explains that Berkeley’s relative theory of motion refers to the causal notion of force merely ‘under another kinematical description’ (*ibid.*, 154–155). According to Myhill, the textual evidence for this kinematical reduction is in the following section of *DM*:

§64. [B]ecause of the diversity of relative spaces, there are various motions of one and the same body, so that from one point of view it may be said to move, and from another point of view

³⁰ For more textual sources of reductionism, see *DM* §§6–7, 21.

to remain stationary; in order to determine true motion and true rest, by which this ambiguity may be removed, [...] it would be sufficient to use the fixed stars, regarded as stationary, instead of absolute space. Motion and rest defined by this relative space can conveniently be used in place of absolute [motion and rest], *from which they cannot be distinguished in any respect* (Myhill's emphasis).

From Myhill's own translation and emphasis of the last sentence, it seems clear that Berkeley draws no distinction between the empirically observable bodies in motion and at rest defined by relative spaces. Thereby Myhill takes the reductionist reading of causation: however referring to the unobservables, mathematical hypotheses like gravity and force are considered by all that can be empirically observable.

In fact, whilst he finds as many as six points of similarity between the empiricist Ernst Mach and Berkeley, Myhill admits one inevitable dissimilarity between them in metaphysics outside physics (Myhill 1957, 149–151).³¹ That is, 'Berkeley held that there do exist real causal explanations, but that they belong rather to metaphysics than to physics; Mach, on the other hand, held that there exist no causes in the world at all, and *a fortiori* no causal explanations except in a Pickwickian sense' (*ibid.*, 151). This interpretation reveals that there is no Pickwickian or metaphorical use of *metaphysical* causes in the commonsensical, scientific domain of mechanics after Mach. Then, on the reductionist reading of Berkeley, there is only one proper type of causation in the realist fundamental metaphysics of the divine mind, wherein the human mind/spirit temporally works for moving one's own bodies.

In other words, putting aside metaphysical causation, the reductionist reading that dynamical terms are *translatable* to kinematical terms of bodily motions cannot correctly explain causation in the domain of mechanics. That is, dynamical causal terms are to be unnecessarily eliminated. On the contrary, from Berkeley's pragmatist viewpoint that I proposed as [Def 1](#) in the last section, causal terms are not actually eliminated in deliberating on mechanical theories and laws of motion and gravity. For those theoretical terms are used or assigned as 'their cause, i.e. the reason why they occur' (*DM* §37) in one's 'mechanical practices' (*DM* §42). Thus, I read that, whilst approving the soundness of metaphysical causation, the Berkeley of *DM* also upholds the mechanical and dynamical theories as another type of causation indispensable in the mechanical domain.

Here lies a downside of the reductionist reading. That is the irreducibility or untranslatability of all mathematical hypotheses (dynamical forces) to observational terms in mechanics; in effect, Berkeley would object to this reductionism.³² According to Walter Ott (2019, 7), '[t]o attribute force to bodies is to make a category mistake, since only minds, for [Berkeley], are agents', as he followed Descartes and a Cartesian Malebranche on this point. Although it is arguable to see the

³¹ However, Myhill goes so far as to claim that: 'Mach is almost precisely Berkeley without his [metaphysical] spirits' (1957, 151, clarification added). See also Popper 1953, 32–34.

³² Although Berkeley does not mention it in *DM*, a mathematical hypothesis like 'aether' (or aethereal corpuscle) occupies a prominent part of interpretation in *Siris*, and it cannot be substituted by any term for observables. See also Downing 1995b, 288–289; Ott 2019, 6. I read that Berkeley's approach to mathematical hypotheses is coherent between *DM* and *Siris*.

4.3 Structuralism undermined

extent to which Berkeley's argument about the mind and sciences coincides with those of the Cartesians,³³ I concur with Ott that dynamical terms are not attributable to observable bodies under the sole causal agency of the minds. To this effect, theorising or expressing causal laws in dynamical terms are indispensable in the domain of mechanics. Put another way, the finite mind or causal deliberator can bring about or deliberate on the bodily motion and rest including dynamical phenomena, such as gravitation. In this sense, it is *useless* if one takes 'force' and 'gravity' to be mere terms for observables, for they refer to occult qualities or unobservable things. In contrast, it is *useful* if one can assign or deliberate on such causal terms (mathematical hypotheses) in the deliberator's successful scientific discourse.³⁴ Hence, the reductionist reading is problematic when there is no exact translation (reduction) to observation terms and sentences about bodies (and when Berkeley himself did not intend).

To wrap up, we have seen the possibility of the reductionist reading of causation through the two main commentaries, Hinrichs and Myhill.³⁵ However, the plausibility of the reductionist reading is low, even if Berkeley was extremely cautious about using the abstract and abstruse language beyond observation as a quasi-Machian empiricist in *DM*. For Berkeley, on my pragmatist reading, the human mind or deliberator of causation holds the utility of mathematical hypotheses including dynamical terms as long as formulating mechanical theories, in the process of which the reduction of dynamical terms does not actually occur. Therefore, the finite mind's deliberation of law-propositions in causal is not eliminated, but indispensable.

4.3 Structuralism undermined

In contrast to the reductionist reading that dispenses with causal terms referring to unobservable phenomena, a structuralist reading does not discard the continuity of structural content that causal theories hold. For the continuity describes the world. However, this reading does discard the continuity of empirical content in the theories. This section singles out what is distinctively featured as structuralism (structural realism) for Berkeley's theory of causation in *DM*. I will primarily deal with the interpretation of Tom Stoneham and Angelo Cei (2009) because they are, to my knowledge, the only champions of the structuralist reading.

In contemporary metaphysics and philosophy of science, structuralism was first advocated by John Worrall, claiming for scientific progress and success by means of the formal structure of theories, such as the syntactic or structural continuity between Fresnel's and Maxwell's theories of light (1989, 117). In respect of Newton's theoretical, causal terms or mathematical hypotheses, Worrall argues (*ibid.*, 122):

On the structural realist view what Newton really discovered are the relationships between phenomena expressed in the mathematical equations of his theory, the theoretical terms of

³³ See Storrie 2012a, nn. 1–5; Downing 1995a, 213; *DM* §§30–34.

³⁴ See also Downing 2005, 263–264, n. 51.

³⁵ See also Brook 1973, 117–118, n. 68.

which should be understood as *genuine primitives* (emphasis added).

This view has been regarded as ‘Epistemic Structural Realism’ (ESR), which Stoneham and Cei (2009, 84) take to be similar to Berkeley’s version of Newtonian mathematical hypotheses. However, on the ground that ESR implicitly presupposes a *true* nature of formulations in theoretical terms, which are ‘genuine primitives’ as Worrall stated. Therefore, Stoneham and Cei avoid ESR (*ibid.*, 84–86). Instead, they argue that another brand of structuralism, ‘Ontic Structural Realism’ (OSR), radically but resoundingly fits with Berkeley’s ‘eliminativist’ view that no ‘things’ but only the theoretical structure can explain phenomena.³⁶ Cei (2010, 38–39) further clarifies the ontological structure itself to be ‘the set of relations that a theory ascribes to its fundamental entities and that in physics is captured by the mathematical formulation of the laws’. That is, in structuralism, the relational characters that causal theories (law-propositions) deduce enable us to see the success of science.

As distinguished from reductionism, there will be a difference between the interpretations of structuralism and instrumentalism in Berkeley’s metaphysics of science. As Stoneham and Cei (2009, 90) summarise, Berkeley as the structuralist differs from Berkeley as the instrumentalist, for the former takes scientific laws to be (linguistic) entities that manifest real structure of the world. In contrast, the latter takes the laws to be merely something useful as tools for calculating and predicting experiences. On the other hand, the structuralist and the instrumentalist Berkeleys agree with each other in terms of the existence of observable entities and non-existence of unobservable ones.³⁷ However, on this epistemic problem of observation (or perception), Berkeley is not regarded as structuralist about the perceptible world. This is because such an epistemic reading is textually misleading (Stoneham and Cei 2009, 89); Berkeley cannot accept ‘those principles [...] that lead us to think all the visible beauty of the creation a false imaginary glare’ (*Dialogues* 2.211). This means that, for Berkeley, there exists nothing beyond one’s sense perception.

To put it differently, Berkeley does not easily admit the existence of anything beyond one’s ken, or occult qualities, because what is occult or unobservable *per se* ‘explains nothing’ (*DM* §6). In this context, he tries to dismantle what is taken to be occult, stating (*DM*, emphasis added):

§4. By reason [...] we infer that there is some cause or principle of these phenomena, and that is commonly called ‘gravity’. But since the cause of the descent of heavy bodies is unseen and unknown, gravity in that use cannot properly be called a sensible quality. It is, therefore, an occult quality. But *one can scarcely, and indeed not even scarcely, conceive what an occult quality is, or how any quality could act or effect anything*. And so men would do better to *let the occult quality go*,³⁸ and attend only to the sensible effects.

³⁶ This does not mean that structuralism is *eliminative* reductionism, as the latter does not distinctively assume any structure or relation of theories. OSR is chiefly a position of James Ladyman (2014), according to whom, ‘[a] crude statement of ESR is the claim that all we know is the structure of the relations between things and not the things themselves, and a corresponding crude statement of OSR is the claim that there are no “things” and that structure is all there is.’

³⁷ On this point, the reductionist and the pragmatist Berkeleys also agree with them.

³⁸ Stoneham and Cei rely on Luce’s translation in interpreting the phrase *missa qualitate occulta* (§4) as ‘letting the occult

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The above clarifies the reason Berkeley seeks to obviate occult qualities, indeed. That is inconceivability of those things denoted by causal terms, such as ‘gravity’ and ‘attraction’, as opposed to observation terms about sensible qualities that are seen and known in one’s perception. However, Berkeley’s negative view of causal terms is ‘a slightly more nuanced’ (Stoneham and Cei 2009, 78), for he needed the relational assistance of their causal terms for *framing* or *structuring* the scientific practice that Berkeley interpreted. Even though they relate to occult qualities, Berkeley argues for causal terms or mathematical hypotheses that can structure, as follows (*DM*, emphasis added):

§17. ‘Force’, ‘gravity’, ‘attraction’, and terms of this sort are useful for reasonings and calculations about motion and moving bodies in motion, but not for understanding the simple nature of motion itself, or for designating so many distinct qualities. As for attraction, it is clear that this was employed by Newton, *not as a real [veram] and physical quality*, but only as a mathematical hypothesis. And indeed Leibniz, in distinguishing elementary effort [*nisus*] or solicitation from impetus, confesses that those entities are not to be found in things themselves in nature, but must be made by abstraction.

In the above sense, mathematical hypotheses such as force, gravity, and attraction compose an abstract relation or framework of causal laws, not an empirical content of the perceptible world. On this point, Stoneham and Cei argue (*ibid.*, 78–79, emphasis added):

[Berkeley] does [...] allow that the mechanical principles of gravity and attraction and impetus can be used to formulate laws which, though not based upon observed correlations, *do extend beyond our experience*, just so long as we still do not think that the *truth* of those laws is derived from their telling us about *the essential natures of things*.

This indicates that the Berkeley of *DM* actually conceded the point that mathematical hypotheses like ‘gravity’ and ‘impetus’ are not discarded as the relational continuity beyond one’s experimentation (or experience), albeit non-empirically justified. Thence, Stoneham and Cei expound that we use causal terms to formulate genuinely true statements about the structure of the world, even if those terms refer to neither sensible qualities nor ‘the essential natures of things’.³⁹ This is because the structure of true theories, even formulated from non-empirical mathematical hypotheses, affords the success of scientific explanation in progress.

However, I contend that a drawback in this structuralist reading of causation is that we are missing who confirms the truth in theorising causal laws from mathematical hypotheses in scientific discourse. As Stoneham and Cei above argued, for the structuralist, theoretical formulations from

quality go’ (Luce 1951, *Works* IV), rather than ‘dismissing [it]’ (Jesseph 1992; D. M. Clarke 2008); ‘to leave [it] out of account’ (Jessop 1952); ‘putting [it] out of view’ (Wright 1843); ‘not consider [it]’ (Belfrage, *forthcoming*). Luce’s rendition is metaphorical as if the occult quality might ‘naturally drift off into the unintelligible void’ (Stoneham and Cei 2009, 73). By contrast, the other renditions more directly indicate the agent’s deliberation that I support for my pragmatist reading.

³⁹ Stressing that causal laws are not in ‘the truth of things’ (*DM* §39), Stoneham and Cei clarify that ‘occult qualities do not exist, not that the laws framed in those terms are not true propositions’ (2009, 80). This rather suggests that, for the structuralist, law-propositions are *true* as long as the theoretical structure is atemporally held.

the hypotheses do possess truth-values on the ground of scientific success in progress. This is because a set of theoretical relations, i.e. continuous structure, maintains true law-propositions, independent of the essence or nature of things (OSR). Nonetheless, for Berkeley, it is uncertain whether the theoretical structure forever holds true propositions independent of the discourse or deliberation by the human agent or ‘definer’ (*DM* §67). What he coherently stresses is to rely on ‘what sense and experiment tell [*suadeat*] us, and thus [*demùm*] reason that rests upon them’ (*DM* §21)⁴⁰ in the conditions of finite minds, which are not infinite. Put differently, the structuralism of causal laws mistakenly hides Berkeley’s intention to explain why our finite (experiential), or *temporal*,⁴¹ deliberation of law-propositions is ‘certain [*certe constat*]’ or reliably confirmed to be true to the extent to which we reason for ourselves (*DM* §25).

This last point clarifies my pragmatist reading that, without postulating atemporally continuous structure of causal laws, the finite mind or human deliberator can successfully infer a reliable belief within the epistemic limits of scientific discourse. As with the above reductionism, the structuralist reading is problematic because, on my view, a correct use of causal laws cannot be independent of the human deliberation to confirm causal laws, which are *not atemporal* within one’s ‘mechanical practices’ (*DM* §42). In other words, the finite mind relies on its personal use and definition of causal terms, not on any continuous structure that theories hold in scientific progress. Rather, the structure depends on practical expressions from one’s finite ‘sense and experiment [...] and thus reason’ (*DM* §21). Therefore, on Berkeley’s empirical and scientific account of the human reasoning and calculations,⁴² I uphold that what a cause is is defined in terms of our temporal deliberative practices. That is [Def 2](#).

To summarise, I have examined the structuralist reading about the use of causal terms—mathematical hypotheses—in Berkeley’s mechanical theories. Indeed, the terms stand for unobservable occult qualities. As seen in Stoneham and Cei’s argument in line with OSR, the structuralist reading does consider causal theories formulated from mathematical hypotheses to be non-empirically or atemporally true. Nevertheless, this construal is undermined, because Berkeley does not presuppose the theoretical structure of causation beyond the agent’s sense, experiment, and reason (three elements for the mechanist). Instead, from my pragmatist viewpoint on the agent’s deliberation of causal terms, formulated law-propositions can be confirmed (or committed) to be true, and thus expressed, in one’s empirical and temporal conditions. In these conditions, causal theories and theorems are framed, deduced, and calculated. Before I defend this pragmatist reading, the next section will examine one more different reading, i.e. instrumentalism.

⁴⁰ In *DM*, Berkeley seriously takes the three components in mechanical practices: the agent’s ‘sensation [*sensus*], experimentation [*experientia*], and geometrical reasoning [*ratiocinium geometricum*]’ (*DM* §1). See also *DM* §§27, 40, 71; [Chapter 3.1.3](#) for my reconstruction of these three elements in *DM*.

⁴¹ On my view, Berkeley had a keen interest in the notion of time for the finite (limited) and infinite (eternal) minds, respectively. See *Notebooks* §590: ‘Each Person’s time being measured to him by his own Ideas’, which indicates the finitude of life to the extent of one’s knowledge. For the other entries with the letter τ (time) and those with the + sign (if not positively treated), see *Notebooks* §§1–16, 39, 48, 92, 118, 127, 129, 130, 194, 390, 460, 647, 655; *Principles* §§97–98, etc.

⁴² See [§4.1](#) above for the three *tiers* of Berkeley’s linguistic distinction.

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4.4 Instrumentalism undermined

In contrast to the above two readings, which are relatively minor views, the most popular reading of Berkeley's theory of causation that I have considered is instrumentalism. On my view, however, this reading is also mistaken. There are a number of proponents of this instrumentalist reading, in addition to Newton-Smith and Schliesser as I earlier touched on in §4.1.2.3.⁴³ Another proponent, Douglas Jesseph (1993, 76) renders as follows:

The strongest version of instrumentalism regards a theory as a 'black box' which delivers reliable results, although the theory itself is taken to be false, meaningless or unintelligible.

This rendition, however problematic,⁴⁴ is telling in terms of the instrumentalist *fictitious* condition that theoretical formulations do not possess truth-values if they are 'meaningless or unintelligible', or they are simply 'false' even if they possess truth-values. In this section, real utility in causal but fictitious terms (mathematical hypotheses) is a moot point with respect to genuine truth of law-propositions.

To start with, Newton's laws of motion are generally treated as correlation in fundamental or low-level physics or mechanics (Field 2003, 443). By contrast, in the Berkeleyan metaphysics, causation or causal laws are rooted in (divine) efficient and final causes beyond physical phenomena (*DM* §72; *Siris* §231; Popper 1953, 33–34). In this metaphysical respect, under no circumstances can mechanical theories be truer than realist metaphysical causes. On the other hand, in Berkeley's ultra-Newtonian discourse of science, there is another type of causation in the mechanical domain. My pragmatist reading of causation here upholds that mechanical theories take a reliable method to truth when they are deliberated in causal terms or mathematical hypotheses. Nonetheless, many commentators accept Berkeley's instrumentalism about mathematical hypotheses that work for the utility of mechanical causation formulated therefrom, irrespective of truth-values.⁴⁵

According to the instrumentalist reading, mathematical hypotheses or theoretical terms like 'gravity' do not refer to any physical entities. Nonetheless, they are useful as formal tools to formulate scientific theories and thereby calculate in deductive reasoning for the prediction of phenomena (Buchdahl 1969, 285–288; Peterschmitt 2003, 186–188).⁴⁶ On the other hand, unlike the instrumentalist reading, the reductionist reading does not straightforwardly direct us to the utility of mathematical hypotheses. This is because the translatability of dynamical terms to kinematical

⁴³ Newton-Smith also proposed another form of instrumentalism, 'epistemological instrumentalism', in contrast with his upholding 'semantical instrumentalism' (1985, 150). Unlike the latter, the former instrumentalism presupposes theoretical sentences having truth-values, but this does not lead to our understanding of scientific practice, where the scientist's concern is only with empirical adequacy, irrespective of the sentences being true or false. That is why he shifts the subject matter from epistemological to semantic problems in Berkeley's philosophy of science, in the light of theoretical sentences being used as tools for observational predictions. However, I contend with Newton-Smith that theoretical sentences do convey truth-values and stay confirmed, as long as they are inferred in causal deliberation by the human mind/agent.

⁴⁴ See Peterschmitt 2008, 19, n. 3, as to the critique of the above too broad treatment of instrumentalism by Jesseph.

⁴⁵ In Chapter 1.1.1, the pyramid model grounded Berkeley's pragmatist theory of mechanical causation on the logical foundation and semantic level of truth-values.

⁴⁶ Here and there, Luc Peterschmitt (2003) does not take the instrumentalist reading as I identify, but criticises it.

terms primarily accounts for Berkeley's scientific discourse. However, in speaking about natural science, Berkeley frequently employs the notion of 'cause' in such theoretical terms as 'force, gravity, attraction' or 'mathematical hypothesis', because they are 'useful for reasonings and calculations about motion and moving bodies' (*DM* §17).⁴⁷ With this instrumentalism, without implying reductionism, one may interpret that the notion of 'cause' is deeply involved in Berkeley's explanation of Newtonian mechanics.

Specifically, in distinguishing the metaphysical nature of incorporeal things that mechanical theories cannot reveal (*DM* §71), Berkeley champions (Newton's) 'clearest theorems of mechanical philosophy' that can unveil 'secrets of nature' under 'human calculations' (*DM* §66). This distinction between Berkeley's metaphysics and (Newtonian) mechanics is germane to understanding Berkeley's use of causal terms in his plausible instrumentalism. Here, one may read that all mathematical hypotheses can be instrumental in explaining theories – for example, 'the cause of the descent of heavy bodies' or gravity (*DM* §4). This is because, according to Lisa Downing (1995a, 199), Berkeley denies dynamical realism in the sense that the theoretical term 'force' cannot be derived from 'spirits' (incorporeal things) beyond 'mechanics and experimentation' (*DM* §42). Apart from Berkeley's metaphysics of spirits (including the human minds, *DM* §25), causal laws in his instrumentalism can be maintained in theoretical and practical sciences insofar as 'the system of the world is subjected to human calculations' (*DM* §66). This is because between certain co-associated variables, (Newtonian) mechanics deals with mathematical hypotheses that refer to non-physical entities (e.g. 'gravity' denoting nothing), without relying on determinism or teleology. Then, on the instrumentalist reading, the significance of sentences involving mathematical hypotheses is held in their utility or 'applicability, not in descriptive content', regardless of truth-values (Downing 2005, 251).⁴⁸ For this reason, the utility of formulating theories in causal terms in low-level theoretical sciences can be instrumentally understood. Hence, certain fully-fledged views of instrumentalism, ranging from low-level fundamental theories to high-level practical sciences, may be found in Berkeley's philosophy of science that flexibly deploys the notion of 'cause' and causal terms.

However, on my view, the instrumentalist argument against dynamical realism is confronted with an objection from a pragmatist viewpoint on the content of causal terms such as gravitational 'force'. Amongst the proponents of instrumentalism, Downing (1995a, 212–213) posits a premiss that 'the term "force" is empty of any significance adequate to secure reference', so as to conclude the argument against dynamical realism.⁴⁹ There is *prima facie* no realism about dynamics in Berkeley's analysis of mechanical causes, for it is empirically adequate to secure the reference of causal terms by sensory significance when all the known qualities of bodies are passive (*ibid.*, 200, 206; *DM*

⁴⁷ See also *DM* §§39, 61; 'beneficial [...] of use' in *Alciphron* §7.10; *Siris* §234; Buchdahl 1969, 288.

⁴⁸ Criticising the instrumentalism lacking 'descriptive content' without truth-values, Ott (2019, 7) points to the utility or applicability as 'prescriptive'. On this point, I side with him against the instrumentalist reading.

⁴⁹ As to why such causal terms as 'forces' are not eliminated—but locutions or theoretical sentences involving them stay meaningful and can be true in Berkeley's scientific discourse—see my pragmatist Def 3; Pearce 2017c, 86, 93–94, n. 16; *DM* §66; *Alciphron* §7.10. It should be noted that due to his approach to Berkeley's use theory of meaning, Kenneth Pearce does not take the instrumentalist position like Downing's. In Chapter 2, more textually, I consider a critical connection between the linguistic use theory and a pragmatist theory of caution in *DM*.

4.4 Instrumentalism undermined

§§21–22, 29). Except for the metaphysical and metaphorical references to (infinite and finite) spirits, there is no active efficient cause for bodily motion and rest independent of sensory observation in the domain of mechanics. Therefore, theorising in causal terms does not signify any underlying entities, such that forces are pure fictions as long as the utility or applicability is maintained.

Providing the above point, it is worthwhile to consider this section in *DM* (emphasis added):

§39. [J]ust as geometers for the sake of their discipline contrive many things which they themselves can *neither describe, nor find in the nature of things*, for just the same reason the mechanist employs certain abstract and general terms [*voces*], and imagines in bodies force, action, attraction, solicitation, etc. which are *exceedingly useful in theories and formulations, as also in calculations* concerning motion, even if in the very *truth* of things and in bodies [*rerum veritate & corporibus*] actually existing they are sought in vain, no less than the *geometers' fiction*⁵⁰ by mathematical abstraction [*a geometris per abstractionem mathematicam finguntur*].

Indeed, nowhere can the ‘truth of things and in bodies’ be found on the instrumentalist reading. On the other hand, in Berkeley’s supposition, the truth of mechanical causation (from ‘abstract and general terms’ to ‘theories and formulations’ by ‘calculations’) is framed, so that it can be confirmed (i.e. judged either true or false) and expressed. That is, this instrumentalist reading is fallacious by excluding the very agent who uses causal terms, formulates the laws of motion and gravity, and calculates therefrom. My pragmatist standpoint here is that, putting aside the metaphysical domain, our finite spirits/minds must be identified as the agents deliberating on mechanical causation as true theories for our temporal needs and practices.⁵¹ In this sense, the content of theoretical sentences in causal terms cannot be empty or fictitious; instead, it is truth-apt within the use of the agent or deliberator.

As seen in the earlier section on the reductionist appropriate language and terms, the point in my objection is inference to empirically ‘sensible effects’ in a correct use of language and common sense against ‘occult qualities’ in theorising law-propositions true to ourselves (*DM* §§1–6).⁵² Although the instrumentalist agrees that causal terms like ‘force’ and ‘gravity’ are not rejected for utility, the point in my objection to the reading is inference to effects in our correct ‘use [*usus*]’ (*DM* §28) of language that conditions or frames true theorems in ‘mechanical practices’ (*DM* §42).⁵³ Berkeley stresses that the formulations of mechanical theories hinge on the correct use or ‘assigning’ of causal terms by the human agent or ‘philosopher’, as follows (*DM*, emphasis added):

⁵⁰ Unlike Luce’s rendition of ‘geometers’ fiction [*finguntur*]’, the other commentators translate the phrase into ‘things geometers frame’ (Jesseph 1992); ‘things that geometers invent’ (Clarke 2008), etc. See also Peterschmitt, [forthcoming](#).

⁵¹ This deliberative approach to causation does not imply metaphysical causal powers but directly refers to the agent of causal deliberation in its evidential framework. See Fernandes 2017, 690.

⁵² See also *Principles* intro §§1, 6, 8; *Correspondence* to Johnson (1730, §3, *Works* II).

⁵³ Berkeley’s deliberative, pragmatic approach to theoretical, causal terms is also evident in his early works regarding the use of words: ‘The impossibility of defining or discoursing clearly of most things proceeds from the fault & scantiness of language’ (*Notebooks* §178), such that ‘the chief thing I do [...] is only to remove the mist or veil of words’ (§642). Thereby we realise the following: ‘Words (by them meaning all sorts of signs) are so necessary that [...] wthout them there could in Mathematiques themselves be no demonstration’ (§750). See also *Notebooks* §§513, 537, 553, 596, 636, 638, 696; *Principles* intro §§1, 6, 8; *Dialogues* 1.199, 3.239; *Correspondence* to Johnson (1730, §3); *DM* §§1–6, etc.; White 1955, 172.

§37. [C]ertainly something can be said to be explained mechanically when it is reduced to these most simple and universal principles, and its harmony and connection with them is shown by accurate reasoning. For once the laws of nature are found, then the *philosopher* is to show that from the *constant observance* [*observatio*] of these laws, that is from these principles, any phenomena necessarily follow. This is what it is to explain and solve the phenomena and to *assign their cause, i.e. the reason why they occur* [*ratio cur fiant*].

From this vital passage, I interpret that the mechanical ‘philosopher’ is to resolve why phenomena deductively conform to the laws of nature (or why they are constantly derived from the laws) after the patterns of laws have been inductively ‘found’ in nature. This practice in mechanics or the ‘constant observance’ aims to establish scientific explanations to predict the probability of phenomena or effects by *assigning or deploying* their ‘cause’ (or ‘reason’) in causal laws that condition on their effects.

Here, on my reading, the question is whether causal laws through the ‘constant observance’ are to express one of three possible entities:

- (i) Something confirmable;
- (ii) Something fictitious; or⁵⁴
- (iii) Something neither confirmable nor fictitious.

I must bracket—or do not examine—the third view, because Berkeley does not imply both non-confirmable and non-fictitious entities from a correct use of abstract causal terms that meaningfully work. That is, as long as terms are meaningful, they assume certain truth-values of those statements.

Instead, my pragmatist reading takes the first view that the statements of causal laws are to be confirmable or confirmed (i.e. nothing fictitious). This is because theories formulated from mathematical hypotheses (causal terms) possess truth-values, or truth, so that we, agents, can constantly demonstrate a reliable belief, or certainty, rooted in our causal deliberation (*DM* §38). To this effect, I argue that a set of confirmable entities denoted by causal terms are truth-makers for truth-bearers, which are law-propositions.⁵⁵ For instance, such truth-makers are mechanical phenomena or mechanistic worlds defined by causal terms, ‘mathematical hypotheses’—‘force’, ‘gravity’, ‘attraction’, ‘impetus’, etc.

Conversely, the instrumentalist reading takes the second view that the agent does not have to confirm theories formulated from mathematical hypotheses to be either true or false. Put differently, the instrumentalist Berkeley does not determine truth-makers for law-propositions, in the condition that formulated theories are mere fictions. This is because conveying truth-values does not matter if the theories show the utility for correct predictions. Thus, mathematical hypotheses can themselves

⁵⁴ I exclude something both confirmable and fictitious, because it is a self-contradiction when fictions are never confirmed in reality. Whence the first two options are mutually exclusive or disjunctive. I view that Berkeley did not intend to infer a *reductio* argument in *DM*.

⁵⁵ Supposing truth-makers concurs with my logicist (or realist) reading of Berkeley’s mathematical thinking for formulating mechanical causation, as put forward in the pyramid model in §1.1.1. See also Mulligan, Simons, and Smith 1984, 297, for logical definitions of the ontology of truths or true sentences *in virtue of* ‘truth-makers’.

4.5 Pragmatism defended

be pure fiction or empty. That is why it is irrelevant for the proponents of instrumentalism to wonder whether causal laws are true or false inasmuch as we are constantly observing them.

Nonetheless, I contend that instrumentalism, such as Downing's instrumentalist argument against dynamical realism, is fallacious. This is because, on the instrumentalist reading, the finite mind—or the agent deliberating on mechanical causation—cannot soundly deduce the conclusion of useful explanation without understanding whether formulations are true or not in our linguistic use. On my pragmatist reading, only when deliberating on mechanical causation can the certainty of truth *in* formulations be maintained or continuously observed, whereby we have useful explanation. That is, we come to know that causal theories or law-propositions are confirmed (committed) to be true within the linguistic definition in our temporal deliberation. Hence, for the pragmatist Berkeley, there exist truth-makers in virtue of which causal laws formulated from mathematical hypotheses are true.

This section has thus examined the instrumentalist reading of causation in Berkeley's *DM*. One may see that instrumentalism is deductively valid in low-level fundamental mechanical theories to infer causal laws in high-level practical sciences for the utility or applicability. On the instrumentalist reading, therefore, theories formulated in causal terms like gravitational 'attraction' and 'action' are not necessarily true, but they can be merely fictitious. However, this instrumentalism is unacceptable for Berkeley, since the instrumentalist utility loses the content of truth despite being ascertained in the human causal deliberation. On my pragmatist reading, the human deliberation rather infers truths or affirms truth-makers, whence we ourselves can define mechanical causation of bodily motion to the extent of our knowledge. In the next section, I will explain why I have deemed my reading of Berkeley's pragmatism about causation to be sound.

4.5 Pragmatism defended

Finally, this section is my vindication for Berkeley's pragmatist theory of causation in *DM*.⁵⁶ What is taken to be pragmatic is, in my interpretation, confirming true causal laws expressed in the use of mathematical hypotheses within the limits of our temporal, personal deliberation.⁵⁷ In support of my version of pragmatism, I propose two components inclined to my version of pragmatism: (i) causal deliberation within one's epistemic limits and (ii) BIBE, i.e. Berkeleyan Inference to the Best

⁵⁶ Though taking a different, reductionist reading of his own, Myhill (1957, 147, emphasis added) previously observed a pragmatism in *DM*: 'So long as we do not hypostatize the concepts of force, gravity, etc., which appear in those formulae, we have not in Berkeley's view violated any principles of methodology or metaphysics. The kinship to Quine and Nagel's variety of *pragmatism*, or to Mach's doctrine of the economy of thought, is evident.' Instead, my pragmatist reading in Chapter 5 will primarily be concerned with the earlier American pragmatist C.S. Peirce's reception of Berkeley's pragmatic method about causation in science.

⁵⁷ In a more general sense than talk of causation, pragmatism is a theory of truth that 'a belief is true if and only if it is useful', according to Peirce, 'the inventor of Pragmatism' (Ramsey 1991, 91–93). As Ramsey goes on to argue, a belief that ϕ is ψ forms a habitual action or inference to the utility of that belief. Here, from a truth-making perspective, one may view that there are entities that make the sentences of ϕ and ψ true. On my reading, one's deliberation about causation from the past to the future within one's knowledge comes into play in this habitual, conditional, or pragmatic inference. See also Fernandes 2017, 704–705.

Explanation. From the two facets, I consider that BIBE reliably leads us to confirm true theories in the human causal deliberation. Thereby I will argue that this pragmatist reading is the most compelling interpretation of Berkeley's treatment of mechanical causation formulated in theoretical terms or mathematical hypotheses.

4.5.1 Berkeley's deliberation of mechanical causation

Thus far, the following points are clear. First of all, mathematical hypotheses ('force', 'gravity', 'attraction', and such causal terms in laws of motion) relate to unobserved and unobservable entities (occult qualities) as they are theoretically useful for reasonings and calculations about motion (*DM* §§4–6, 17). In addition, there is a certain division of labour between the metaphysician and the physicist or mechanist (*DM* §§37–42).⁵⁸ On one hand, we humans do not comprehend divine cause in the theological, metaphysical domain, including other animate beings like us (*DM* §§3, 25, 72). Berkeley criticises 'metaphysical abstractions' in Leibniz and Borelli (e.g. 'dead force' and 'expansive force') as they involve unnecessary metaphysical problems about motion beyond the senses and experiments (*DM* §§8, 11, 16, 19).⁵⁹ On the other hand, in the domain of mechanics from low-level fundamental to high-level practical sciences, I construe that Berkeley addresses causal talk of useful theories for finite minds, who need to deliberate on 'mathematical hypotheses and abstractions' (*DM* §40)⁶⁰ framed or assigned in law-propositions. There, if we take a deliberative approach to causation, then Berkeley's causal talk in mechanics is indispensable and confirmed (committed) to be genuinely true as long as finite minds are inferring mechanical causes for their needs. This leads to Berkeley's pragmatism about causation that I endorse.

I will focus on the following passage in *DM*, which textually supports the deliberative approach to mechanical causation (emphasis added):

§67. We have now to discuss the question of the cause of the communication of motions [...]

⁵⁸ On the distinction of metaphysical and mechanical domains, see [Chapter 2](#); especially *DM* §38: 'as by the application of geometrical theorems the particular magnitudes of bodies are measured, so also by the application of the universal theorems of mechanics the motions of any parts of the mundane system, and the phenomena which depend upon these motions, become known and are determined: and this is the only goal at which the physicist should aim.'

⁵⁹ *DM* §19 (emphasis added): 'Aristotle once posed this question, whether *motion is made and passes away*, or whether it exists from eternity. *Physics*, Book 8. *That sensible motion perishes is plain to the senses*, but it seems that they will have it that the same impetus and nisus, or the same sum of forces remains. Whence Borelli affirms that the force in percussion is not diminished but expanded, and even that contrary impetus are received and retained in the same body. Likewise, Leibniz contends that *nisus* is everywhere and always in matter and, where it is not evident to the senses, it is understood by reason. But it must be admitted that these things are *abstract and obscure*, and of nearly the same sort as substantial forms and entelechies.' Interestingly, here, Berkeley takes a neutral position to Aristotle's account of motion. Instead, only in representing Borelli's and Leibniz's metaphysically 'abstract and obscure' notions in force and matter does he take the offensive.

⁶⁰ Within the mechanical domain, I consider both mathematical hypotheses and abstractions (e.g. 'forces') to be part of the linguistic, pragmatic framing to make 'formulations/statements [*enunciaciones*]' truth-apt (*DM* §§38–40). In these sections of *DM*, I take it that both 'being formed/framed [*efformandae/finguntur*]' and 'framing/imaging [*fingit(que)*]' are part of confirming or deliberating on true law-propositions (theories), including theorems, in one's mechanical practice. On the term 'abstraction', which Berkeley does not discard in the mathematical method or inference in mechanics, unlike the metaphysically abstract essence of things, see [Chapter 3](#); *DM* §§17, 47, 66; *Siris* §§234, 323, 354, etc.

4.5 Pragmatism defended

all forces attributed to bodies are as much mathematical hypotheses as are attractive forces in the planets and the sun. Mathematical entities, however, have no stable essence [*stabilem essentiam*] in the nature of things: they depend on the notion [*notione*] of the definer [*definiētis*].

I construe from here that mathematical hypotheses, such as force and attraction, contain no ‘stable essence’ themselves, such that they hinge on the linguistic use of the ‘definer [*definiens*]’ or finite mind as the *deliberator* to confirm the laws and theorems. On this point, the instrumentalist readings takes it that Berkeley’s mathematical hypotheses without fixed essences are merely ‘geometers’ fictions [*finḡit/finḡuntur*]’ (*DM* §39) for the utility of mechanical theories. In fact, the Latin verb *finḡere*, appearing twice in §39, does not straightforwardly mean the instrumentalist notion of mere ‘fiction’ (*fictio*). *Pace* many of the previous translators, interpreting Berkeley’s original Latin text as the phrase ‘geometers’ fictions’ is misleadingly unclear, even if the Latin noun *fictio* (‘fiction’ in English) is derived from the verb *finḡere/finḡo*. As Pearce (2017c, 95) translates the Latin verb as ‘feign’, meaning ‘make, invent, or contrive’, I interpret *finḡere* as a synonym of *invenire*. In the sense of ‘inventing’ or ‘making’ (though not ‘feigning’ that connotes falseness),⁶¹ one can rather see the pragmatically true definitions or theories deliberated within epistemic limits through the inventive *definer/deliberator* (agent). From Berkeley’s emphasis on ‘a faculty of changing [*mutandi*]’ in the mind (*DM* §33),⁶² I read that *finḡere/invenire* fits within a pragmatic scope of the finite mind’s theoretical imagination, whereby deliberating or confirming law-propositions to be true. This is because Berkeley’s scientist (agent) inferentially or deductively defines correct—or genuinely true—formulations from mathematical hypotheses for themselves. To this end, the instrumentalist construal that mathematical hypotheses are literally fictitious in inferring correct predictions is a *non sequitur*.

In other words, I contend that theoretical formulations for utility from mathematical hypotheses are neither fictitious nor potentially false but rather genuinely confirmed, as long as they reliably make us believe the truth in causal talk *by* the agent. For, I argue, they are always defined by the deliberating finite mind within its inventive scientific knowledge. Here Berkeley claims that the scientist or ‘human mind delights [*gaudet*] in extending and expanding its knowledge’ but to the extent to which the following is true in *DM* (emphasis added):

§38. [G]eneral notions and propositions must be *formed* [*efformandæ*], in which particular propositions and knowledge are in some way *contained* [*continentur*], which are then, and only then, *believed to be understood* [*intelligi creduntur*].

This indicates that our finite minds linguistically confirm or deliberate on the ‘notions and propor-

⁶¹ See also Carey 2012, 20–23; §3.2.2 on the distinction of Newton’s *hypothesis non finḡo* and Berkeley’s ‘framing’ of *hypothesis*. I read that the pragmatist Berkeley regards formulations in causal terms as true, neither false nor fictitious, to express their utility in one’s mechanical practice. When he does not imply falseness in framing (*finḡere*) or formulating causal theories, his stance appears close to Newton’s renowned proposition: *hypotheses non finḡo*. However, I read that Berkeley takes the term ‘hypothesis’ (supposition) to be determinate in framing law-propositions, unlike Newton’s rejection of the term.

⁶² See also *Siris* §335: ‘figments of the mind’.

tions’ to the extent to which we have the deduced (i.e. ‘formed’/‘contained’) or defined knowledge.⁶³ Therefore, we can understand the deliberated law-proposition to be true—unable to be fictitious—for ourselves. To that extent, the definition or deliberation of causal terms (mathematical hypotheses) for theorising the laws of motion is ‘certain’ or reliably believed for the finite mind (*DM* §25).⁶⁴ *A fortiori*, the reason that the finite ‘mind [*mens*]’ is regarded as the principle of motion is ‘fortified by *personal experimentation* [*propria experientia*] and fully approved in the judgements of the most learned humans of all ages’ (*DM* §31, emphasis added).⁶⁵ These passages in *DM* highlight the epistemic limitations of our finite minds to the extent that we can deliberate on a reliable, deductive method to formulate laws of motion from mechanical causation that must be true within our personal, finite time of deliberation.⁶⁶ Therefore, in Berkeley’s scientific discourse, our own deliberation of the certainty of causal laws is inferentially analyzed within our temporal conditions.⁶⁷ This leads to my pragmatist defence that causal laws are indispensably conditioned in our deliberation as long as we theorise them to be true. Hence, the Berkeley of *DM* has the pragmatist theory of causation to the effect that one can deliberate on true formulations (theories and theorems) from a mathematical hypothesis, such as ‘attraction’:

§28. [I]n mechanical philosophy the truth [*veritas*] and use [*usus*] of theorems about the mutual attraction of bodies remain firm, [...] whatever is deliberated [*quaecunq̄ue tradita*]⁶⁸ of the rules and laws of motion, and also of the theorems deduced [*deducta*] from them, remains unshaken.

In this way, the *truth of useful* mechanical theories is deliberatively confirmed. Thus far, this sort of

⁶³ *DM* §36 (emphasis added): ‘the principles of experimental philosophy are properly called the foundations upon which rests, or the sources from which derives [...] *our knowledge of corporeal things*, and these foundations are sensation and experimentation [*sensus utq̄ue & experientia*]. Similarly, in the mechanical philosophy, those things are to be called principles in which the whole discipline is founded and contained: those primary laws of motion which are proved by experiments, refined by reason, and rendered universal.’ From here, I construe that this is how the knowledge of bodily motions is formed and contained in Berkeley’s discourse on natural philosophy including experiments and mechanics from the human senses and experiments (experiences). What Berkeley means by the ‘natural philosophy [...] is almost completely confined to experiments and mechanics’ (*DM* §§34, 42).

⁶⁴ See the full quotation of §25 in this chapter §4.1.2 above.

⁶⁵ More specifically, albeit reminding Descartes’s meaning, by the Latin term ‘*mens*’ Berkeley means the Greek term ‘*νοῦς*’ that Anaxagoras first introduced in the sense of ‘a thinking, active thing [...] soul, mind, and spirit’ (*DM* §§30, 32). I construe that these terms in the context are all applicable to human finite ‘beings that have life [*animatis/animae*]’ (*DM* §3), not just God.

⁶⁶ *DM* §66 (clarification/emphasis added): ‘through [theorems of the mechanical philosophy] the recesses of nature [*naturae recessus*] are opened up and the system of the world is subjected to human calculation [*calculus humanus*].’ That is, in the Berkeleyan geometrical reasoning in [three steps](#) defining [three tiers](#) of mechanical language, our finite mind infers the mechanical causal laws, whereby the mind can calculate the physical motion within its knowledge.

⁶⁷ See also Price 2007, 279, n. 24: ‘The constraint comes from the needs of the deliberative standpoint, as instantiated in creatures whose epistemic access is to things in the past [...] the notion of choice seems to presuppose a personal time in which choice takes place. So such an agent cannot be entirely atemporal, even if it occupies a different time dimension than the one in which its god-like interventions manifest themselves in our world’. Although I do not delve into temporal problems here, I agree with Price that one’s causal deliberation is set by epistemic limitations within one’s personal time.

⁶⁸ The translation of *quaecunq̄ue tradita* (*DM* §28) differs in the following: ‘whatsoever things have been laid down’ (Wright 1843); ‘traditional formulations’ (Luce 1951; *Works* IV); ‘whatever is said of’ (Jesseph 1992); ‘whatever is taught about’ (Clarke 2008); ‘in what terms they are formulated’ (Belfrage, [forthcoming](#)). I interpret the Latin *tradita* as ‘deliberated’ in the sense of being carefully formulated whereby orally propounded.

4.5 Pragmatism defended

deliberation of mechanical causation, in which both truth and utility are defined, confirmed, and thus expressed, is the first point on my defence of Berkeley's pragmatist theory of causation.

4.5.2 Berkeley's inference to the best explanation

Furthermore, construing Berkeley's theory of causation in the domain of mechanics, I attribute to it my view of Inference to the Best Explanation. IBE is a causal model regarding inductive reasonings discussed in philosophy of science.⁶⁹ Most notably and viably, this causal model was championed by Peter Lipton, in the form of scientific realism about 'inferences to unobservable causes' (Lipton 2004, 200).⁷⁰ Specifically, our inductive criteria in IBE are 'truth-tropic', by which Lipton means that IBE reliably takes scientists towards the approximate truth or true theories (*ibid.*, 57, 184–186). More specifically, according to the truth-tropism in IBE, if one takes an inductive reasoning to observable causes, then one ought to take the same reasoning to *un*observable causes for presumably true theories. I apply this IBE towards truth to Berkeley's scientific realism in confirming the utility of unobservable occult qualities referred to by force and gravity (mathematical hypotheses *en masse*). This is because I read that Berkeley's theoretical formulations of causal laws are truth-tropic in a reliable method of the deliberation by finite minds. Hence, in relation to the deliberative approach, I call this inductive inference BIBE in a pragmatist key.

With BIBE, I thus argue that the causal terms, even referring to unobservable qualities, are formulated in accordance with approximate truth of mechanical theories to the extent that finite minds deliberate on useful theories to be true. Here, Berkeley's pragmatism of mechanical causation comes into play in the sense that from a limited (not infinite) set of data, we are habitually inclined to believe the certainty of theories to be true when we are deliberating on the utility of formulations in causal terms. Put another way, the reliable method for mechanical theories like Newtonian laws of motion from mathematical hypotheses (causal terms) is maintained in this inductive inference, which can be identified as BIBE.

Indeed, in order for Berkeley to ascertain the truth of causal laws including theorems, mathematical hypotheses are supposed to be useful for reasoning and calculating about motion and moving bodies. If this is taken to be his scientific reasoning, I read that we reason in Berkeleyan Inference *to*

⁶⁹ In the context of *DM*, I read Berkeley's inductive method in science based on one's 'sense and experiment' (§21). I further take it that by the term 'induction' Berkeley means 'experimental' philosophy, as distinguished from 'speculative' philosophy with reason and principles. Both experimental and speculative philosophies are two subdivisions of natural philosophy in early modern times from Bacon, Newton, Boyle, and Locke (Anstey 2011, 3–9, n. 9). See, for example, John Sergeant (1696, Preface, b6.recto-verso): 'The METHODS which I pitch upon to examine, shall be of two sorts, viz. that of *Speculative*, and that of *Experimental* Philosophers; The Former of which pretend to proceed by *Reason* and *Principles*; the Later by *Induction*; and both of them aim at advancing *Science*.' In fact, unlike the above experimental philosophers and Berkeley, the Aristotelian Sergeant argues against the 'Way of Experiments or Induction', as it 'can never breed Science' without the assistance of reason and principles (*ibid.*, d5.r-v, 246).

⁷⁰ According to IBE, 'our inferential practices are governed by explanatory considerations. Given our data and our background beliefs, we infer what would, if true, provide the best of the competing explanations we can generate of those data (so long as the best is good enough for us to make any inference at all)[... for] explanatory considerations are a guide to inference' (Lipton 2004, 56). This suggests that Lipton's argument specifically assumes inferential and explanatory realism, which I think is compatible with Berkeley's mathematical and pragmatic reasoning of mechanical causation.

the Best Explanation in scientific inquiry towards a reliable belief (what is believed to be at work in our linguistic and mathematical use of causal terms), in addition to the deductive-nomological model *from* the best explanation.⁷¹ In this primarily inductive BIBE, mathematical hypotheses are assumed to be useful in generalising the reasoning for probably true theories (formulations/sentences). This utility to frame from mathematical hypotheses implies that, even referring to unobserved and unobservable entities, formulations involving them are confirmed (committed) to be truth-apt and meaningful in *pragmatic* scientific inquiry of the finite minds like us (animate beings/thinking active things) (*DM* §§3, 25, 30–33). If we reason in BIBE towards approximate truth, then the formulations from mathematical hypotheses are confirmed in our pragmatic scientific inquiry. Therefore, I consider that Berkeley has a pragmatist theory of causation in BIBE, in deliberating on the utility within the agent’s correct use (framing) of mechanical formulations. To this effect, my pragmatist reading of Berkeley’s causal deliberation in BIBE can be favoured over the other readings, such as instrumentalism that takes theoretical formulations to be mere fictions lacking truth.⁷²

Finally, I criticise an alternative reading of Walter Ott (2019, 7, n. 2) who takes a deductive model of causation as the best system imaginable in terms of Berkeley’s law-statements and objection to occult qualities, as opposed to the instrumentalist and reductionist readings. However, *pace* Ott, demonstrating a deductive model from reason is not adequate in interpreting Berkeley’s theory of causation in *DM*. In addition to the deductive reasoning, I argue that Berkeley willingly undertakes his empirical, inductive method regarding causal terms, following ‘what sensation and experimentation tell us, and reasoning that *rests upon them*’ (*DM* §21, emphasis added).⁷³ My pragmatist reading here reinforces the point that Berkeley first empirically and inductively formulates mechanical theories in causal terms like ‘forces’. Thereby we can infer the approximate truth about mechanical causation in BIBE. Then and only then, in the final geometrical reasoning or mathematical demonstration, mechanical causation can be defined, deliberated, and confirmed for the human mind’s temporal needs or practices. To this effect, also based on the deliberative approach, Berkeley has a pragmatist theory of mechanical causation. Providing BIBE, the agent deliberates on true propositions about sensible qualities (bodies in motion/at rest) in the inductive reasoning, whereby also inferring the utility of objects having unobservable, occult qualities.

Thus, this section has explained why I vindicated the pragmatist reading in the deliberative approach to causation in the truth-tropic BIBE. The reading is to cast clearer light than the other

⁷¹ On the deductive(-nomological) system, see *DM* §37; *Siris* §228; *Principles* §107. That is, Berkeley keeps employing a deductive reasoning, whereas my BIBE reinforces his inductive reasoning in line with deduction in *DM*. See also Ramsey 1978, 131; Lipton 2004, 57–58. In particular, related to Berkeley’s *DM* (e.g. §20), Leibniz deploys his version of hypothetico-deductive model of mechanical causation. See his ‘Specimen dynamicum’ (1695; 1969, 448).

⁷² Ott (2019, 7) argues, against the instrumentalist reading, that ‘[l]aw-statements can be true in an unproblematic sense: they correspond to the rules God observes in producing his effect.’ Here I agree with him on the first clause, but *not on the second one after the colon*, because without recourse to the divine rule involving the metaphysical domain, the definer or deliberator like us can formulate law-propositions from mathematical hypotheses to be approximately true for our temporal needs. In effect, Berkeley does not refer mechanical causation to statements about divine metaphysics in *DM*. Epistemically distinguished from the metaphysical domain, our finite minds cannot comprehend whether our statements of causal laws in the mechanical domain correspond to the infinite divine truth in metaphysical causation.

⁷³ See again §3.1 for my orchestration of the three elements, three ingredients of the pragmatist definition, and three steps regimented for Berkeley’s pragmatist theory of causation.

4.5 Pragmatism defended

readings upon what Berkeley himself intended to prove in commenting or deliberating on (Newtonian) mechanical theories formulated from mathematical hypotheses. Not merely deductively, but also inductively in Berkeley's discourse on natural philosophy, I uphold that the finite mind (agent) infers certain or true mechanical theories from the observables to the unobservables within one's epistemic limitations.

Conclusion


Consequently, Berkeley scholarship has hitherto branched out into conflicting readings of his theory of causation in *DM*. The interpretative point in question was whether truth was involved in theorising or expressing the practical utility of 'mathematical hypotheses' (e.g. causal terms 'attraction', 'gravity', and 'force') that refer to unobservable qualities in mechanics and dynamics. I answered in the affirmative from Berkeley's pragmatist viewpoint. I justified that there must be a reliable belief or certainty that causal laws must be true, insofar as the temporally finite mind defines or deliberates on correctly framed theories for themselves in BIBE and then deductively. In this pragmatist sense, there must be truth confirmed in the use of theories and law-propositions formulated from mathematical hypotheses.

In the upshot, within the deliberation of propositions through constant observance, not only can our minds realistically affirm unobservable entities in BIBE, but also pragmatically express mechanistic worlds formulated from mathematical hypotheses as truth-makers for causal laws as truth-bearers. However, the other readings—reductionism, structuralism, and instrumentalism—fail to justify this point. In other words, it is mistaken not to identify who is the agent that employs causal terms, formulates causal laws, and calculates therefrom. The mechanist's step-by-step approach to causation is rooted in the three elements of sensation, experimentation, and reasoning for the Berkeley of *DM*. Without involving the metaphysical domain, it is the human, finite mind that deliberates on whether mechanical causation is genuinely true within its temporal, epistemic limitations in the context of *DM*. To this end, my pragmatist reading of mechanical causation in Berkeley can be favoured over the other readings.

Chapter 5

Peirce's Reception of Berkeley's Pragmatist Theory of Causation

Introduction

ow has Berkeley's pragmatist theory of causation developed since his day? This final chapter will argue that George Berkeley's interpretation of scientific language or causal vocabulary was significantly received in C.S. Peirce's (1839–1914) pragmatism.¹ Berkeley being an Anglican bishop, and Peirce's life being linked to the Episcopal Church,² a chief emphasis will be placed upon Peirce's deriving his pragmatic method from Berkeley's philosophy of language in their discourses on mechanical causation. This initially concerns Peirce's uncommon interest in Berkeley's philosophy. Remarkably, at least three times, he reviewed Berkeley's *Works*, including *Manuscript Introduction* (to the *Principles*), in which he identified his version of Berkeleyan

¹ The abbreviations of Peirce's oeuvre are as follows:

CP *Collected Papers*, 1931–58;

CS *Contributions to the Nation*, 1975–87;

MS 'Manuscripts in microfilm rolls' in *Annotated Catalogue*, 1967;

NEM *New Elements of Mathematics*, 1976;

P *Pragmatism: The 1903 Harvard Lectures on Pragmatism*, 1997.

² The first and second sections of this chapter are a version developed from my previous discussion over the two pragmatists' accounts of religious language, 'Semiotics against Transubstantiation: Peirce's Reception of Berkeley' (Oda 2021). According to Peirce's draft letter (24 April 1892) to the Rev John Wesley Brown (Rector of St Thomas Church, Fifth Avenue, in New York City), he had a 'mystical' experience of the Eucharist: 'no sooner had I got into the church than I seemed to receive the direct permission of the Master to come. [...] But when the instant [of the communion] came, I found myself carried up to the altar rail, almost without my own volition' (*MS* L482, clarification added). Also, drafting 'The First of Six Lessons in Elocution for Episcopalian Ministers' (*MS* 1570), Peirce intended to apply for a vacant post at the Episcopal Church's theological seminary but in vain. Peirce was born to a devout Unitarian father Benjamin Peirce (Harvard professor of mathematics) but converted to the Episcopal Church in 1863 when he married the first wife Zina Fay, who partly influenced him to espouse Trinitarianism. We have no evidence that Peirce apostatized from Christianity. See H. Johnson 2006, 552–562. The Episcopal Church is the American branch of the Anglican Communion, as the Church of Ireland, to which Berkeley belonged, is the Irish branch.

nominalism.

Berkeley's original *Manuscript Introduction* (1708) reads: 'whatsoever proposition is made up of terms standing for general notions or ideas, the same is to me, so far forth, [absolutely] unintelligible' (1901 III, 370; *MI* §27).³ If terms do not denote anything particular but 'abstract and universal ideas' expressed by 'metaphysicians' (1901 III, 370), then there exist no such ideas.⁴ On this point, though arguably, one can see the budding of Berkeley's pragmatic (or use) theory of meaning, according to which there is no general or universal idea independent of its practical use of the term.⁵

The later pragmatist Peirce read Berkeley's *MI* in the first Fraser edition,⁶ as he claimed in his first 'Berkeley Review' (1871, *CP* 8.26):

In the first draft⁷ of the Introduction of *the Principles of Human Knowledge*, which is now for the first time printed, he even goes so far as to censure Ockam [sic] for admitting that we can have general terms in our mind; Ockam's opinion being that we have in our minds conceptions, which are singular themselves, but are signs of many things.

Through the medieval scholastic realist-nominalist debate, such as William of Ockham's nominalism,⁸ Peirce criticised *his version of* Berkeleyan nominalism (i.e. no abstract, universal, general ideas, notions, or mental representations) in the hitherto unpublished *MI*. In effect, Peirce was an extremely attentive reader of Berkeley's *Works*. In his 1901 review of the second Fraser edition (i.e. his third review after the 1871 and 1899 ones),⁹ Peirce rather extolled: 'Berkeley is [...] entitled to be considered the father of all modern philosophy [...] more than any other single philosopher, who should be regarded as the author of that method of modern "pragmatism"'.¹⁰ In this Peircean sense of pragmatism,¹¹ the question is whether he derived his pragmatic method from Berkeley's

³ The two Fraser editions (1871 I, 422; 1901 III, 370), which Peirce read and I quoted as above (*MI* §27), slightly differ from those of Belfrage 1987 and Luce-Jessop 1948–57 (*Works* II). The Belfrage edition of *MI* is the most detailed and annotated presentation to date.

⁴ However, this early view (*MI*, 1708) is to be modified in the published version of the *Principles* (e.g. Intro §§12, 15) and Berkeley's mature philosophy of language (e.g. *DM*, §§39, 71; *Alciphron*, §7.7), for general or universal ideas are useful and meaningful in (mechanical) theories and locutions, unless they are *abstract* or *abstracted*. More of this *anon*.

⁵ See e.g. Roberts 2017; Pearce 2017c; 2022.

⁶ *Manuscript Introduction* was first published in the first Fraser edition and also included in the second one as *Berkeley's Rough Draft of the Introduction to the Principles of Human Knowledge*, though not in the Sampson edition (1897–98). See Fraser 1871 I, 407–437; Fraser 1901 III, 357–383; Belfrage 1987, 12–13.

⁷ *MI* is arguably no 'first draft' unlike Peirce's assumption. As Bertil Belfrage (1987, 11) notes, 'it was no draft at all, and certainly no rough draft, but intended as a final copy to be printed.' Thus Belfrage adopts a neutral name 'manuscript'.

⁸ Berkeley referred to 'schoolmen call'd Nominals' (1901 III, 365–366, *MI* §19a). Ockham, whose spelling often differs, is a representative of scholastic nominalists. A passage containing this reference was erased by Berkeley himself, but the Fraser editions presented it in footnotes.

⁹ Peirce's first review (1871, *CP* 8.7–38) was on the first Fraser edition of Berkeley's *Works* (1871); the second (1899, *CN* 2.212, only one page) was on the Sampson edition (1897–98); the third (1901, *CN* 3.36–39) was on the second Fraser edition (1901).

¹⁰ See Peirce's later laudatory, perhaps exaggerating, remarks: Berkeley is 'a very distinguished master of the pragmatist mode of thinking' (c.1907, *MS* 322); 'great pabulum [i.e. food for thought] in Berkeley' (1909, *MS* 620); 'a thinker to whom I owed half what I owe to Berkeley' (1910, *MS* 663); Friedman 1997, 253.

¹¹ What Peirce meant by 'pragmatism' as 'a maxim of logic' (Lecture Four, *P* 189) is to 'Consider what effects, that might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of

philosophy of language in scientific contexts without metaphysical perplexities. I will answer in the affirmative.

In what follows, the chapter is divided into three sections. §5.1 firstly introduces what Peirce meant by ‘Berkeleyanism’ when he was constructing his own semiotic and thereby pragmatism. Here I will specifically examine Peirce’s Harvard Lectures (1903, *P*; *CP*) and his Reviews of Berkeley’s *Works* (*CP*; *CN*). §5.2 explicates Berkeley’s pragmatic method in his theory of signs or signification. For this analysis, revising Kenny Pearce’s discussion (2017c), I will apply the distinction between (genuine) reference and *quasi*-reference in Berkeley to Peirce’s use of terms or language. The former referential terms (e.g. ‘white’ about the idea of a wall) label individual ideas (objects) that exist extra-linguistically. On the other hand, in the latter use, the ideas to which we quasi-refer purely depend on the sign system for their existence, but their quasi-referential terms (e.g. ‘force’ and ‘gravity’ in physics; ‘grace’ and ‘mercy’ in theology) are useful or pragmatic in directing the disposition and action in the believer’s mind. Specifically, I argue that this referential and quasi-referential distinction lends itself to understanding Peirce’s reception of Berkeley’s pragmatic method in using terms or signs. Then, assuming this linguistic distinction of causal vocabulary in the mechanical domain, §5.3 presents my final analysis of Berkeley’s pragmatist theory of causation through Peirce and later pragmatists’ accounts of causation. For this, I will begin with an overview of contemporary understanding of pragmatic causation, such as agency theories (Price 2007; 2017, et al.), which defend the agent’s own perspective for conceptual manipulation. On this basis, as regards ‘mechanical causation’, I regiment and analyze Peirce’s argument for pragmatic causation. This will be contrasted with Berkeley’s argument, so that we can recognise their premised disagreement on the regularity or irregularity in nature as well as their consequential agreement on a pragmatic conception of causation. Consequentially, in my reformulation, the Peircean ‘practical bearings’ or effects from unintelligible mechanical causes, such as ‘force’ and ‘gravity’, can be defended by the Berkeley of *DM* for the *conceivable* utility of quasi-reference in discursive thinking.¹²

these effects is the whole of our conception of the object. [...] an application of the sole principle of logic which was recommended by Jesus; “Ye may know them by their fruits,” and it is very intimately allied with the ideas of the gospel’ (‘How to Make Our Ideas Clear’, 1878, *CP* 5.402, n. 2; *Matt* 7.20). The maxim will be considered in this chapter §5.3.

¹² Peirce’s loathsome distance from different tenets of ‘pragmatism’ by his contemporaries should be noted, whereas William James’s presentation might have been in the limelight of their age. After Peirce’s definition of ‘pragmatism’, that of James was in the next paragraph in Baldwin’s *Dictionary* (1902 II, 321):

The doctrine that the whole ‘meaning’ of a conception expresses itself in practical consequences, consequences either in the shape of conduct to be recommended, or in that of experiences to be expected, if the conception be true; which consequences would be different if it were untrue, and must be different from the consequences by which the meaning of other conceptions is in turn expressed.

On my reading, the significant of ‘conception’ in the human mind for *expressing* true meanings in consequence is rather common to the pragmatists, including Berkeley. Peirce’s maxim in the dictionary will be examined in the final section.

5.1 Berkeleyanism through the lens of Peirce's pragmatism

5.1.1 Peirce's three categories and seven metaphysical systems

Concerning each pragmatic method, it is first crucial to explain why I defend the connection between Berkeley and Peirce. This section deals with what Peirce meant by 'Berkeleyanism', and why he differed from it (the 1903 Harvard Lectures). Then, I focus on how he discovered a pragmatist 'unformulated method followed by Berkeley' (1908, *CP* 6.482) in relation to Berkeley's nominalist philosophy of language (the Berkeley Reviews).

Although paying exceptional attention to Berkeley's *Works* (as he wrote the *Works* reviews three times at least), Peirce did not precisely label himself a Berkeleyan. At the beginning of Lecture Four of the Harvard Lectures (also in Lecture Three), Peirce places 'Berkeleyanism' as one of the *seven* systems of metaphysics (*CP* 5.77; *P* 189–190). In the seven 'metaphysico-cosmical elements' within three categories, the 'Berkeleyanism' Peirce meant is a combination of categories I and III without II: that is, 'I. Nihilism [...] and Idealistic Sensualism' plus 'III. Hegelianism' but without 'II. Strict individualism. The doctrine of [Wincenty] Lutosławski and his unpronounceable master [Mickiewicz]' (*P* 189–190, 268, clarification added).¹³ According to Peirce's trichotomy (Lecture Three, *CP* 5.66; *P* 167, etc.):

First category (Firstness) 'the Idea of that which is such as it is regardless of anything else
[...] a *Quality* of Feeling';

¹³ '[A feeling of effort without a regular connection between the feeling and the occurrence of motions of matter] is a *sort of pragmatism* very much like Berkeley's inasmuch as it involves the recognition of the first and third categories [...] I make my regular argumentative attack upon this *quasi-Berkeleyan* position', as it lacks category II or *reaction* (Harvard Lecture Two, Part B: On Phenomenology [Draft One], *MS* 304; *P* 143, emphasis added). The 'seven possible classes' (*CP* 5.77; *P* 190) that Peirce postulated are:

- I Nihilism, so-called, and Idealistic Sensualism.
- II Strict individualism. The doctrine of Lutosławski and his unpronounceable master.
- III Hegelianism of all shades.
- II III Cartesianism of all kinds, Leibnizianism, Spinozism, and the metaphysics of the Physicists of today.
- I III Berkeleyanism.
- I II Ordinary Nominalism.
- I II III The metaphysics that recognizes all the categories may need at once to be subdivided. But I shall not stop to consider its subdivision. It embraces Kantism, Reid's Philosophy, and the Platonic philosophy of which Aristotelianism is a special development.

Neither here nor in the Berkeley Reviews did Peirce clarify 'conceptualism' (i.e. universals are 'real thoughts' or concepts in individual minds) as a third scholastic position different to 'nominalism' and 'realism', though he might have indicated it as regards Ockham (1871, *CP* 8.26, see the introduction above). If not positively, he articulated this third position from his realist perspective: 'Their calling their "conceptualism" a middle term between realism and nominalism is itself an example in the very matter to which nominalism relates' (1909, *CP* 1.27). Be that as it may, Peirce once confusingly included all 'Descartes [...] Locke [...] Berkeley, Hartley, Hume [...] Reid [...] Leibniz [...] Kant [...] Hegel' in 'a tidal wave of nominalism' (1903, *CP* 1.19). See also Jaffro 2013, 128–131: e.g. Thomas Reid (in Peirce's class seven) can be one of early modern conceptualists. Certainly, many of the above belong to the different classes of his categories.

5.1 Berkeleyanism through the lens of Peirce's pragmatism

Second category (Secondness) 'the Idea of that which is such as it is as being Second to some First [...] *Reaction* as an element of the Phenomenon';

Third category (Thirdness) 'the Idea of that which is such as it is as being a Third, Medium, between a Second and its First [...] *Representation* as an element of the Phenomenon'.¹⁴

Explaining diverse philosophical positions, this distinction of Firstness (quality), Secondness (reaction) and Thirdness (representation) is the basis for his semiotic and logical thinking. It must have been clear for Peirce, if not necessarily for us.

Peirce's semiotic theory of triadic categories is arguably his central philosophy. Here I argue that it has evolved through his lifelong critical, yet misleading, reading of Berkeley's *Works*. About forty years after his first 'Berkeley Review' (1871, *CP* 8.29), he wrote a manuscript 'The Rationale of Reasoning' (1910, *MS* 663, 11–13), where he also criticises Berkeley's thesis '*esse is percipi*' (*to be is to be perceived*) (*Principles* §3). For Peirce, 'Berkeley had strangely failed to appreciate' the distinction between the possibility ('*capable of being perceived*') and its actuality ('*being perceived*'). Based on this criticism of Berkeleyanism, Peirce proposed another set of 'three categories of Reals; to wit, 1st, would-bes, 2nd, Existents and Actuals, which are definite individuals; and 3rd, Can-bes' (*MS* 663, 13). In his third 'Berkeley Review' (1901, *CN* 3.37), Peirce construes that Berkeley deemed 'possibility [to be] absolute nonentity: material objects must [...] be all along actually present to the Divine mind, or they would collapse into utter nothingness'. According to Peirce's reading of Berkeley's nominalist idealism, every being is actually perceived by the divine mind. Therefore, to better understand the possible and actual realities than Berkeley's perceptual system, Peirce concluded that the Berkeleyans 'deny Secondness [i.e. strict individualism or 'Reaction as an element of the Phenomenon', *P* 167], which they wish to replace with Divine Creative Influence'. For Peirce takes it that this divine act 'certainly has all the flavor of Thirdness' or representative medium (1903, *P* 172, 190; Friedman 1997, 263–264).

However, Peirce might have deliberately disregarded why Berkeley did not expunge general ideas from his nominalism about particulars: 'I do not deny absolutely there are general ideas, but only that there are any abstract general ideas' (*Principles* Intro §12).¹⁵ Peirce's triadic framework

¹⁴ The trichotomy in Peirce's 'propedeutic [i.e. introduction] to logic' (1902, *CP* 2.199) is a trinity of normative sciences: Firstness as aesthetics; Secondness as ethics and Thirdness as logic. 'Ethics, or the science of right and wrong, must appeal to Esthetics for aid in determining the *summum bonum*. It is the theory of self-controlled, or deliberate, conduct. Logic is the theory of self-controlled, or deliberate, thought; and as such, must appeal to ethics for its principles' (1903, *CP* 1.191. See also Harvard Lecture One, *P* 118–119; *CP* 1.281, 1.573–575, 2.197; Bennett 2014, 260. Although aesthetics was little defined in a vast amount of his writings (*CP* 1.573, n. 2), this triadic definition, where aesthetics ought to be prior to logic, can be germane to Peirce's semiotic position on matters of religion and theology.

¹⁵ Peirce does recognise Berkeley as a nominalist about particular ideas, albeit not a strict individualist due to the divine interaction of ideas/signs (categories I and III): e.g. 'Berkeley and nominalists of his stripe deny that we have any idea at all of a triangle in general' (Lecture Seven, *CP* 5.180; *P* 241; see also the first 'Berkeley Review', *CP* 8.26). However, Berkeley confirms general ideas, though refuting 'abstract general ideas', where he claims that 'an idea, which considered in it self is particular, becomes general [...] by being a sign' (*Principles* Intro §12). For Berkeley, particular ideas, things and signs cannot be just abstracted to be general and universal, because succumbing to metaphysical 'abstractions' is being 'bound to pursue terms which have no certain signification and [...] mere shadows of scholastic things' (*DM* §8), 'however useful they may be in argument' (*DM* §4). See also *Principles* Intro §§15, 18–19; *MI* §§6, 20, 27, 30–34; *Dialogues* 1.193, 2.214; *Defence* §§45–48; *Alciphron* §§7.8, 7.15, 7.17, 7.21; *DM* §§2–11, 16–17, 47, 71;

can be undermined without considering Berkeley's own confirmation of general ideas, as it relates to category II. In Berkeley's nominalism about ideas 'by sense, or by reason', our minds make *particular* ideas, being signs, 'corresponding' to their immediate sensible qualities that are rendered *general or universal*; or by 'a natural or just way of thinking', our minds induce from 'particular and concrete' objects to conclude 'general' notions or ideas.¹⁶ Here, the second category of *Reaction* ('individuals') by our minds, though under the divine influence, cannot be jettisoned from the Berkeleyan framework of ideas (*mental representations*). Thus, on my view, Peirce's categorisation of I and III without II does not clearly capture Berkeley's nominalism, where ideas are not restricted to the first category of *Quality* ('would-bes') and third category of *Representation* ('can-bes').

Nonetheless, opposing his version of Berkeleyanism and the other five systems, Peirce defended his own seventh system ($I \cap II \cap III$), labelling himself 'an Aristotelian of the scholastic wing, approaching Scotism, but going much further in the direction of scholastic realism' about universals or general ideas (*CP* 5.77; *P* 190).¹⁷ Given his realism, Peirce formulated each 'fatal defect' of 'the six kinds of metaphysics', for they 'fail to recognize the reality of all the categories' (*P* 190). Therefore, to the extent of the Harvard Lectures (1903), it may suffice to say that Peirce does not identify himself as a nominalist Berkeleyan, but a scholastically developed realist. Misleading notwithstanding in terms of category II, Peirce's construction of Berkeley's philosophy from his realist perspective shall be further examined below.

5.1.2 Peirce's Berkeley reviews

In fact, Peirce's view of scholastic realism, since his first 'Berkeley Review' (1871, *CP* 8.7–38),¹⁸ can be somewhat consistent in his career as a logician and semiotician. To that effect, he does not commit himself to deep theological doctrines that Christian scholastics such as Scotus and Ockham were concerned with. This is rather a contentious point regarding whether Peirce drew on a pragmatic method from Berkeley's theistic philosophy, as expressed in his third 'Berkeley Review' (1901, *CN* 3.36). There he did not label himself a Berkeleyan, either.¹⁹ Indeed, he found 'great inconsistency of the Berkeleyan theory' (*CP* 8.34; Popkin 1953, 138). Nonetheless, from the time when he 'used to preach' in the Harvard Metaphysical Club (1871), stated Peirce, he discovered 'the unformulated method followed by Berkeley, and in conversation about it [he] called it "Pragmatism"' ('A Neglected Argument', 1908, *CP* 6.482).²⁰ As to the distinction between the actuality and possibility of being

Belfrage 1987, 39; Pearce 2022. Overall, I think, Peirce's interpretation of Berkeley's nominalism is misleading.

¹⁶ See *Principles* Intro §15, Part I §18; *Dialogues* 3.241; *Alciphron* §7.23, etc.

¹⁷ Peirce's doctrine of scholastic realism is that laws or 'general principles are really operative in nature' (Harvard Lecture Four, *CP* 5.101; *P* 193). The normativity of law is strictly grounded in Peirce's realist argument.

¹⁸ The first review was originally published in the *North American Review* (October 1871). Peirce's had since changed his scientific view on nominalism and realism, the former being 'superficial and transient' in its modern tendency but the latter lying at the heart of his science, according to himself ('Lessons from the History of Philosophy', 1903, *CP* 1.20).

¹⁹ In contrast to the two Fraser editions, Peirce's second (very short) 'Berkeley Review' highly evaluates the Sampson edition (1897–98) as 'quite beyond Fraser' (1899, *CN* 2.212). Here he does not label himself a Berkeleyan, either.

²⁰ To clarify that Peirce derived his pragmatism (later pragmatism) from that of Berkeley, below is the preceding passage of the 'Neglected Argument' (*CP* 6.481, emphasis added):

5.1 Berkeleyanism through the lens of Peirce's pragmatism

to be perceived,²¹ the very inconsistency lies in Berkeley's immaterialist treatment of mind and matter (idea)—metaphysically different kinds—in his nominalism, whereby matters (ideas) are accidentally outside human minds. This nominalist thinking of Berkeley was to be replaced by Peirce's version of medieval Scotist realism, whereby matters are universally objective to human minds.

Despite his criticism of Berkeleyanism, however, what Peirce claimed should be kept in mind. In his third 'Berkeley Review' (1901, *CN* 3.36), Peirce championed the following view:

Berkeley is, in truth, far better entitled to be considered the father of all modern philosophy than is Kant.²² It was he, not Kant, who first produced an *Erkenntnistheorie*, or 'principles of human knowledge,' which was for the most part correct in its positive assertions. It was he, more than any other single philosopher, who should be regarded as the author of that *method of modern 'pragmatism'*—i.e., the definition, or interpretation, of conceptions by their issues—which [...] neither philosopher [i.e. neither Berkeley nor Kant, but Peirce himself] grasped clearly enough to formulate it in *general terms* [emphasis and clarification added].

Peirce's pragmatic method, even in his 'general terms' against nominalism, was indeed gleaned from Berkeley's way of reasoning.²³ Here, I interpret that Peirce positively received and incorporated Berkeley's pragmatic method for inference. I take it that the Berkeleyan way of inference that Peirce learned is how to *define or interpret conceptions* grounded in the sign system, which entails the notion of habit in the normative sciences.²⁴ In the first 'Berkeley Review' (1871), a set of normative tests is proposed by Peirce (*CP* 8.31; *ibid.*, 137):

Since I have employed the word *Pragmaticism*, and shall have occasion to use it once more, it may perhaps be well to explain it. About forty years ago, my studies of Berkeley, Kant, and others led me, after convincing myself that all thinking is performed in Signs, and that meditation takes the form of a dialogue, so that it is *proper to speak of the 'meaning' of a concept*, to conclude that to acquire full mastery of that meaning it is requisite, in the first place, to learn to recognize the concept under every disguise, through extensive familiarity with instances of it. But this, after all, does not imply any true understanding of it; so that it is further requisite that we should make an abstract logical analysis of it into its ultimate elements, or as complete an analysis as we can compass. But, even so, we may still be without any living comprehension of it; and the only way to complete our knowledge of its nature is to discover and recognize just what general habits of conduct *a belief in the truth of the concept (of any conceivable subject, and under any conceivable circumstances)* would reasonably develop; that is to say, what habits would ultimately result from a sufficient consideration of such truth.

By this quotation, on my view, it transpires that Peirce's reception of Berkeley led to his pragmatic method entailing the truth of 'concept' or conception about any 'general habits of conduct'. This conceivable truth that clarify the meaning in use (i.e. 'proper to speak') is what the human agent constructs in the mind and what is fundamental to both Berkeley's and Peirce's discursive thinking. This shall be further considered for Peirce's emphasis on the human manipulative thought or 'conception' with 'practical bearings' in §5.3.2 below.

²¹ Right after the first 'Berkeley Review', Peirce distinguishes the realist and nominalist assumptions in response to Chauncey Wright (1871, *CN* 1.45): 'the realists assuming that reality belongs to what is present to us in true knowledge of any sort, the nominalists assuming that the absolutely external causes of perception are the only realities.'

²² Peirce's first 'Review' (*CP* 8.34): 'Berkeley ought to have a far more important place in the history of philosophy than has usually been assigned to him.'

²³ See especially *Principles* §§102–107.

²⁴ Peirce argued the importance of *habit* in a pragmatic way of normative inference: 'The habit is good or otherwise, according as it produces true conclusions from true premisses or not; and an inference is regarded as valid or not,

A better rule for avoiding the *deceits of language* is this: Do *things fulfil* the same function practically? Then let them be *signified* by the same words [emphasis added]. Do they not? Then let them be distinguished. If I have learned a formula in gibberish which in any way jogs my memory so as to enable me in each single case to act as though I had a general idea, what possible utility is there in distinguishing between such a gibberish and formula and an idea? Why use the term *a general idea* [emphasis original] in such a sense as to separate things which, for all experimental purposes, are the same?

This indicates Peirce's linguistic and normative concern with general ideas: how to preempt the misuse of *terms* that 'fulfil' or 'signify' ideas which do not correspond to existent things or sensory objects (i.e. 'gibberish' or nonsense). This Peirce acknowledges from Berkeley's arguments of the relationship between mind (spirit) and idea, to the effect that all the meaningful use of terms or signs in the mind relates to, or refers to, sensory things or ideas. As I will argue, this referential use or rule in Peirce's pragmatic method can primarily assimilate Berkeley's metaphysical but linguistically inferential or normative argument, irrespective of nominalism.

Moreover, Peirce stated clearly: 'Berkeley on the whole has more right to be considered the introducer of pragmatism into philosophy than any other one man, though I was more explicit in enunciating it' (Peirce's 1903 letter to James; Perry 1935 II, 425). This explains Peirce's incorporation of Berkeley's *implicit* pragmatic method as he intended to make it *explicit*. Nonetheless, their pragmatic methods in terms of linguistic reference and habitual normativity differ from what Peirce meant by 'Berkeleyanism' including nominalism. In other words, extending the scope of his pragmatism to theological matters, Peirce expressed his consistent attitude against the Berkeleyan nominalism in a letter to his lifelong friend, William James (1904, *ibid.* II, 430):

I have always insisted—as, for example, in my notice of Frazer's [sic] Berkeley in the *North American Review of October, 1871*—is that under that conception of reality *we must abandon nominalism*. That in my opinion is the great need of philosophy. [...] I also want to say that after all *pragmatism solves no real problem*. It only shows that supposed problems are not real problems. But when one comes to such questions as *immortality*, the nature of the connection of mind and matter [...] we are left completely in the dark. The effect of pragmatism here is simply to open our minds to receiving any evidence, not to furnish evidence. [...] *Come up and see our waterfalls, therein is peace* [emphasis added].

Whether or not we can see tranquillizing 'peace' in such pragmatically open 'waterfalls', which let any evidence drift away, we may read this passage with Peirce's religious connotation about

without reference to the truth or falsity of its conclusion specially, but according as the habit which determines it is such as to produce true conclusions in general or not. The particular habit of mind which governs this or that inference may be formulated in a proposition whose truth depends on the validity of the inferences which the habit determines; and such a formula is called a guiding principle of inference' ('The Fixation of Belief', 1877, *CP* 5.367; Nöth 2016, 56). On Berkeley's references to 'habit'/'custom' and its role in language and inferential rule, some of which I think Peirce must have read, see *DM* §7: 'terms have been invented by common habit to abbreviate speech [...] they come in useful for handing on received opinions by making [...] the propositions universal'; *Defence* §50: 'habits of just and exact reasoning'; *NTV* §17: 'habitual or customary connexion between [...] ideas', §§21, 77, 147; *Alciphron* §§4.21, 7.17; *Analyst* §§2, 49; *MI* §57; *Principles* Intro §23, etc.

5.1 Berkeleyanism through the lens of Peirce's pragmatism

'immortality'.²⁵ What we may well wonder, however, is the very pragmatism that Peirce actually found in Berkeley's philosophy. In effect, Peirce later left this manuscript: '[a]mong all the doctrines of metaphysics, there is none that seems to me to be more obviously favored by this rule of methodeutic [i.e. pragmatism] than what may be called *conditional idealism*, which is *Berkeleyanism with some corrections*' (c.1907, *MS* 322, 20, emphasis added). In this context, Peirce identifies his conditional, or pragmatic, idealism with his corrected version of Berkeley's idealist metaphysics, although some commentators (e.g. Lesley Friedman 1997, 254) take it 'superficial' and argue fundamental differences between them. On the contrary, with some modifications or discounting Berkeley's nominalism and the problem of category II, I consider that Peirce had long held his version of pragmatic method in his metaphysical and religious thinking.

Moreover, what Peirce meant by 'conditional' as above can be clarified in his sense of formulating a 'conditional sentence' in the imperative mood, as it results in the maxim of pragmatism. Peirce addressed that he has 'not succeeded any better than [putting] this: Pragmatism is the principle that every theoretical judgment expressible in a sentence in the indicative mood is a confused form of thought whose only meaning, if it has any, lies in its tendency to enforce a corresponding practical maxim expressible as a conditional sentence having its apodosis [i.e. concluding clause or consequence] *in the imperative mood*' (Harvard Lecture One, *CP* 5.18; *P* 110, emphasis and clarification added).²⁶ Then, our question is whether Berkeley's pragmatic method about quasi-reference (as shown below) is fundamentally expressible in a conditional sentence in the imperative mood. I answer in the affirmative because such quasi-referential terms as 'gravity' and 'grace' are imperatively or normatively conditioned to be meaningful or useful as laws of nature, or they are not at work in the indicative mood as lacking reference to existent objects. This can be pertinent to Berkeley's and Peirce's realisms about the normativity of (divine) laws in their pragmatic methods.

Hence, given Peirce's critical reading of his 'Berkeleyanism' (categories I and III without II), his realism about universals disagrees with Berkeley's nominalism about particular ideas. Thus, Peirce's category of 'Berkeleyanism' and the pragmatic method that he found in Berkeley differ from each other. On my reading, for his categorisation as such, Peirce probably intentionally misread Berkeley, who actually did not discard general ideas in mathematical abstractions (see earlier chapters of my thesis). However, as Peirce noted, there is indeed an *unformulated* pragmatic method in Berkeley's metaphysical mind-idea argument concerning the normativity of terms/signs in use, such as defining and interpreting concepts (*CN* 3.36). This method of Berkeley is originated in his philosophy of language before Peirce clearly uttered, or rather complicated, his own pragmatic method.

²⁵ There seem to be two *incompatible Peirces* (Goudge 1950, 5–7): a naturalistic epistemologist with his empiricism and philosophy of science, on the one hand, and a transcendentalist or religious thinker with his metaphysical speculation and realism, on the other. It may be so difficult to reconcile these *prima facie* contradicting tendencies within Peirce.

²⁶ See also *CP* 5.543; *MS* 301; *P*, 257 (Lecture Three).

5.2 Berkeley's pragmatism in his theory of signs: the case for quasi-reference

Assuming Peirce's understanding delineated in the last section, this section will chiefly shed light on Berkeley's pragmatic method, or way of thinking, in the scientific and religious contexts. To this end, I introduce a technical linguistic distinction in referring to things or ideas, within the purview of Berkeley's normative use of terms or signs.

In terms of Berkeley's philosophy of language, taking his theory of signs into account, Berkeley scholarship is radically changing. Previously, for instance, Ian Hacking (1975, 43, 51–53) argued that early modern empiricists, Berkeley included, offered no 'well-worked-out theories of meaning at all' in the contemporary (or Hacking's Fregean) sense. However, I disagree with this kind of treatment that underestimates early modern philosophers' concern with the use of language or signs.²⁷ This is because, as Peirce may have comprehended, Berkeley was consistently mindful of the misuse of language. For instance, Berkeley sets forth in the very first sentence of his scientific work, *De motu* (*DM* §1):

In order to discover the truth, it is most important that one avoid being obstructed by terms that are poorly understood.

From this linguistic concern with conventional normativity of terms/signs, one can corroborate Berkeley's philosophy of language, or more technically, his theory of reference between signs and the things signified (significations) within the use, featuring Berkeley's entire works including *MI*, *DM* and *Alciphron*. Based on the philosophy of language developed in Berkeley scholarship, I will clarify why there are two uses of terms: (genuine) referential terms and quasi-referential ones.

Recently, Kenny Pearce (2017c, 86–96) distinguished two uses of language in Berkeley (especially the uses in *DM*): i.e. 'genuine reference' and 'quasi-reference'. Whilst both types of reference are ruled by the same syntactic (and thus inferential) systems, they differ semantically. For the former (genuine) referring expressions (words and phrases),²⁸ e.g. 'gold' and 'Charles Santiago', are used to label or name individual objects or ideas/notions (e.g. a crown and Peirce himself),²⁹ which exist extra-linguistically or independently of the sign system. Whereas the latter quasi-referring expressions do not label objects (ideas/notions), although sentences containing them do bear truth-value (either true or false) and can be meaningful for the user or definer. In speaking about natural

²⁷ On scholarly debate of Berkeley's philosophy of language, see Roberts 2017, 423–424, 432–434; Fields 2001, 79–83; Jaffro 2013, 130–137; Pearce 2017c, 62–65; 2022. John Roberts rejects Berkeley's *ideational* (or *representational*) theory of meaning (i.e. denoting representational mental entities or 'ideas'), and instead favours the use theory of meaning (i.e. words are meaningful because they are used, irrespective of such idea-denoting). Siding with Roberts and Pearce, I support the latter use theory of meaning for my pragmatist reading of Berkeley's theory of causation.

²⁸ Unlike Pearce's original distinction, I prefer not to employ the term 'genuine'. For, to me, the term is merely an emphatic or rhetorical adjective of linguistic 'reference' or relating to objects as representational ideas.

²⁹ According to Pearce (2017c, 87–89), 'labelling' is to 'call [multiple objects] by the same name' (*NTV* §128, emphasis and clarification added; *MI* §§7, 17–19).

5.2 Berkeley's pragmatism in his theory of signs: the case for quasi-reference

science, the quasi-referential expressions are considered to be theoretical terms,³⁰ such as 'force, gravity, attraction' or 'mathematical hypotheses', because they are 'useful for reasoning, and for calculating about motion and moving bodies' (*DM* §17).³¹ However, despite the utility, the quasi-referring expressions of physics, typically 'force', do not 'signify certain nature' (*DM* §6) or 'stable essence' (*DM* §67), such that 'in the truth of things [force] would be looked for in vain' (*DM* §39, clarification added). This is because such theoretical terms as 'attractive forces' or mathematical hypotheses 'depend on the notion of the definer' (*DM* §67). Hence, theoretical terms are merely conventionally intelligible within our linguistic use, or in sentences involving them, so as to relate (or quasi-refer) to their phenomena within the sign system.

Likewise, religious terms in Christian discourse, such as 'grace', are quasi-referential expressions.³² According to Berkeley's mouthpiece Euphranor, refuting the free-thinking antagonist Alciphron, 'grace may [...] be an object of our faith, and influence our life and actions, as a principle destructive of evil habits and productive of good ones, *although we cannot attain a distinct idea of it*' (*Alciphron* §7.10, emphasis added). That is, theoretical terms such as 'grace' quasi-refer or do not label extra-linguistic objects (ideas), even though sentences containing them have truth-value for one's judgement (faith or assent) and bear the meaning (e.g. producing good habits) only when they are uttered in particular propositions. This signifies that Berkeley's theory of signs is undergirded if and only if terms are used for invoking ideas corresponding to them in sentences, or within the sign system. This is just because 'a particular idea can become general by being *used to stand for or represent* other ideas [...] yet become universal, being used as a sign' (*Alciphron* §7.7, emphasis added). Here, one can see Berkeley's pragmatism where pragmatics (or use of terms in particular sentences) necessarily lends itself to semantics; otherwise, the meaning of words or signs cannot be understood. In other words, anything theoretically occult or unperceivable through sensible qualities, or anything beyond empirical facts, cannot be practical without the linguistic use of reference and quasi-reference. Hence, Berkeley previously argued: 'one thing for to keep a name constantly to the same definition, and another to make it stand every where for the same idea: the one is necessary, the other *useless and impracticable*' (*Principles* §18, emphasis added). That is, constant use of the same terms stays useful in Berkeley's nominalist and pragmatic method, wherein they do not have to stand for abstract ideas.

In short, Berkeley consistently refrained from *abstract* general ideas in the sense of *metaphysical* abstractions of 'gravitation', 'velocity', etc. from 'motion' (*DM* §11), however useful they may be. As with his early works such as *Principles* (including *MI*), he *semantically* and *epistemologically* upheld anti-abstractionism against his (Cartesian) precursors including Nicolas Malebranche, the

³⁰ By 'theoretical terms' I mean something 'purely referential' in postulates or sentences involving them, 'open to existential generalization' (D. K. Lewis 1970, 429). As will be clear, I uphold that theoretical terms ('force' and 'grace') refer to no extra-linguistic ideas of existent objects independent of the use of language or signs in Berkeley and Peirce.

³¹ See also *DM* §§28, 66; *Alciphron* §7.10: 'beneficial [...] of use'; *Siris* §234; Downing 2005, 247–248.

³² In line with Pearce (2017c, 167), I hold the view that the use of quasi-reference in natural philosophy can be theoretically extended to the divine matters such as 'grace' and 'faith', for one can assume the coherent continuum of Berkeley's philosophical argument from empirical science to Anglican theology. See e.g. *Alciphron* §7.11.

Port-Royalists such as Antoine Arnauld and the empiricist John Locke.³³ For Berkeley was critical about the abuse of (scientific) language and terms, as in *DM* §2:

when the motion is discussed, many words [*vocabula*] of too abstract and obscure signification occur, such as ‘solicitation of gravity’, ‘effort’, ‘dead forces’, etc., those that darken writings [*scriptis*] in other respects very learned, and beget opinions [*sententiisque*] no less abhorrent [*abhorrentibus*] to the truth than to the human common sense.³⁴

That is, these theoretical, causal terms in mechanics are *prima facie* ‘abhorrent’ to what human minds ordinarily conceive as true ‘thought’ (*sentitia*) and ‘common sense’, for such abstract terms are obscure and ‘metaphorical’ (*DM* §3) in specific sentences. However, Berkeley aimed at the correct use of language in scientific discourse ‘in the interests of truth [*veritatis gratia*] rather than desiring to refute others’ (*DM* §2). Therefore, he was coherently careful of how to use language in his inference, with which the pragmatist Peirce strongly agrees as he also intended to rescue philosophy from ‘meaningless surplusage’.³⁵ On the other hand, though Peirce might be confused, *abstract* general words that Berkeley meant are not exactly abandoned in the scientific context of his *DM*. This is because, no matter how they appear to be at variance with our true judgement, abstracted terms or abstractions *per se* are still quasi-referentially used to formulate mechanical theories as well as calculations in mathematical, deductive reasoning. As Walter Ott (2003, 128) argues, Berkeley’s ‘theoretical discourse itself is at bottom practical’ without distinguishing the theoretical and practical uses of language, such as the term ‘force’. This scientific use of abstract words or theoretical terms is, I think, the very foundation for Berkeley’s discourse on causation, as it relates to matters apologetics in using the term ‘grace’. This converges upon a normative point that the definitions of ‘force’ and ‘grace’ should be meaningful or useful, as long as they are quasi-referentially used in true sentences as deliberated and expressed thoughts.

Finally, touching on Berkeley’s theological argument for the ultimate beauty designed by God or divine language of nature, the Berkeley of *Alciphron* (via his theist mouthpiece Crito) seems to propound an apologetic version of pragmatism (i.e. defending the utility of faith). This theological pragmatism may not be his invention but derived from the very beginning of Christianity, e.g. St Justin Martyr in the second century.³⁶ However, one can clarify the extent to which Berkeley’s

³³ See, e.g. Malebranche 1997a (*Dialogues* 1688, §7.6); Arnauld and Nicole 1996 (*Logic* 1662, pt. 1, ch. 5); Locke 1975 (*Essay* 1690); Pearce 2017c, 13–16, 26–27; Jaffro 2013, 129–146; Taylor 1978, 108. For Locke, a proper use of words (or names) is to make each word signify immediately and consistently a certain idea; otherwise, the signification is insignificant, meaningless, or an ‘abuse of Words’ (*Essay* §3.10.5). Therefore, Locke advocates the proper use of terms that signify general or abstract ideas through sense perception, for ‘advantageous use of Sounds was obtain’d by the difference of the Ideas they were made signs of. Those names becoming general, which are made to stand for general Ideas’ (*Essay* §3.1.3). In his anti-abstractionist and nominalist approach to conceiving ideas in human minds, Berkeley criticises Locke and the other abstractionists (e.g. *Dialogues* 2.214, against Malebranche) because for him, terms merely signify particular ideas (e.g. this triangle and that circle), but not abstract general ideas, whose representational contents are ‘incomprehensible’ in one’s own sense perception and imagination (*NTV* §§123–125). See further Berkeley’s objection to the ‘abuse of language’, ‘the deception of words’, and the verbal ‘weeds’ undermining the progress of scientific knowledge (*Principles* Intro §§6, 22, 23).

³⁴ see also *DM* 23, 44.

³⁵ Peirce, ‘Consequences of Critical Common-Sensism’, c.1905, *CP* 5.525; Friedman 2003, 86.

³⁶ See Brădăţan 2006, 78–83, 140–144.

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original, pragmatic method has also advanced in theology, based on his linguistic distinction of reference and quasi-reference in empirical science (as in *DM*). On this point, I side with Gavin Ardley who argues (1968, 138, emphasis added):

[Berkeley] uses language as a *pragmatic* and enlivening instrument, a *force* for directing our attention to the obvious (his remarks in *Principles* Intro §20; and Euphranor in *Alciphron* §7.5f). Words are not merely passive signs of static things; *when combined into sentences they become dynamic*. The passages on the beauties of Nature, with which his writings abound, are not mere extraneous ornaments; like the dramatic settings of Plato's dialogues.

Following Ardley's analysis, it is resoundingly important that one consider the directing, active, dynamic nature of signs, rather than the passive things signified (significations), in Berkeley's pragmatic method. In other words, on my view, it is of paramount importance that terms as signs are *pragmatically* active when they are formulated into sentences or law-propositions. In this sense, without invoking metaphysical perplexities, we agents can rationally understand the power of language in formulating, deliberating, and expressing causation.

It is, indeed, the lawfulness or linguistically normative nature—originally or teleologically, the divine language of nature³⁷—that designed the sign system in Berkeley's philosophy of language. Thereby the quasi-reference of mathematical hypotheses or causal terms (e.g. 'force') is sustained to be meaningful or useful for changing the dispositions of human minds. However, I argue that it still remains in the capacity of human minds as language-users as long as we keep engaged in the discursive thought about mechanical causation. This argument shall be explored in the next section.

To conclude this section, in the linguistic sense involving quasi-reference, I have evaluated that what Berkeley argued for normative use of signs or terms is fundamentally essential to Peirce's semiotic pragmatism. To this effect, in the distinction between reference and quasi-reference, Peirce's pragmatic method can assimilate or incorporate Berkeley's use of quasi-reference within the sign system. From their similar linguistic, semiotic views, finally, the next section will discuss how we can understand a contemporary development of pragmatic causation.

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Assuming Peirce's pragmatic method assimilating Berkeley's quasi-referential use of theoretical terms (e.g. 'force' and 'grace') as distinguished from reference to extra-linguistic objects, we are now in a position to examine whether our linguistic practice of quasi-referencing gives rise to the pragmatic expression of mechanical causation. Thus, this final section is to reformulate Peirce's argument for pragmatic causation in contrast with that of Berkeley. Primarily delving into Peirce's

³⁷ For Berkeley's divine language argument, the design argument for 'an universal language of the Author of nature', see *NTV* §147; *Alciphron* §4.12, etc.; Jesseph 2005; Pearce 2017c.

text, I will parse the premisses of the respective arguments. Thereby I reconsider the Berkeleyan quasi-reference of *unknown* mechanical causes for their manifest effects or practical bearings.³⁸ In this contrastive analysis, light shall be shed on my reformulation of Peirce’s pragmatic method augmented by Berkeley’s pragmatic way of thinking about causation in discursive thinking. But beforehand, I will start with a broader background of pragmatic causation or causal relations from our contemporary viewpoints.

5.3.1 Contemporary background of pragmatic causation

It is true that there are currently diverse theories of causation galore.³⁹ For instance, since the 1970s, David Lewis’s counterfactual theory of causation has garnered much critical attention.⁴⁰ The theory is reductive in the sense that it reduces facts about causation to facts about what would have happened in a variety of counterfactual circumstances. Berkeley’s use of the term ‘mathematical hypothesis’ in *DM* connotes what is hypothetical in conditional sentences. Therefore, I think, it does imply counterfactual conditionals. This is because theoretical terms ‘mathematical hypotheses’, such as ‘gravity’ and ‘attraction’, quasi-refer to mechanical causes for natural phenomena in the form of law-propositions, on the grounds of what are supposed to happen in our manipulative formulations by geometrical reasoning.⁴¹

In this line of thought, in Berkeley, the hypotheses for causal laws as propositions—not terms—may lead to fictionalist arguments (Jesseph 1993, et al.).⁴² According to fictionalism, without judging either true or false of various propositions (claims/theories) *except for* fictional claims, it is not necessary to find truth-makers (a set of entities that make truths true) for the propositions (truth-bearers). Thus, fictionalists take the claims to have no truth-makers at all. In this sense, some law-propositions can be mere fictions lacking truth-makers and truth-values outside fictions.⁴³ But I disagree with this anti-realist fictionalism, because I construe that the Berkeley of *DM* is

³⁸ Contrary to the other classical pragmatists, such as John Dewey’s naturalism, Peirce’s position is realist about unobservable theoretical entities in our long inquiry to pursue a correct answer or truth. On the contrary, many of contemporary pragmatists are usually non-realists (i.e. agnostic about theoretical entities), and some of them are anti-realists like Richard Rorty (i.e. atheist about the entities). See Almeder 2014, 106–108; Rorty 2000, 16.

³⁹ Perhaps, a root of the contemporary pragmatic theories of causation can be found in C.I. Lewis’s theory of knowledge that reverses the explanatory direction ‘by way of the *ratio cognoscendi*’ (1929, 426): ‘[t]he analysis and verification of knowledge runs from effect to cause, from evidence to the thing evidenced.’

⁴⁰ See D. Lewis 1973 [1986]; 2000; Pearl 2009, 238–242. In the final, most developed version (2000, 184–185), Lewis declines his thesis of *quasi*-dependence of the internal causal chain, for the pre-emption of potential causes could trump counterfactual dependence of the chain at possible worlds.

⁴¹ I have noted that in *DM* there is another type of hypotheses, namely ‘empirical hypotheses’, such as ‘mass’ and ‘figure’, which also bring about natural phenomena of motions based on the senses (sensation) and experiments (experimentation) about what actually happen. I defined sensation and experimentation as elements 1 and 2, distinct from element 3, (geometrical) reasoning, in §3.1.1. On the distinction of mathematical and empirical hypotheses, see Chapter 3; R. Schwartz 2020.

⁴² In Chapter 4, my pragmatist reading has argued against the instrumentalist reading that subsumed fictionalism.

⁴³ Typologically, instead of the existential quantifier \exists , a fictional operator (backwards F) may be needed for fictionalist propositions. However, my pragmatist reading does not require the fictional operator in interpreting Berkeley’s and Peirce’s pragmatist theories of causation.

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pragmatically truth-making.⁴⁴ To put it another way, he is inclined to truth-maker theory, even though the notion of truth-making is usually realist in the domain of metaphysics.⁴⁵ On my rendering, if not straightforwardly realist, the Berkeleyan pragmatist view does allow for truth-makers for mechanical causation, as long as the mechanist can maintain truths useful in actual (non-fictional) life and practices as confirmed by their epistemic deliberation.

If one takes no fictionalist reading, can one read that Berkeley really finds a truth-maker for a law-proposition about gravity, for example? Are there realistically no such things as gravitational entities? I answer in the affirmative, because there must be some moving or gravitating (falling) entities as truth-makers in one's observation, experiment, and hypothetical reasoning, even though their theoretical terms 'gravity' and 'impetus' do not refer but quasi-refer to the causes making some objects fall. In other words, I maintain an inter-related process of the three elements—*sensus, experientia, et ratiocinium geometricum*—as obvious in *DM*, for the sake of Berkeley's discursive thinking. In this full scope, his pragmatic truth-making occurs in the discursive process through the first two elements, sensation and experimentation, no matter how much hypothetical, counterfactual reasoning is involved in the final element of (geometrical) reasoning or conceptual imagination. This is because, as discussed in §4.5.2, approximate truths can be held though Berkeley's inference to the best explanation (BIBE) with the first two elements. I consider that the final element of geometrical reasoning as well as the three steps therein are in accordance with BIBE, so as to ensure the discursive thinking about useful *and* truthful causation within one's mechanistic practice.

Accordingly, putting aside the fictionalist interpretation, I rather consider that Berkeley's pragmatist theory of causation in the mechanical, scientific domain is understood from contemporary pragmatist perspectives. On my view, what is tenable from Berkeley's pragmatic view of causation to those of contemporary pragmatists is the importance of human agency. By agency I bring to the fore the agent's own power of imagination or conceiving, when it comes to formulating mathematical, mechanical causation. This is pragmatic to the extent to which the agent can discursively manipulate their concepts of causation for their needs and practices.

Amongst the agency theorists of causation or 'agent causation',⁴⁶ I briefly review the account of a modern pragmatist Huw Price (1953–).⁴⁷ He argues for agent causation as follows (2007, 281, emphasis added):

[A]n agent thinks of her own actions as probabilistically independent of everything except

⁴⁴ See also Pihlström 2005; Mulligan, Simons, and Smith 1984.

⁴⁵ See also Asay 2020, ch. 8 'Realism'.

⁴⁶ With Peter Menzies, Price defines agent causation as the following account that: 'the ordinary notions of cause and effect have a direct and essential connection with our ability to intervene in the world as agents' (Menzies and Price 1993, 187). See also Price 2007, 280–282; 2017; Menzies 2017; Fernandes 2017; forthcoming.

⁴⁷ I regard Price as one of the most prominent pragmatists to date (as of 2022). However, it is noteworthy of Anglo-American diverse threads of 'pragmatism' ignited by Peirce, James, and Dewey, which concerned certain aspects of C.I. Lewis, Quine, Whitehead, et al. For surveys over the modern history of pragmatism, see Anderson 2009, 490–491; Almeder 2014. As a counter-argument to fully-fledged later-period pragmatists (e.g. Richard Rorty) and the anti-classicist Quine (Bertrand Russell's *classical* thinking about universals), Mark Wilson (2006, 223–225) captures 'pre-pragmatism' or 'seat-of-the-pants hunches about language' that is *ur*-philosophically impractical before becoming practical.

their effects—as not themselves determined by anything ‘further back’. This is where causal chains *begin*, as it were, *from the agent’s own perspective*. And this should be read in *reverse*, I think. We should explain the genealogy of the notions of cause and effect by noting that we apply the terms, initially, on the following basis: we say that B is an effect of A, when we think that *doing* A would be a way of ensuring B (or increasing the probability of B, in a more general version).

From here, one can see the Pricean theory of agent causation from one’s own ‘perspective’ upon observed effects. The perspective makes sense within the scope of knowledge that the agent can define, within which causal chains or relations are *reversible* to identify the causes. That is, this is *manipulative* within our imagination so as to deliberate on the utility and truth of formulated law-propositions. Hence I see that, to the extent of the agent’s conception rooted in the universe of discourse, this discursive thinking is genuinely pragmatic with no metaphysical background, as upheld in contemporary probabilistic discussion.⁴⁸

Whilst I considered Price’s approach to discursive deliberation about causation in the last chapter, my final concern is a middle segue into diverse types of contemporary pragmatism like Price’s. It is, as I have argued in this chapter, C.S. Peirce’s reception of Berkeley’s pragmatist theory of causation in the mechanical domain, especially as regards the agent’s pragmatic power of discursive thinking. Accordingly, from the next section, the former discussion over quasi-reference will be integrated into my vindication of Peirce’s argument from Berkeley’s perspective.

5.3.2 Peirce’s argument for pragmatic causation

From an anomalously enormous amount of Peirce’s texts and manuscripts, it is onerous indeed to reconstruct what Peirce scientifically and logically meant by the ‘cause’ and ‘causation’.⁴⁹ Providing

⁴⁸ Regarding another contemporary probabilistic, Bayesian *causal inference*, albeit in statistics, see recent ‘three levels of causation’ in their ladder model (Pearl and Mackenzie 2018, fig. 1.2): (1) association (seeing and observing), (2) intervention (doing and intervening), and (3) counterfactuals (imagining, retrospection, and understanding). On my reading, within M pyramid model (§1.1.1) that I constructed for Berkeley’s pragmatist theory of causation in *DM*, element 1 ‘sensation’ corresponds to (1), element 2 ‘experimentation’ to (2), and element 3 ‘reasoning’ to (3). As the Pearlian ladder shows, interventionist experimentation is below counterfactual reasoning because the latter mathematical hypothesising is distinctly based on our own *manipulative* experiments (and senses). On this trichotomous-elementary basis, I reconstructed that the first step of geometrical reasoning (element 3) was the imagination or framing (*fingere*) of causal terms or mathematical hypotheses, followed by two more steps of epistemic deliberation and pragmatic expression (§3.1.3).

⁴⁹ In expounding Peirce’s pragmatist theory of causation, I do not distinguish the term ‘causation’ from ‘causality’. Here, I am aware that a Peirce scholar Menno Hulswit (2001, 339–340) strictly distinguishes the two terms for clarification: *causation* exclusively used for the *production* of an effect by a cause (e.g. breaking a leg), and *causality* for the *relation* between cause and effect (e.g. relationship between the broken leg and its cause). However, for Peirce himself, this distinction is far from clear. For example, regarding the principle of causality *or* causation (*CP* 6.69, emphasis added):

It will be perceived that there is an essential *thirdness*, which the *principle of causality* fails to recognize, so that its first proposition is false. The second proposition, that the cause precedes the effect in time, is equally false. [...] The second proposition of the *principle of causation* is false. The third is equally so. This proposition is that no event determines a previous event in the same sense in which it determines a subsequent one. [...] Thus, all three of the propositions involved in the *principle of causation* are in flat contradiction to the science of mechanics.

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his own distinction of mechanical science and metaphysics, this final section is my regimentation of his argument about mechanical causation. Therein can we critically understand the significance of quasi-referential terms like 'force' and 'gravity' in Peirce's discourse on causation, followed by Berkeley's objection with the same conclusion. Peirce's argument can go thus:

Peirce's argument for pragmatic causation

- P1. The grand principle of causation determines no regularity in nature.
- P2. If the grand principle of causation determines no regularity in nature, then mechanical causation is merely pragmatically conceived.
- ⊢ Therefore, mechanical causation is pragmatically conceived.

Berkeley could condone the implication of P2, because where there is no mechanical causation for the laws of nature, there is no pragmatic value to conceive it. However, he cannot accept P1, for there must be mechanistic facets and tenets of regularities in nature as causal laws, being rooted in quasi-referential expressions like 'force' and 'mathematical hypotheses'. On my reading, Berkeley is realist about causal laws as long as he non-sceptically accepts useful truths of mechanical theorems and theories relative to the human conception, putting aside the absolute notions of space-time and motion.⁵⁰ To this end, Berkeley would object to Premiss 1 of Peirce's argument. As an analytical tradition dictates, one's *modus ponens* is another's *modus tollens*. Therefore, in my reformulation, B1, Berkeley's objection to P1 is posited as its negation ($\neg P1$), for he does not doubt that one can express the utility of *regular* mechanical effects in the form of causal laws. This is followed by B2, an implication reversing P2. On the other hand, both of their arguments can reach the same conclusion of pragmatic causation. Berkeley's argument, using Peirce's phrases, can go thus:

Berkeley's argument for pragmatic causation

- B1. The grand principle of causation *does determine* an element of regularity in nature.
[$\neg P1$]
- B2. Were mechanical causation not pragmatically conceived, then the grand principle of causation would determine no regularity in nature.
- ⊢ Therefore, mechanical causation must pragmatically be conceived.

In effect, though rejecting B1, Peirce would accept the implication of B2, which is a counterfactual conditional in Berkeley's reasoning.⁵¹ This is because, on my rendering of Peirce's pragmatism,

As above, Peirce does not strictly distinguish the causation and causality in the context of mechanical science. Nor do I, though I keep using the term 'causation' in the remaining of this section.

⁵⁰ For Psillos's theses of scientific realism that I greatly undertake, see §0.1.2.

⁵¹ Berkeley's counterfactual reasoning can be underscored when it comes down to the inconsistency of his statements in *DM* between the antecedent and the consequent, i.e between his assumption to expunge unintelligible *occult qualities*, to which the terms of mechanical causes quasi-refer, and the consequence of utility, for which the qualities are irreducible. See earlier §0.1.1; *DM* §§4–6.

nothing follows from the assumption that one conceives of no meaningful, useful effect in observations. At this juncture, it behoves me to provide textual evidence for each premiss of Peirce's argument, so as to see his critical reception of Berkeley's pragmatist theory of causation towards the same conclusion. In the first place, I shall consider Peirce's maintenance of P1 and rejection of B1.

P1. The grand principle of causation determines no regularity in nature

According to Peirce, we mean by the mechanical cause 'force' what is 'completely involved in its effects' (CP 5.403).⁵² This is because, on the basis of the last section of Berkeley's linguistic distinction, the term 'force' quasi-refers to unobjectionable entities that have occult qualities, the causes of which are solely understood by the meaning of practical effects. That is, in his 'How to Make Our Ideas Clear' (Peirce 1878; CP 5.404, emphasis added):

In a recent admired work on *Analytic Mechanics*⁵³ it is stated that we understand precisely the effect of force, but what force itself is we do not understand! This is simply a self-contradiction. The idea which the word force excites in our minds has no other function than to affect our actions, and these actions can have *no reference to force otherwise than through its effects*. Consequently, if we know what the effects of force are, we are *acquainted with every fact which is implied in saying that a force exists*, and there is nothing more to know. The truth is, there is some *vague notion afloat* that a question may mean something which the mind cannot conceive.

On my reading, however self-contradictory, knowing the effect of force is satisfactory when we do not understand the cause. In other words, whether a floating 'vague notion' of cause is an existing object or not does not matter to Peirce to verify, as far as the effects that it brings about make sense or have practical bearings. The point is not to prove existence, but utility by quasi-reference of mechanical causes for their manifest effects, where there seems 'no reference to' the causes. As long as we can confirm the truth and utility of mechanical effects in observations, it is not a problem as to 'whether some particular facts may not account for [the cause of] gravity' (CP 5.403, clarification added).⁵⁴ Thus, with quasi-referential expressions, I take it that Peirce's pragmatic method in mechanics set forth 'to undertake an account of the idea of Force in general', originated in 'the rude idea of a cause' in the early seventeenth century (CP 5.404).⁵⁵ There, it is significant that Peirce had

⁵² See also Thayer 1981, 90, appendices 3.B, 5.

⁵³ Peirce referenced Gustav Kirchhoff's *Vorlesungen über mathematische Physik* (1876).

⁵⁴ It is noteworthy that the 1878 'How to Make Our Ideas Clear' was written when Peirce had long been interested in gravity through his research of geodesy. Working for the U.S. Coast and Geodetic Survey for 32 years (1859–91), he had been swinging a pendulum to observe the intensity of gravity. It is no wonder that his logical and philosophical thinking merited from his experimental work on precise measurement of the force of gravity, and indeterminism therefrom. See Eisele 1978, 432; Lenzen 1975, 164, referring to the 1889 'Report on gravity at the Smithsonian, Ann Arbor, Madison, and Cornell' rejected for publication by the superintendent, one of Peirce's 70 reports. CP 7, ch. 1 contains two of his writings whilst in the service of the Survey: 'A Source of Error in Pendulum Measurements' (1881) and 'Six Reasons for the Prosecution of Pendulum Experiments' (1882).

⁵⁵ Peirce here does not specify early modern philosophers who postulated 'the rude idea of a cause' in 'the early part of the seventeenth century' (CP 5.404). But I assume Descartes at least, because he was mentioned in the earlier passages (CP 5.391–392). Bacon, Hobbes, Newton, et al. are not mentioned in the 1878 article.

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in mind a certain early modern notion of cause, which I think Berkeley similarly had in a broad Cartesian-Newtonian paradigm.

Based on the above rendition of quasi-reference of mechanical causes, P1 chiefly derives from Peirce's *Monist* article (*CP* 6.46, emphasis added):⁵⁶

Those observations which are generally adduced in favor of *mechanical causation* simply prove that there is an element of regularity in nature, and have no bearing whatever upon the question of whether such regularity is exact and universal or not. Nay, in regard to this *exactitude*, all observation is directly *opposed* to it; and the most that can be said is that a good deal of this observation can be explained away. Try to verify any law of nature, and you will find that the more precise your observations, the more certain they will be to show irregular departures from the law. We are accustomed to ascribe these, and I do not say wrongly, to errors of observation; yet we cannot usually account for such errors in any antecedently probable way. Trace their *causes* back far enough and you will be forced to admit they are always due to *arbitrary determination, or chance*.

As the last sentence shows, in the metaphysical domain, Peirce maintains indeterminism in relation to his cosmological view called 'tychism', according to which we are inclined to admit the cause of absolute *chance* (τύχη) in the universe.⁵⁷ Owing to this metaphysical tychism,⁵⁸ his view of 'mechanical causation' stands upon 'arbitrary determinism'. This is because, for Peirce, no law of nature is exactly and universally *verified* based on one's observation of natural phenomena. Therefore, when we deploy causal vocabulary in expressing the uniformity of nature in the mechanical domain, it can be argued that we are destined to *quasi-refer* to mechanical causes that have no reference to extra-linguistic, objectionable entities. However, Peirce assumes that those causes actually portray *arbitrary* irregularity of natural phenomena. This crucially differs from the Berkeley of *DM*, who holds the regularity in nature by quasi-referential mechanical causes. Thus the two premisses, P1 and B1, contradict each other.

Furthermore, the first premiss of Peirce's argument is rather fortified by his later lecture (*CP* 6.68, emphasis added):⁵⁹

But *the grand principle of causation* which is generally held to be the most certain of all truths and literally beyond the possibility of doubt [...] involves three propositions to which I beg your particular attention.⁶⁰ [...] In truth, however, all three of them are in flat contradiction

⁵⁶ §3 of 'The Doctrine of Necessity Examined' (1892), which is the second of a series of five *Monist* articles (1891–93). See also his later *Monist* article 'Prolegomena to an Apology for Pragmaticism' (1906; *NEM* 4.313–314), regarding his semiotic understanding of 'the mechanical statement' about the 'gravity' of bricks.

⁵⁷ See also Forster 1997, 57, n. 9.

⁵⁸ It is also noteworthy that final causation plays a substantial rôle in Peirce's metaphysical understanding of the universe, in which mechanical causes do not refer to 'pure' entities. See Hulswit 2002, 82–84; *MS* 1343: 26–27 (1902).

⁵⁹ §1 'Physical Causation' in Lecture 4 entitled 'Detached Ideas on Vitaly Important Topics' (1898).

⁶⁰ Peirce meant the following 'three propositions' (*CP* 6.68, in the bracketed part above):

- i. 'the state of things at any one instant is completely and exactly determined by the state of things at one other instant';

to the principles of mechanics. According to the dominant mechanical philosophy, nothing is real in the physical universe except particles of matter with their masses, their relative positions in space at different instants of time, and the immutable laws of the relations of those three elements of space, time, and matter. Accordingly, at any one instant all that is real is the masses and their positions, together with the laws of their motion. But according to Newton's second law of motion the positions of the masses at any one instant are not determined by their positions at any other single instant, even with the aid of the laws. On the contrary, that which is determined is an acceleration.

As above, because he admits that we refer to existing 'particles of matter' with masses, space, time, etc. in the 'dominant mechanical philosophy' of his day, Peirce would disagree that we deploy quasi-referential causal vocabulary for anything real. On the grounds of indeterminate mechanical causation, even involving Newtonian laws of motion that determines only an acceleration but not masses, he rejects every mechanistic implication of the 'grand principle of causation'. For he rather metaphysically upholds tychism, from which perspective we cannot refer to causal phenomena. Then, we can assume that what Peirce called 'the grand principle of causation' plays no rôle in expressing mechanical causation. That is P1, which does not convince Berkeley.

P2. If the grand principle of causation determines no regularity in nature, then mechanical causation is merely pragmatically conceived.

On the other hand, providing P1 as the antecedent, P2 illuminates Peirce's pragmatic method. Here, I consider Peirce's maxim of pragmatism, where he repeatedly stresses the significance of 'conceiving', *conicipere* (CP 5.2, emphasis much added):⁶¹

[Pragmatism is t]he opinion that metaphysics is to be largely cleared up by the application of the following maxim for attaining clearness of apprehension: 'Consider what effects,⁶² that might *conceivably* have *practical bearings*, we *conceive* the object of our *conception* to have. Then, our *conception* of these effects is the whole of our *conception* of the object.'

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- ii. 'the cause, or determining state of things, precedes the effect or determined state of things in time';
 - iii. 'no fact determines a fact *preceding* it in time in the same sense in which it determines a fact *following* it in time.'

Amongst them, especially, the second proposition highlights Peirce's emphasis on the 'cause' that determines the temporal regularity of phenomena. However, such causes (and states and facts) are not provable by 'modern science', whence Peirce denies such 'self-evident truths' (CP 6.68).

⁶¹ Peirce, 'Pragmatic and Pragmatism' in Baldwin's *Dictionary of Philosophy and Psychology* (1902 II, 321; CP 5.2). The quotation is by himself from Peirce 1878, 'How to Make Our Ideas Clear'. This sentence as his pragmatist maxim ('Consider what effects [...]') was so many times quoted; see e.g. CP 5.402 n. 2 ('Grand Logic', 1893), 5.438 ('Issues of Pragmatism', 1905); MS [R] 305: 1 ('Harvard Lectures', Lec. 2, 1903), [R] L107: 7–8 ('A Brief Intellectual Autobiography', 1904).

⁶² The 'effects' in this quotation, according to C.I. Lewis (1929, 134), 'can, in the end, mean nothing more than actual or possible presentations'. I take it that Lewis accepts this Peircean pragmatic conception through his own reiteration: 'Berkeley's doctrine of the "idea" as a sign' towards '*the conceptual interpretation of what is presented*' (1929, 133, emphasis original). Referring to both Berkeley and Peirce, I view Lewis establish his pragmatic method for theorising the actual/possible knowledge of objects.

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That is to say, conceiving mechanical causation *bears* utility or the effects that make sense in our practices. Thus, causation is nothing but pragmatically conceived for the conceived objects. Therefore, the consequent of P2, the Peircean pragmatic conception of mechanical causation can be deduced in the conclusion.

Moreover, a few years later, Peirce hammers out that pragmati(ci)sm makes our conception or 'thought ultimately *apply* to action exclusively—to *conceived* action'.⁶³ In other words, conceiving causal relations is the inference to pragmatically conceived action. Contrastingly, Peirce also argues that '[b]y "mechanical" causation, I mean a causation entirely determinative, like that of dynamics, but not necessarily operating upon matter'.⁶⁴ In short, for Peirce, the meaning of 'mechanical' itself is deterministic. As seen above in P1, causation in mechanics likely ends up being arbitrary and irregular in observations, unless otherwise pragmatically conceived. Hence, he goes on to state that 'the universality, or better, the generality, of a pure form involves no necessity' (CP 6.592). It is thus clear that Peirce's metaphysical *tychism*—finding no absolute necessity but *chance*—is the basis for understanding the arbitrary determinism of mechanical causation. In these respects, the deduction of the above conclusion is tenable, because practical bearings on causation are solely conceived without recourse to the metaphysically absolute, universal truth of *tychistic* laws.

Furthering the defence of P2 in Peirce's argument, the question here is what he actually meant by 'pragmatism'. It is true that the meaning is highly convoluted throughout Peirce's lifetime, let alone his later modification of 'pragmaticism'.⁶⁵ However, I construe that his meanings of pragmatism converge on his emphasis on it as 'a logical doctrine [...] that what any word or thought means *consists in* what it can contribute to an expectation about future experience, and nothing more'.⁶⁶

⁶³ CP 5.402 n. 3: 'Issues of Pragmaticism' (1905, emphasis original). There, on his self-quotation of the maxim, Peirce meticulously emphasises the importance of pragmatic conception:

Note that in these three lines one finds, 'conceivably', 'conceive', 'conception', 'conception', 'conception'. Now I find there are many people who detect the authorship of my unsigned screeds; and I doubt not that one of the marks of my style by which they do so is my inordinate reluctance to repeat a word. This employment five times over of derivatives of *concipere* must then have had a purpose. In point of fact it had two. One was to show that I was speaking of meaning in no other sense than that of *intellectual purport*. The other was to avoid all danger of being understood as attempting to explain a concept by percepts, images, schemata, or by anything but concepts.

The two purposes that Peirce meant are important that the conception with practical bearings ought to be (i) *intellectual purport* or determining what intellectual concepts mean in our reasoning (see also CP 5.8) and (ii) solely the conception *per se*. On my reading, pragmatically conceiving of causation for 'conceived action' is Peirce's ultimate key to achieving the following goal (CP 5.402 n. 3): i.e. 'an esthetic ideal' 'through thought [...] by modifying the rules of self-control modifies action, and so experience too – both the man's own and that of others, and this centrifugal movement thus rebounds in a new centripetal movement, and so on.'

⁶⁴ CP 6.590: 'Reply to the Necessitarians' in the *Monist* (1893).

⁶⁵ Since April 1905, Peirce has renamed pragmatism 'pragmaticism' to avoid the other pragmatists' usage, in particular, that of William James whose 'doctrine of philosophy [...] opposed to sound logic' ('A Neglected Argument for the Reality of God', 1908, CP 6.482). For Peirce, pragmaticism is 'a theory of logical analysis, or true definition' ('Additament to the Article A Neglected Argument', 1910, CP 6.490). Providing Peirce's internal coherency for his pragmatic method, even if self-contradictory, I keep using 'pragmatism' including 'pragmaticism'.

⁶⁶ MS [R] 462, 42: 'The Lowell Lectures of 1903', 2nd Draught of 3rd Lecture. Further light shall be shed on the sentence prior to the above quotation in the manuscript (2021, 226, emphasis added):

Now when I say I am only talking logic and not metaphysics, I mean that for the time being *I do not care one straw what the occult truth may be about the real natures of qualities*, but all I care for is under

What he means by the predictable, expressible ‘future’ is linguistically and logically tensed in the following consideration on the lawfulness (*CP* 8.192, emphasis added):⁶⁷

[W]hat the answer to the pragmatist’s self-question does require is that the law should be *a truth expressible as a conditional proposition* whose antecedent and consequent express experiences *in a future tense* [...] But in all the range of science there is *no single proposition that goes by the name of a law*, from which conditional predictions as to future experiences may not be deduced.

This spotlights that laws of nature should bear ‘expressible’ truth-values,⁶⁸ whereas one cannot observe tenseless, permanent ‘truths’ in the formulated laws, for they ‘present downright exceptions’ by not quite ‘exact’ regularities in nature (*CP* 8.192).⁶⁹

Accordingly, I hold the view that, without deducing the lawfulness of future predictability, Peirce takes only the validity of *practical bearings* when deliberating on law-propositions. That is the conclusion of Peirce’s argument, which Berkeley could willingly defend in my further reformulation.

5.3.3 Berkeley’s defence of Peirce’s pragmatic method

Finally, despite the P1-B1 disagreement, I will explicate why Berkeley would even more defend a pragmatic inference from the same conclusion ‘mechanical causation is pragmatically conceived’ in response to Peirce’s argument. To reinforce Berkeley’s defence, I posit one more premiss, P4. As a result, looking back on the two arguments that I regimented earlier in §1.4.1 and §3.3.1, the intended conclusions can be likewise deduced from the two premisses of Berkeley’s following argument:

3. Mechanical causation is pragmatically conceived. [the conclusions in the last section]
4. Whatever is pragmatically conceived is discursively thought. [new premiss]

what *aspect or form of thought* you ought to regard them if you do no [sic] want to fall into grievous practical errors and to miss important *practical truth*.

Hardly can we miss Peirce’s endorsement of the ‘practical truth’, not the metaphysical ‘occult truth’, in his logical (or even logicist) approach to the ‘form of thought’ or conception.

⁶⁷ A manuscript (1905): Peirce’s review of Herbert Nichols’s *A Treatise on Cosmology* (1904).

⁶⁸ On truth-values, there is a third value called the ‘limit’ (L) between truth and falsity (V and F). On the grounds of *synechism*, i.e. his metaphysical theory that everything is ‘continuous’, *συνεχής* (*CP* 1.172; *NEM* 4.98, etc.), Peirce argues in a 40-page letter to William James, 26 Feb 1909 (*NEM* 3.851, emphasis original):

I have long felt that it is a serious defect in existing logic that it takes no heed of the *limit* between two realms. I do not say that the Principle of Excluded Middle is downright *false*; but I *do* say that in every field of thought whatsoever there is an intermediate ground between *positive assertion* and *positive negation* which is just as Real as they.

Whilst he did not reject the principles of excluded middle and bivalence, Peirce is nowadays considered the first logician who defined the operators for triadic (three-valued) logic. However, this view may be excoriated when we appreciate the third value of *avaktavya* (‘inexpressible’) as one of the seven-valued logic in Jainism (Oda and Galanos 2021). On my non-classical view, Peirce would not disagree that his logic was continuous with Jaina logic. See also *NEM* 3, ch. 17 ‘N-Valued Logic’; Lane 2018, 191.

⁶⁹ As such irregular and inexact laws, Peirce names some examples, such as the thermodynamic Dulong-Petit law and the periodic law of the chemical elements.

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- ⊢ Therefore, mechanical causation is discursively thought. [in accord with the conclusions of Berkeley's arguments in Chapters 1 & 3]

By this argument regarding mechanical causation, I maintain that Berkeley's discursive thinking underlies Peirce's approach to conceiving 'practical bearings' (*CP* 5.2 above). This is because we can see that the Peircean pragmatic conception of mechanical causation is eventually established through our discursive thinking about the truth and utility of mechanistic formulations, which I have reformulated throughout the thesis.

Nonetheless, in my final analysis, Premiss 4 should be further parsed in the context of *DM*. On my rendering, *DM* §7 clarifies Berkeley's consistent claim that, whether the vulgar or the learned, we ought to correctly understand that 'general and abstract terms are useful in discourse [*disserendo utiles*] and [... the significance of] their value [*vim*, i.e. truth-values of formulated propositions]' (clarification added).⁷⁰ On the one hand, those abstract terms, as later called 'mathematical hypotheses' (*DM* §17 etc.), are pragmatically conceived or 'invented [*inventæ*]⁷¹ by common custom [*consuetudine vulgari* or ordinary practice ... to facilitate] speech [*sermonem* or discourse]' (§7). This pragmatic conception of causal vocabulary is thus discursively thought in the minds of the vulgar, or ordinary people, with no interest in metaphysical perplexities. On the other, whatever is pragmatically conceived from mathematical hypotheses is 'deliberated [*excogitatæ*] by philosophers [i.e. the learned] for instruction [...] for handing down teachings [*tradendas disciplinas*]' (§7). The 'teachings', namely, mechanical theories and propositions, are so *discursively thought* that they can be conceived, both in the vulgar/ordinary mode of speaking and the learned/philosophical theorisation about causation.

In other words, as I reformulated from the text and context of *DM*, Berkeley's theory of causation from mathematical hypotheses in the mechanical domain is, after the processes of sensation and experimentation, geometrically reasoned for practical bearings.⁷² In the deductive reasoning for pragmatic conceiving, starting with linguistic or theoretical framing, the mechanist is to deliberately confirm a set of true causal laws *within* their discursive thinking, i.e. in three steps of defining, confirming, and thus expressing. The following section of *DM* further encapsulates Premiss 4 (clarification added):

§67. We have now to discourse [*disseramus*]⁷³ the question of the cause of the communication of motions [steps 3.1–3.3]. Certainly, all forces [*vires omnes*] attributed to bodies are as much mathematical hypotheses [*hypotheses mathematicæ*] as are attractive forces in the planets and

⁷⁰ On the quotation of *DM* §7 in full, see §0.1.1.

⁷¹ The verb 'invent [*invenire*]' is important, for I take it to be approximately the same meaning as 'imagine [*comminiscor*]' and 'frame [*ingere*]' without connoting possible falseness of 'feigning'. I construe that these verbs signify the conception of useful and truthful mechanical causation in our discursive thinking and practices. For more textual evidence, see *DM* §§1 ('inveniendam'), 17, 24, 39, 40; earlier footnotes in §3.1.3 and §4.5.1.

⁷² This was initially indicated as model 3 causation in the Introduction, §0.1.2.

⁷³ The Latin verb *disserere* was translated as 'dissert'/'dissertate' (in the sense of *dissertation*) or more generally 'argue' (in the sense of *argument*), both of which I argue bear the meaning of rational 'discourse' for utility, or discursive and deliberative thinking that expresses usefulness in mechanics. For the other references of this term, see *DM* §§4 (*disserendum utiles*), 7 (*disserendo utiles*), 21 (*disserere nil juvat*), 44 (*disserunimus*), 55 (*disseruntur*); Chapter 3.

the sun. Mathematical entities [*entia*], however, have no stable essence [*stabilis essentia*] in the nature of things [*res*]: they depend on the notion of the definer [*definiens*].

Defining scientific terms in the mind of the agent as *definer* was key to understanding Berkeley's theory of causation by mathematical framing or abstract imagination (especially step 3.1 of geometrical reasoning). This discursive process, on my view, lends itself to what Peirce meant by the *conceivably conceived conception* of mechanical causation with practical bearings or useful effects, for we can scientifically and logically express them.

Providing the above argument with the final conclusion as above, I uphold that Berkeley's pragmatist theory of causation in *DM* laid a solid foundation for Peirce's pragmatic method by discursive thinking. This is the interpretative goal that I have aimed to achieve through a chain of arguments thus far. Certainly, Berkeley's quasi-reference of mechanical terms is not integrated into P1 of Peirce's argument. Nonetheless, the conclusion can be the same from each argument as seen in the last section.

Therefore, whilst in the settings of mechanical causation, this way of discursive thinking is what Peirce did not clearly formulate but instead, what I reformulated through Berkeley's pragmatism about causation. It is true, regarding the unformulated pragmatic way of thinking, Peirce confessed as follows (*CP* 6.490):⁷⁴

But although it is 'an old way of thinking', in the sense that it was practiced by Spinoza, Berkeley, and Kant, I am not aware of its having been definitely formulated, whether as a maxim of logical analysis or otherwise, by anybody before my publication of it in 1878.⁷⁵

However, it can now be argued that Peirce's formulated maxim with practical bearings should be better understood with one of the early moderns, namely, Berkeley's pragmatist theory of causation.

In this unificatory way, overall, Berkeley's defence of Peirce's argument for mechanical causation can be further interwoven into our contemporary understanding of pragmatism thorough Peirce's *unformulated* reception of Berkeley's pragmatic method in *DM*.

Conclusion

In consequence, focusing on linguistic aspects in Berkeley and Peirce, we can newly understand a modern and future importance of pragmatist theories of causation. To this end, the first two sections, Peirce's categorisation of Berkeleyanism (§5.1) and Berkeley's distinction between reference and quasi-reference (§5.2), laid the groundwork for reformulating their arguments for pragmatic causation (§5.3).

On the one hand, the Berkeleyan definer (agent) holds *quasi-referential* mechanical terms, such as 'gravity' and 'mathematical hypothesis', which are useful in expressing causal relations and laws of

⁷⁴ *MS* [R] 844: 'Additament to the Article A Neglected Argument for the Reality of God' (1910).

⁷⁵ The publication he meant is 'How to Make Our Ideas Clear' (1878), from which Peirce's pragmatic maxim was repetitively taken as his favourite quotation. See also Friedman 2003.

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nature within the epistemic limits that they can define (B1). On the other, the pragmatist Peirce cannot accept the lawfulness of mechanical causation due to the arbitrary determination or irregularity in nature (P1). However, he was sympathetic to the Berkeleyan quasi-reference of unintelligible causes like 'force' and 'gravity' for manifest effects that make sense. Put another way, both Peirce and Berkeley agree on the pragmatic conception of mechanical causation (P2 and B2). Therefore, the conclusions of their arguments can be the same, where Peirce's formulation of his pragmatic method is reinforced by Berkeley's emphasis on discursive thinking in mathematical reasoning. Moreover, in broader contemporary settings, agent causation for conceptually manipulating their actions within their perspectives can be understood as the definer's formulation of conceivably useful causation in discursive thinking. And this can effectively be done with quasi-reference. Hence, I have fleshed out that Berkeley's and Peirce's pragmatist theories of causation as such can be appreciated in their critical, yet positive contrast.

A corollary of this conclusion can be the significance of mechanical causation for practitioners on the vulgar level, as opposed to the learned level.⁷⁶ Unlike abstruse metaphysical causation only for the learned, the vulgar who can use mechanical causation at hand are disposed towards the end of improving their own lives. In their efforts to make way on the often-disgruntled seas of life, mechanical causes are quasi-referentially formulated, confirmed, and expressed for their meaningful effects that the practitioners can conceivably manipulate.

⁷⁶ See Berkeley's contrast between the vulgar expression and the learned thinking, '*loquendum est ut plures, sentiendum ut pauci* [think with the learned, and speak with the vulgar]', see e.g. *Principles* §51; *Alciphron* §1.12; fn. 6 in [Chapter 0](#).

Conclusion

RRINGING everything summarily together, the Zagzebskian Big Shift of the universe and our minds may be considered here. For I assume that it applies to the case broached by this doctoral thesis. There was a dominantly Newtonian—albeit on my rendering, pragmatic—paradigm shift in the early modern period concerning the notion of cause, whereby the mechanist could take its usefulness and formulable truthfulness for themselves. Through his reception of the pragmatic aspects of Francis Bacon and John Toland, in particular, Berkeley’s pragmatist theory of causation set in motion the path to modernity. Regarding this kind of scientific development in modern Europe, it is Linda Zagzebski who argues for a big shift that occurred from the first great idea in the Renaissance to early modern times, such as metaphysics as the beginning of philosophy, to the second great idea in modern times, such as epistemology as ‘first philosophy’ (2021, 15).⁷⁷ As with Descartes’s methodical doubt in the *Meditations* (*ibid.*, 67), this transition from the pre-modern idea (i.e. harmony with the whole universe) to the modern idea (i.e. autonomous understanding of the human mind itself) would be inferred from my reformulation of the historical perspective and pragmatic conception of *causes* or ‘mathematical hypotheses’ in Berkeley’s *De motu*. This is because, refraining from the pre-modern ‘first philosophy or metaphysics’ (*DM* §§71–72), I see Berkeley conditioning the finite mind’s epistemic capacity to entertain mechanical causation. This, I think, is to pave the path to modernity or scientific progress. Therefore, in the context of *DM* aligned with the primacy of the second idea, the individualistic human mind defines causes, confirms truths of causal laws, and expresses the computed utility therefrom *just for their practical needs*.

Put another way, it is in this Zagzebskian shift that the gradual detachment of science from theology,⁷⁸ which I indicated in the Introduction, is brought to light with regard to occult qualities. In the early modern period, the detachment was not primarily rooted in metaphysics but epistemology when judging the difference between manifest and occult qualities, both empirically and rationally,

⁷⁷ Although I agree with Zagzebski regarding the cases for Berkeley and other early modern philosophers in Europe, it is hardly justifiable the way she treats non-Western philosophies and religions, such as Buddhism. For in the Buddhist history, on my view, no Zagzebskian big shift really occurred. Consider, for instance, the Indian Middle-Way (Madhyamaka) Buddhist philosopher Nāgārjuna (approx. 2nd century CE) who argued the terms ‘cause’ and ‘condition’ epistemically against metaphysically-oriented Buddhists in the Abhidharma tradition. Be that as it may, I thank her for the Donnellan Lectures on her *Two Greatest Ideas* (2021) at Trinity College, Dublin (Hilary Term, 2022, in person).

⁷⁸ For instance, *ibid.*, 65: ‘By the seventeenth century the new astronomy of Copernicus and Galileo ensured the decline of religious authority and the version of the first great idea that had dominated European life for many centuries. Philosophy had to chart a path in a world in which everything was contested except science and mathematics.’

in one's own perception and reasoning. In this sense, the second great idea of individualistic epistemology can chiefly be featured in Berkeley's scientific scheme. The first great idea of theological metaphysics is thereby put into his background picture of efficient and final causation by divine and spiritual causes. The latter metaphysical causation is certainly important for the Berkeley of *DM*, whereas I argued that it was primarily pragmatic when it comes down to his analysis of scientific, mechanical causation as distinguished from metaphysical causation.

For the Berkeley of *DM*, to that effect, occult qualities were apparently rejectable as *insensible* but not as pragmatically *unintelligible* within the Newtonian paradigm. On my rendering, during this paradigm shift, Berkeley's analysis of mechanical, dynamical causation made sense by taking the utility of causal terms—'mathematical hypotheses'—that *quasi*-refer to unobservable *quasi*-objects that have unknown occult qualities. In the context of *DM*, their unintelligibility is not reduced to observation sentences, but their applicability is made clear when causal terms ('force', 'gravity', and such 'mathematical hypotheses') are usefully formulated into causal relations, theories, and laws. Moreover, those generalised theories and laws are taken to be true as long as they are confirmed and expressed in the mechanist's practice or discursive thinking. Therefore, I defended that the usefulness and truthfulness of causation are pragmatically conceived inasmuch as they are discursively thought. This is because the Berkeley of *DM* brings to the fore the importance of pragmatic causation in the domain of mechanics, which should be approached within the mechanist's epistemic limits as distinct from the metaphysical domain. Reformulating *DM* thus, I set forth the three models of causation, one about the theologically superior metaphysical relations, the other two being scientifically mechanical relations of the cause and the effect. As seen through the five chapters, the focal point was to understand the third model of pragmatic mechanical causation from mathematical hypotheses, which describe or quasi-refer to occult causes for their manifest, meaningful effects.

Hence, I have integrated the central definition below into my analysis that Berkeley developed his version of the pragmatist theory of causation:

Definition. A pragmatist theory of causation is one which holds that:

- ① Causal terms are indispensable in scientific deliberation for their usefulness; they cannot be eliminated.
- ② What a cause is is defined by one's temporal deliberative practices, independent of atemporal structure that theories hold.
- ③ Causal laws (theories and theorems formulated in causal terms) are genuinely true, not fictitious, when one confirms and deduces them.

Defending this tripartite definition was what I principally characterised on my rendering of the Berkeley of *DM*. In this defence, my reformulation of his pragmatist theory of causation ran the gamut of three elements (sensation, experimentation, and geometrical reasoning) and three steps in geometrical reasoning (linguistic definition, epistemic deliberation, and pragmatic locution)

within the pyramid model of mechanical causation in *DM*. Whilst I took Bacon and Toland to have positive influences on Berkeley, the metaphysical views of Leibniz, Borelli, and Torricelli as well as the Cambridge Platonists were critically contrasted with Berkeley's view that appropriates Newton's mechanics and yet pragmatically treats 'mathematical hypotheses' as causal terms, such as 'force', 'impetus', and 'gravity'. Through those precursors, Berkeley's pragmatism about causation can be newly understood. Furthermore, my justification of Berkeley's pragmatic conception of causation was deepened critically in opposition to the three rival readings (reductionism, structuralism, and instrumentalism). Finally, I reinforced the above definition with more analysis with Peirce's reception of Berkeley's unformulated pragmatic method. Constructing the five chapters, on the whole, I have accomplished my original contribution to Berkeley scholarship as well as early modern philosophical studies. Thus, it is my view that this contribution makes sense to the future understanding of ourselves in pragmatic progress, namely, in pursuit of useful truths by our communicative, discursive thinking.

Returning to the theme of this Conclusion, the ending of the Zagzebskian shift is yet to come. In Berkeley's case, how could we infer the third greatest idea from his early modern view of pragmatic causation? I follow Zagzebski in speculating a possible third great idea that '*the human mind can grasp another mind*' towards intersubjective knowledge (2021, ch. 6). The Berkeleyan third idea can be a pragmatic *therapy* of future minds, for example, in a seamless convergence of the universe and metaverse (decentralised actual-virtual realities).⁷⁹ In addition to correcting the abuse of language 'abhorrent to the truth and the commonsense of people' (*DM* §2), in Berkeley's other works (*MI* §18; *Defence* §28; *Dialogues* preface 167, 3.263, etc.), we must go back to our commonsense to 'remedy' or 'rescue' our minds from metaphysical perplexities. On this commonsensical basis, we hold linguistic interdependence to communicate,⁸⁰ so that we can correctly perceive and understand one another (as digital avatars) in scientific as well as mundane practices. Thereby we can identify what causes, effects, and their relations are (i.e. three objects in causation) via sensation, experimentation, and reasoning in our 'mode of speaking' (*DM* §1). Developing from *DM* (q.v. §72), our prospective 'meditation and reasoning' would no longer convey the literal meaning of metaphysics as 'first philosophy' (the first idea), nor would they do epistemology as 'first philosophy' (the second idea). Instead, *we* can keep reformulating the third idea of therapy as 'first philosophy' derived from Berkeley's pragmatic method about causation.

⁷⁹ A Berkeleyan metaverse or virtual reality hinges on one's own perception and that of other minds. See also Chalmers 2022, ch. 4, rejecting Berkeley's idealism. However, I contend that David Chalmers's 'virtual realism' (against virtual fictionalism) rather underpins Berkeley's pragmatic and commonsensical analysis of the metaverse in our life.

⁸⁰ It should be noted that for Berkeley, the linguistic dependence upon one another is still theological. This is because 'the *Author of Nature*' or 'the Creator [...] alone it is who *upholding all things by the Word of his Power*, maintains that intercourse between spirits, whereby they are able to perceive the existence of each other' (*Principles* §147). Although this can be seen as divine final causation in the metaphysical domain, I have shown that there exists another domain of mechanical causation that human minds can conceive for themselves. It is in the latter domain where both the vulgar and the learned minds can articulate their conceived causation, as it were, in the universe of discourse. On my rendering, Berkeley's pragmatist theory of causation can be further reinforced in Donald Davidson's approach to the 'intercourse' by sentence-users of a given language (2001, 181): 'Nothing in the world would count as a sentence, and the concept of truth would therefore have no application, if there were not creatures that used sentences by uttering or inscribing tokens of them. Any complete account of truth must therefore relate it to actual linguistic intercourse.'

Appendix A1

Paris *Académie Royale des Sciences*

A1.1 *De motu* undocumented in the *Académie* archives



At the end of his Italian trip before coming back to London,¹ Berkeley might have intended to apply for a prize competition held by the Paris Académie royale des sciences, before the first year of the award decided on Tuesday 13th November, 1720.²

However, it is extremely uncertain whether he actually submitted it to the Académie. On the scepticism of Berkeley's arguable submission, I confirmed myself (2020) that there was no record of Berkeley's document in the Paris Académie's archives; my inquiry was also confirmed by two preceding inquiring letters of Bertil Belfrage (1982) and Nguyen Minh Nhang (1950) and the Académie's responses that answered in the negative.³ Another suggestion of Susana Seguin (Webex online meeting, 21 sep 2020) is that all the submitted drafts and the list of candidates for the 1720 Académie prizes might have belonged to the property of Fontenelle, but one does not know where they are and whether they are conserved or lost. According to articles 40 and 41 in the *Règlement* of 1699, the perpetual secretary (Fontenelle, 1699–1740) had the obligation to hold the registers and collect the treatises and titles, namely, the most diverse papers, 'demeureront toujours entre les mains du secrétaire [will always remain in the hands of the secretary]'.⁴

I identified five members of the Académie royale des sciences who judged the 1720 prize competitions under the control of Bernard de Fontenelle (1657–1757), perpetual secretary at the time and defender of Cartesianism. The five are: Pierre Varignon (1654–1722, registered in the Académie's 'pensionnaires' section: 'Géométrie' since 4 fev 1699); Joseph Saurin (1659–1737, 'Géométrie' since 4 fev 1699); Jacques Cassini (1677–1756, 'Astronomie' since 4 fev 1699) known as Cassini

¹ See Jones 2021, ch. 8; Oda, [forthcoming](#) (book review of Jones's biography).

² L'Académie royale des sciences 1720, *Procès-verbaux* (cote: 2B39*), le mercredi 13 novembre 1720. This is one of the outcomes from my archival research in Paris, the 2020 summer. I am indebted to the French governmental grant, la bourse de séjour scientifique de haut niveau France-Irlande (SSHN).

³ I deeply thank the Académie archivists, Mme Isabelle Maurin-Joffre, Mme Christine Foulcher, et M. Karim Benslama. See also Jessep 1992, 3, n. 1; Luce's introduction to *DM* (*Works* IV, 3); Iltis 1973, 359–360.

⁴ See the 'Règlement de 1699' in Demeulenaere-Douyère and Brian 2002, xxiii–xxviii; Lardit 2002, 382–383; Demeulenaere-Douyère 2002, 470; Rappaport 1981, 228–230.

II; René-Antoine Ferchault de Réaumur (1683–1757, ‘Mécanique’ since 16 may 1711); Le P. Reineau or le père Charles-René Reyneau [Reyraud] (1656–1728, ‘Associé Libre’ since 12 fev 1716).⁵ In addition, the 1720 président was Torcy, Jean-Baptiste Colbert, marquis de (1665–1746); vice-président Bignon, l’abbé Jean-Paul (1662–1743); directeur Réaumur; sous-directeur Geoffroy, Étienne-François (1672–1731).⁶ The degrees of affinity with Newtonianism in these Cartesian natural philosophers vary, whilst many followed the Cartesian methodology, such as the planetary theory of vortices for Cassini II. However, on my view, it is certain that they (including Fontenelle) all welcomed Newtonian physics/mechanics, for e.g. the theory of attraction is inexplicable by rational laws by Cartesian methods. For example, through the influential French Newtonianism of Maupertuis (directeur in 1736 and 1742), it seems clearer that Jean-Jacques Dortous de Mairan (1678–1771), perpetual secretary after Fontenelle (1741–1743) of the Académie, applies the Newtonian methods to the tradition of Cartesianism. Thus, Ellen McNiven Hine labels Mairan the ‘cartonian’ (1989). I uphold here that Cartonianism can be a proper term to describe the atmosphere of the early eighteenth-century Académie of Paris.⁷

A1.2 Académie prize questions in 1720

What are certain are the archived details of the prize selection, and particularly, one of the two prize questions in 1720: ‘what is the principle and the nature of the motion, and what is the cause of the communication of the motions?’ This prize question should be carefully kept in mind, because Berkeley must have paid attention to the causes of motions. This concerns Berkeley’s theory of causation in terms of laws of nature, developed after the scientific discussion in his earlier works.⁸

The first prize question in French was ‘Quel est le principe et la nature du mouvement, et quelle est la cause de la communication des mouvements?’; 2000 £ was awarded to Jean-Pierre de Crousaz (1720). The second prize question was ‘Quelle serait la maniere la plus parfaite de conserver sur mer l’égalité du mouvement d’une pendule, soit par la construction de la machine, soit par sa suspension?’; 500 £ was awarded to Nicolas Massy (1720). Originally, the Académie prize foundation consisted of 125,000 livres, the bequest of Jean-Pierre Rouillé, compte de Meslay (1656–1715), dated on

⁵ See l’Académie royale des sciences 1720, *Procès-verbaux* (cote: 2B39*), le samedi 20 avril 1720; 1721, *État chronologique* (cote: 1B3*).

⁶ See l’Académie royale des sciences 1720, *Procès-verbaux* (cote: 2B39*), le mercredi 10 janvier 1720; Hahn 1993, 89; L’Institut de France 1979.

⁷ See also Seguin 2020, 67–80; Schaffër 2015, 50–58; Canguilhem 1994 [1957], 51–58 (esp. 55); Blay 1993, 175–182; Crépel and Schmit 2017, 47ff.

⁸ See e.g. *Principles* (1710) §30: ‘the set rules or established methods, wherein the mind we depend on [i.e. the spiritual or animating being, God, who causes our ideas] excites in us the ideas of sense, are called the Laws of Nature: and these we learn by experience, which teaches us that such and such ideas are attended with such and such other ideas, in the ordinary course of things’ (clarification added). On this quote, from a ‘secularised’ perspective, Rom Harré argues that the ‘laws’ in Berkeley’s times was already taken to be ‘human versions of divine edicts, through which the divine governance of the world was accomplished. The metaphor of “law” was close to a literal description’ (1993, 9–10). On my reading, Berkeley’s human versions of laws of nature (law-statements) is identified with a set of mechanical causations from mathematical hypotheses.

21 mars 1716.⁹ The first awardee, Crousaz (1663–1750) was a Swiss theologian, Cartesian, and professor of philosophy and mathematics at l'Académie de Lausanne. It is noteworthy that he was already acquainted with at least one of the Académie prize committee members, Réaumur (also with Fontenelle).¹⁰ Crousaz's essay publication after his prize award was 'Discours sur le principe, la nature et la communication du mouvement' (1721, 1–67).

⁹ See Maindron 1881, 17; Demeulenaere-Douyère 1996, 69–72; Rivet-Alpert 2002, 396–398.

¹⁰ For the correspondences between Réaumur and Crousaz (1718, 1719, 1725), see e.g. Crousaz to Réaumur, 24 May 1718 (l'Académie, fonds Réaumur, cote: 69J, 67.13/07) concerning Newton. See also Schaffer 2015, 53, 55, nn. 20, 32; Terrall 2014, ch. 3, n. 1.

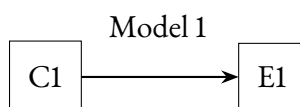
Appendix A2

The Term ‘*Causa*’ Ramified in *De motu*

Ramification

This appendix ramifies the three models of causation, which I have set forth in Introduction Chapter §0.1.2. By my count, there are 44 instances of the term ‘cause’ (*causa*) in *De motu*. Including the verb form in the vocabulary,¹ the following is my attempt to consider the terminological level of ‘cause’, the object in causal relations and laws, concerning the three models in the text of *DM*. The term is emphasised with the number with its number in order.

A2.1 Metaphysical causation



24 instances, 7 of which are taken to be the objects of metaphysical, efficient causation (in short, EF).

§6. Obviously then it is idle to lay down gravity or force as the principle of motion; for how could that principle be known more clearly by being styled an occult quality? What is itself occult explains nothing. And I need not say that an unknown acting *cause* [1] could be more correctly styled substance than quality.

§22. All that which we know to which we have given the name body contains nothing in itself which could be the principle of motion or its *efficient cause* [2, EF].

¹ In the term ‘cause’, I include what I label ‘causal terms’, such as ‘force’ and ‘mass’, whereas I do not consider the respective terms of mechanics and metaphysics in *DM*. Causal terms like ‘force’ and ‘gravity’ do not refer to objectionable qualities but *quasi*-refer to occult qualities as mathematical hypotheses. By contrast, on my rendering, causal terms like ‘mass’ and ‘figure’ do refer to objectionable or sensible qualities as empirical hypotheses. See especially [Chapter 3](#) and [Chapter 5](#).

§28. Action and reaction are said to be in bodies, and that way of speaking suits the purposes of mechanical demonstrations; but we must not on that account suppose that there is some real virtue in them which is the CAUSE (10) or principle of motion. [...] Similarly the traditional formulations of rules and laws of motions, along with the theorems thence deduced remain unshaken, provided that sensible and the reasonings grounded in them are granted, whether we suppose the action itself or the force that *causes* [*causatricem*] these effects to be in the body or in the incorporeal agent.

§29. If therefore by the term body be meant that which we conceive, obviously the principle of motion cannot be sought therein, that is, no part or attribute thereof is the true, *efficient cause* [3, EF] of the production of motion.

§35. The imperfect understanding of this situation has *caused* [*in causa est*, 4] some to make the mistake of rejecting the mathematical principles of physics on the ground that they do not assign the *efficient causes* [5, EF] of thing. It is not, however, in fact the business of physics or mechanics to establish *efficient causes* [6, EF], but only the rules of impulsions or attractions, and, in a word, the laws of motions, and from the established laws to assign the solution, not the *efficient cause* [7 EF], of particular phenomena.

§36. The true, *efficient* and *conserving cause* [8, EF and final cause] of all things by supreme right is called their fount and principle. But the principles of experimental philosophy are properly to be called foundations and springs, not of their existence but of our knowledge of corporeal things, both knowledge by sense and knowledge by experience, foundations on which that knowledge rests and springs from which it flows.

§37. In that consist the explanation and solution of phenomena and the assigning their *cause* [9], i.e. the reason why they take place [*id est ratio cur fiant*].²

§41. But metaphysical principles and real *efficient causes* [10, EF] of the motion and existence of bodies or of corporeal attributes in no way belong to mechanics or experiment, nor throw light on them, except in so far as by being known beforehand they may serve to define the limits of physics, and in that way to remove imported difficulties and problems.

§47. For it has become usual to confuse motion with the *efficient cause* [11, EF] of motion. [...] Thence obscurity, confusion, and various paradoxes of motion take their rise, while what belongs in truth to the *cause* [12] alone is falsely attributed to the effect.

§48. This is the source of the opinion that the same quantity of motion is always conserved; anyone will easily satisfy himself of its falsity unless it be understood of the force and power of the *cause* [13], whether that *cause* [14] be called nature or nous, or whatever be the ultimate agent.

² My reading opposes the non-metaphysical but deductive-nomological interpretation of Brook 2017; see §2.2.3.

§67. It remains to discuss the *cause* [15] of the communication of motions.

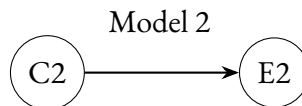
§69. That the Mind which moves and contains this universal, bodily mass, and is the true *efficient cause* [16, EF] of motion, is the same *cause* [17], properly and strictly speaking, of the communication thereof I would not deny. [...] Physically, therefore, a thing is explained not by assigning its truly active and incorporeal *cause* [18], but by showing its connection with mechanical principles, such as action and reaction are always opposite and equal.

§70. It is not established that there is force, virtue, or bodily action truly and properly *causing* [*causatricem*, 19] such effects. The body in motion impinges on the quiescent body; we speak, however, in terms of action and say that that impels this; and it is correct to do so in mechanics where mathematical ideas, rather than the true natures of things, are regarded.

§71. In first philosophy or metaphysics we are concerned with incorporeal things, with *causes* [20], truth, and the existence of things. [...] No account is taken of the actual seat of the forces or of the active powers or of the real *cause* [21] in which they are.

§72. Only by meditation and reasoning can truly active *causes* [*causae*, 22] be rescued from the surrounding darkness and be to some extent known. To deal with them is the business of first philosophy or metaphysics.

A2.2 Mechanical causation from empirical hypotheses



Mechanical causes are 20 instances in total, on my reading. The first type rooted in manifest ‘empirical hypotheses’, formulable for C2 propositions in model 2, can be ramified as below: in total approximately, 9 instances. It should be noted that this ramification is quite loaded with my interpretation.

§20. All those who, to explain the *cause* [1, on my reading, this can also apply to model 3 ‘mathematical hypothesis’] and origin of motion, make use of the hylarchic principle, or of a nature’s want or appetite, or indeed of a natural instinct, are to be considered as having said something, rather than thought it. And from these they are not far removed who have supposed ‘that the parts of the earth are self-moving, or even that spirits are implanted in them like a form’ in order to assign the *cause* [2] of the acceleration of heavy bodies falling. So too with him who said ‘that in the body besides solid extension, there must be something posited to serve as starting-point for the consideration of forces.’ All these indeed either say nothing particular and determinate, or if there is anything in what they say, it will be as difficult to explain as that very thing that the *cause* [3] was adduced to explain.

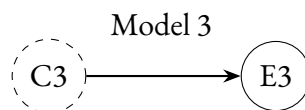
§22. As for gravity we have already shown above that by that term is meant nothing we know, nothing other than the sensible effect, the *cause* [4] of which we seek. And indeed when we call a body heavy we understand nothing else except that it is borne downwards, and we are not thinking at all about the *cause* [5] of this sensible effect.

§28. For in mechanical philosophy the truth and the use of theorems about the mutual attraction of bodies remain firm, as founded solely in the motion of bodies, whether that motion be supposed to be *caused* [*causari*, 6] by the action of bodies mutually attracting each other, or by the action of some agent different from the bodies, impelling and controlling them.

§50. The Peripatetics who say that motion is the one act of both the mover and the moved do not sufficiently divide *cause* [7] from effect.

§71. And on this method we say that the body in motion is the *cause* [8] of motion in the other, and impresses motion on it, draws it also or impels it. In this sense second corporeal *causes* [9] ought to be understood, no account being taken of the actual.

A2.3 Mechanical causation from mathematical hypotheses



C3 propositions in model 3 are formulated from ‘mathematical hypotheses’, i.e. mechanical causes that *quasi*-refer to non-sensible, occult qualities as *quasi*-objects.³ There are certainly many theoretical, causal terms subsumed under ‘mathematical hypotheses’, whereas I zero in on the term ‘cause’ *per se*: in total 11 instances.

§4. By reason, however, we infer that there is some *cause* [1] or principle of these phenomena, and that is popularly called gravity. But since the *cause* [2] of the fall of heavy bodies is unseen and unknown, gravity in that usage cannot properly be styled a sensible quality.

§34. Modern thinkers consider motion and rest in bodies as two states of existence in either of which every body, without pressure from external force, would naturally remain passive; whence one might gather that the *cause* [3] of the existence of bodies is also *that* [*quæ*] of their motion and rest. For no other *cause* [4] of the successive existence of the body in different parts or space should be sought, it would seem, than *that* [*illa*] whence is derived the successive existence of the same body in different parts of time.

³ For quasi-reference and quasi-objects, see first §0.1.1.

§39. And just as geometers, for the *cause* [*causa*, or nominally ‘for the sake’, 5] of their art, make use of many devices which they themselves cannot describe nor find in the nature of things, even so the mechanist makes use of certain abstract and general terms, imagining in bodies force, action, attraction, sollicitation, etc.

§67. Most people think that the force impressed on the moveable body is the *cause* [6] of motion in it. However that they do not assign a known *cause* [7] of motion, and one distinct from the body and the motion is clear from the preceding argument.

§69. In physical philosophy, however, we must seek the *causes* [8, this can also apply to model 2 ‘empirical hypothesis’] and solutions of phenomena among mechanical principles.

§71. The physicist studies the series or successions of sensible things, noting by what laws they are connected, and in what order, what precedes as *cause* [9, as above, this can also apply to model 2], and what follows as effect. [...] Further, besides body, figure, and motion, even the primary axioms of mechanical science can be called *causes* [10] or mechanical principles, being regarded as the *causes* [11] of the consequences.

Appendix A3

Logic, Mathematics, and Lexicon

Berkeley's logic and mathematics textbooks into scrutiny

This appendix reads into textbook sources from which Berkeley supposedly learnt the terms for his theory of causation, such as ‘hypothesis’¹ or ‘supposition’ and ‘abstraction’.² In the dominance of the philosophical textbook of his day,³ the appendix shines a light on historically manifold roots for Berkeley’s theorisation of pragmatic mechanical causes, or mathematical hypotheses. From the sources under my review, I will reconstruct that the causal antecedent of a proposition, operationally having its truth-value, frames causal laws to be useful in mechanics. This pragmatic sense, I think, is applied to the context of *DM* in terms of Berkeley’s pragmatist theory of causation. From his nascent *Arithmetica/Miscellanea* (1707) and ‘Of Infinites’ (1707) to the *Analyst* (1734), one can see obvious influences of Newton, Locke, Hobbes, Boyle, and other British/Irish precursors upon Berkeley’s training in logic, mathematics, and natural philosophy. There is also manifest evidence that Berkeley has read the mathematical works of John Wallis and Isaac Barrow (Newton’s teacher).⁴ However, in this appendix, I will consider to what extent the other—more underestimated than canonical—pieces that Berkeley read gave rise to his uses of ‘mathematical hypothesis’ in *DM*.

It is difficult, indeed, to identify exact textual evidence of Berkeley’s Newtonian and non-

¹ In seventeenth-century science, according to Lorne Falkenstein (2010, ch. 2), e.g. Bacon and Boyle ‘would probably have said that they regarded the mechanical philosophy as a “hypothesis” rather than as a fact, that is, as a speculation about the “latent constitutions” of materials and the “latent processes” governing all change in nature. They might further have remarked that they took the mechanical hypothesis to be an especially promising one, that is, one well worth investigating further, and Boyle might have said that appeals to its simplicity, intelligibility, comprehensiveness, and explanatory power are just reasons for investigating it further, not reasons for accepting it.’

² On the term ‘abstraction’, here is a contradictory remark of early Berkeley (*MI* §19): ‘From all w^{ch} to me it seems evident that the having of General Names does not imply the having of General Ideas, but barely the Marking by them a Number of particular ideas. And that all the Ends of Language may be, & are, attain’d, to without the help of any such Faculty as Abstraction.’ Nonetheless, I consider that mathematical ‘abstraction’ in mechanics is not the case for this remark in the Berkeley of *DM*.

³ Unlike the mainstream teaching of Aristotle’s writings in the Middle Ages down to the end of the sixteenth century, the seventeenth century began to witness the emergence of the philosophical textbook as ‘the subject in most formal courses in institutions of higher learning’ (Schmitt 1988, 801).

⁴ See *Notebooks* §§482, 834, 837 (Berkeley was interested in the Hobbes-Wallis controversy on geometry); *NTV* §§75–76 (the moon distance in Wallis’s work). See also Wallis’s conventional use of ‘*ex hypothesi*’ in his *Opera mathematica* (Wallis 1657; 1693–99).

Newtonian implications of causal terms and sentences as the mathematical hypotheses. On the one hand, Newton's influence on Berkeley's mathematical and philosophical methods have been sufficiently studied.⁵ I do not argue against the commentators here. On the other hand, what is lacking in Berkeley scholarship concerning the use of 'mathematical hypotheses' is the viability of multi-faceted non-Newtonian influences on Berkeley before the 1721 publication of *De motu*. To clarify, as is further discussed in [Chapter 3](#) (over *DM* §61), I argue that the terms 'hypothesis' and 'supposition' are identical with each other in Berkeley, inasmuch as they are proper to both geometry and mechanics within the mathematical science.⁶ In fact, due to the etymology of *hypo/sub* or 'under' and *stasis/positio* or 'positing', these Greek and Latin terms are equivalent, when they come down to deductive argument and when they both occur in mathematical propositions about causal laws. Moreover, both terms will be found pragmatically identical in my textual analysis (main chapters), inasmuch as they are regarded as 'useful' in the discourse by mathematical abstraction or deduction.

Certainly, the uses of the terms 'hypothesis' (*ex hypothesi*) and 'supposition' (*ex suppositione*) are narrowly distinct in interpreting early modern scientific texts, such as those of Galileo.⁷ However, in a broad early modern context of logic and mathematics, I take it that this generic term 'hypothesis' is the same as 'supposition' in the sense of a causal antecedent in the premises of a deductive argument. By 'causal' I mean that the antecedent—i.e. what precedes the effect or consequent—pertains to both the term and the conditional sentence, which are *sine qua non* for a premise. In other words, *but for* the premised term or antecedent *qua* cause, the mathematician or mechanist cannot deduce the consequent or conclusion *qua* effect in the argument. Here, I do distinguish terms and sentences. Any scientific linguistic term/word *indispensably* signifies its singular idea (or produces the effect),⁸

⁵ See e.g. Brook 2018; Pearce 2021; Peterschmitt 2007, [forthcoming](#). In addition to Newton, of course, it is evident that Berkeley read the works of Descartes, Hobbes, Malebranche, Locke, and Leibniz. See *Notebooks* §§784, 795, etc. However, though I will consider Descartes' *Geometria*, I will not primarily focus on these canonical 'Great Books', since the comparisons with Berkeley are likewise sufficiently established. Instead, I will aim at my version of 'contextual revolution' as Christia Mercer lately advocated (Mercer 2019; Pearce and Oda 2020b, 1).

⁶ For the uses of *ὑπόθεσις/suppositio* from Aristotle's *Posterior Analytics* to Galileo's works, such as his early *De motu* (c.1590 unpublished), or Galileo's indebtedness to Aristotle, see, especially, Wallace 1981, 74 (as much as 12 types of 'supposition'). Regarding Galileo's 'mathematical science', which Berkeley must have learnt in terms of local motion, type 11 of Galileo's 'supposition' in Wallace is one of the essential background for my interpretation of Berkeley's use in *DM*: 'suppositio of one or more conditions under which a mathematical principle or definition will be verified [judged to be true or confirmed] in nature to a determinate degree of approximation' (clarification added).

⁷ According to W.A. Wallace (1974, 81, 90), Galileo distinguishes non-productive reasoning *ex hypothesi* from productive demonstration *ex suppositione* in the mathematical and natural sciences. The latter demonstration is deemed Galileo's strict *nuova scienza* with a stronger proof. In addition, Galileo distinguishes two senses of 'supposition':

1. primary suppositions with reference to the absolute truth in nature, and
2. secondary ones with reference to the appearances (e.g. movements of the stars) that one imaginatively posits, which are 'chimerical and fictive [...] false in nature' merely for the sake of astronomical computation.

See Galileo, *Considerazioni circa l'opinione Copernicana* (1890–1909 V, 357–359). In Berkeley's *DM*, I do not see these nuanced Galilean distinctions because mathematical suppositions/hypotheses (both terms and sentences) are pragmatic within a correct use of language in the 'mode of speaking' (*loquendi consuetudine*, *DM* §1 etc.), namely, useful for mechanical causation that is judged or confirmed to be true.

⁸ I also distinguish linguistically or logically explanatory causes of events from productive causes, which are extra-

whereas the sentence/proposition is indispensably identical with the judgement, e.g. in the context of Arnauld and Nicole's *Port-Royal Logic* (1662).⁹ That is, terms (and phrases) do not have truth-values for themselves, but sentences have to be judged either true or false whence assented. To this logical end, on my view, the hypotheses/suppositions as antecedents are both meant to be causal terms and causal sentences, so as to infer the effects and consequents (sentences) alike. Therefore, I consider the two levels of term and sentence with respect to Berkeley's meanings of mechanical causes as 'mathematical hypotheses' (suppositions). When he refers to the term (phrase) in *DM*, setting aside metaphysical theological causes, the context about mechanical (dynamical) causes is distinctively mathematical (geometrical) by the nature of deductive argument.¹⁰

For my interpretative purpose, I will limit the range and propose these three types of sources:

- (i) Logic textbooks that Berkeley read at TCD;
- (ii) Loan books that he borrowed from TCD library, especially on mathematics;¹¹
- (iii) A variety of books that he owned at home, especially lexicons.¹²

The degrees of my speculation (or mere surmise) increase from type (i) to type (iii). Accordingly, in A3.1, the greatest light will be shed on type (i) logic textbooks, regarding the term 'hypothesis' in its logical sense that is the basis for every mathematical method. In addition, A3.2 concerns (ii) the mathematical part in the loan books, and A3.3 zeros in on (iii) the lexical part in the Berkeley family's own books. Thereby I will probe into three layers of meanings of the term 'hypothesis/supposition'. Even providing those non-Newtonian sources for Berkeley, there can be still more sources excluded from this range, of which I am not currently aware.¹³ However, from the three types of sources, I

linguistic and metaphysical. Berkeley's mechanistic business of causation on my reading is the former. See also Tuomela 1974, 325–326; Mackie 1974.

⁹ It was common that early modern logic textbooks, such as the *Port-Royal Logic*, have the quadripartite division of the book structure. Singular ideas refer to the level of terms, and judgements refer to the level of sentences. The third (or fourth) level is reasoning or argumentation (syllogism in the Aristotelian sense), and the final level is method that coalesces all the levels. See Arnauld and Nicole 1996 [1662]: 'I. Contenant les reflexions sur les idées, ou sur la premiere action de l'esprit, qui s'appelle concevoir. II. Contenant les reflexions que les hommes ont faites sur leurs jugemens. III. Du Raisonnement. IV. De la Methode'; Le Clerc 1692: 'I. De Singulis Ideis, II. De judiciis, III. De Methodo, IV. De Argumentation'; Schuurman 2003, 140–142; 2004, chs. 3, 5.

¹⁰ In main chapters (Chapters 1 and 4, I also read inductive and abductive aspects (inference to the best explanation) in *DM* by the human senses and experiment (sensation and experimentation).

¹¹ For the sources of textbooks and loan books that Berkeley read at Trinity College, Dublin, see Jones 2021, ch. 2; McDowell and Webb 1947; McDowell and Webb 1982; Maxwell 1946; Boran 2013, 79–83; TCD Trinity College, Dublin, MS 2087–2090. I thank Elizabethanne Boran, librarian of The Edward Worth Library in Dublin, who assisted me by her additional notes on Berkeley's borrowing records.

¹² Leigh and Sotheby 1796 is the auction catalogue of the Berkeley family's books. It should be noted that, amongst all, there is no evidence of whether Berkeley read Arnauld and Nicole's *Logique, ou l'art de penser* (*Port-Royal Logic*, 1996), though he might have encountered it through canonical books in logic and philosophy. On the other hand, the Berkeley family owned the *Port-Royal Greek Grammar* (1796, 1415 in the auction catalogue), but its edition was published in 1748. As with this book, I will not take into account books on the catalogue list published after 1721, as they are too late to impress Berkeley on causal terms in *DM*.

¹³ For example, Archbishop Narcissus Marsh's *Institutiones logicae* (1681) is not found in any of the three types of sources. He published this logic textbook when he was Provost of TCD (1679–83). His theories of connotative terms, signification, supposition, and so on are worthy of note to understand the Dublin milieu of how logic was taught just before 1700 when Berkeley enrolled in TCD. The first page is telling (*ibid.*): 'Logica (seu Dialectica) est ars instrumentalis,

will adequately consider the multifarious uses of the term by seventeenth-century precursors. On my rendering, therefore, the following sources potentially yet directly formed Berkeley's pragmatic uses of the term 'mathematical hypotheses' in *DM*.

A3.1 Logic textbooks on the mathematical hypothesis

One can easily surmise several immediate influences on Berkeley, such as the texts of Newton, Locke, Malebranche, those canonical philosophers, as he critically cited them. On the other hand, I will propose the other yet immediate influences on Berkeley from valid sources, such as his logic textbooks used at Trinity College, Dublin. In the cases of early modern logic and mathematics, these textbooks were neither uncanonical nor unconventional.

Heuristically, in my reading, (i) TCD official textbooks of logic are the most likely sources amongst the there types I specified. Historiographically recorded,¹⁴ they are chiefly three textbooks in Latin: Śmiglecki's *Logica: selectis disputationibus et quaestionibus illustrata* (1618; 1634, etc. repr. in Oxford), Burgersdijk's *Institutionum logicarum* (1626; 1680, etc.), Le Clerc's *Logica, sive ars ratiocinandi* (1692, etc.).¹⁵ Supposing that Berkeley probably (had to) read these seventeenth-century textbooks at TCD, I will parse out the uses of 'supposition' and 'hypothesis' that can be relevant to his *DM*.

Śmiglecki's *Logica*

Born in Lwów (now Lviv, Ukraine), having belonged to the Jesuit order in Rome in 1581, the Polish Śmiglecki's theology and logic stand on the mainstream Catholicism, which was duly influenced by St Thomas Aquinas and Francisco Suárez, SJ (Roncaglio 1995, 27–36). In the year of his death, 1618, his massive and mature work *Logica*, a collection of eighteen disputations (subdivided into 185 questions in 2 vols.), was first published in Ingolstadt, Bavaria, and became a standard textbook at Oxford (three reprints) and also Dublin in the seventeenth century.¹⁶

Starting off with his tenet of *entia rationis*, necessary to logic,¹⁷ Śmiglecki differentiates three levels of our intellect's operations directed by the *entia*:

1. 'simple apprehension' (*simplex apprehensio*, impression) without judgement but with cognitive 'abstraction' (I, disp. 3);

dirigens mentem nostram in rerum cognitione. Unde pro triplici mentis operatione, (scilicet. apprehensione simplici, iudicio et discursu) tres sunt Partes Logicæ: 1. De termino simplici. 2. De enuciatione. 3. De argumentatione.' However, even if Berkeley might have read, I will not consider the direct influences of Marsh's *Institutiones* and logic books in Marsh's Library. See also Sgarbi 2013, 223; Dawson 2007, ch. 1.

¹⁴ McDowell and Webb 1947; 1947; Maxwell 1946; Jones 2021.

¹⁵ In more details, the three European logicians are: Marcin Śmiglecki, SJ (Martinus Smiglecius, 1563–1618), Franco Burgersdijk (Franciscus Burgersdicius 1590–1635), and Jean le Clerc (Joannes Clericus, 1657–1736).

¹⁶ Interestingly, Jonathan Swift failed to answer questions on Śmiglecki's *Logica* in the 1685 examination at TCD. See Roncaglio 1995, 31.

¹⁷ Śmiglecki, *Logica* I, disp. 2, q. 2, 121: 'Entia rationis esse rebus Logicis necessaria: necessarium, enim est Logicæ scire modos concipiendi, sub quibus res concipit et cognoscit intellectus noster.'

2. ‘composition’ (*compositio*) as affirmation and ‘division’ (*divisio*) as negation, which concern propositional judgement (II, disp. 12); and
3. ‘discourse’ (*discursus*) with the four types of reasoning—syllogism, enthymeme, induction, and exemplification (II, disp. 13).¹⁸

Whilst an ‘act’ of abstraction of concepts from apprehension at the first level (disp. 3, q. 7) is worthy of note before the second propositional level, the second level is our concern with the term ‘supposition’.

Disputation 12 is devoted to the theory of ‘proposition’ (*enunciatio*) at the second level, although it does not necessarily reveal medieval theories of supposition.¹⁹ At this propositional level, according to his theory of signification, terms immediately signify concepts (being conceived) whereby signifying things.²⁰ This is conceptualism because the term (*vox*) is understood to be the ‘natural instrument’ of the human intellect (mind) for signifying things (q. 2, 8). It differs from realism, according to which the term is natural to things that are objectively real.²¹ In the conceptualist context, albeit briefly, Śmiglecki distinguishes terms (*voces*, words) as *signa suppositiva* and concepts (*conceptus*, thoughts) as *signa manifestiva* (disp. 12, q. 1, 4–6). Here, on my view, the term ‘supposition’ derives from the sense of ‘suppositied signs’, or the supposits for manifesting the other signs of concepts. Indeed, there are more conventional uses in Latin, *ex suppositione* (‘from the supposition’ or assumption), at more than 100 times in the book. And the term ‘hypothesis’ is scantily mentioned.²² Nonetheless, Śmiglecki’s *signa suppositiva* at the terminological level should be kept in mind this way, so that we can later consider ‘mathematical hypotheses’ or suppositions as causal terms, not necessarily assumed sentences or supposed antecedents in causal relations and laws, in Berkeley’s *DM*.

Burgersdijk’s *Institutionum logicarum*

On the other hand, there are plenty of mentions of the ‘hypothesis’ in the Dutch logician Burgersdijk’s *Institutionum logicarum* (61 chapters in 2 vols). Also taking a conceptualist position, though different to Śmiglecki,²³ Burgersdijk methodologically follows Aristotle’s definitions at numerous times (nearly once per two pages). With no reference to Aristotle at times, however, Burgersdijk answers a question as follows (II, ch. 23, 350 [my translation]):

¹⁸ Majewski 1982/1983, 145–151; Roncaglio 1995, 32–33; Sgarbi 2013, 130–134.

¹⁹ For my reformulation of the medieval theories of supposition relevant to Berkeley’s *DM*, see Chapter 3.

²⁰ Śmiglecki, *Logica* II, disp. 12, q. 1, 2–3: ‘Primo: quia Aristoteles ait voces esse notas passionum animæ. Secundo: quia vox ad hoc est homini data, ut eius beneficio suam mentem, quæ occulta et invisibilis est, modo sensibili, exponat et manifestet; isque finis immediatus loquentis est, mentem suam exponere. Tertio: quia is, qui nihil concepit, nihil significat [...] Quarto, quia res non significantur vocibus, nisi sub ea ratione, sub qua conceptæ sunt. Ergo prius voces significant conceptus, quam res.’

²¹ See also Sgarbi 2013, 133–134; Aristotle 1984, *De interpretatione*, I.1, 16a3.

²² However, see Śmiglecki, *Logica* II, disp. 13, q. 11, 162 (emphasis added): ‘Quia igitur hæc conclusio infertur ut substat tali medio, sub qua *hypothesi* necessariò illi conuenit tale prædicatum.’

²³ See Dawson 2007, 28; Sgarbi 2013, 137–140; Krop 2015.

Quid est hypothesis ? [What is the hypothesis?]

Quâ, an res sit, aut non sit, enunciamus, ut, *Esse animam, Deum, &c. A quolibet puncto ad quodlibet punctum duci posse rectam lineam.* [(It is) what we declare whether a thing be or not be, such as *an animate Being, God, etc., from a point whatsoever to another point whatsoever a straight line can be drawn.*]

If I render it correctly, this suggests that the term ‘hypothesis’ applies to any objects that we can imagine, be they existent or not, so that any proposition (*enunciatio*) whatsoever could be declared or formulated. It is the terms, such as the ‘divine existence’ and ‘rectilinear motion’, that imply or bring about any objects assumed as their effects, In this sense, the hypothesis is taken to be the cause.²⁴ These various sorts of hypotheses in Burgersdijk range over the terminological to propositional levels so that we can deduce propositions.

It is important to see this ‘hypothesis’ situate in the context of defining the other terms in mathematics, such as ‘universal terms’ (*voces communia*), ‘principles’ that are divided into ‘axioms’, ‘theses’, and ‘definition’,²⁵ in a short chapter entitled ‘How many conditions are considered in premises or principles of demonstration?’ In this chapter, the hypothesis is understood to be a condition *indispensable* for any mathematical deductive demonstration. It is true that, in this textbook, there are diverse uses of the terms ‘hypothesis’ and ‘supposition’ alike.²⁶ However, at times, they have the same meaning in Burgersdijk (II, ch. 21 ‘De præcognitionibus’, 242): ‘*si prolata statim à discipulo credantur, propriè dicuntur ὑποθέσεις*, suppositiones [if what have been uttered were believed by a disciple, (then) the hypotheses or suppositions are stated].’ In this way, both of the terms are integrated into this kind of statement or proposition to express what is believed (*creditur*) and assumed. If the term ‘hypothesis’ gives rise to any causation, then I argue, from the above-quoted answer, that it concerns both the terminological level (whence theoretical, causal *terms*) and the propositional level that we declare whatsoever. Therefore, one can hold a causal relation, where the antecedent implies the consequent, whereas the terms are in formulable into this conditional proposition.

Le Clerc’s *Logica*

Finally, whilst Burgersdijk took a contra-Remonstrant and humanist position when he studied theology at Leiden, the theologian from Geneva in the late seventeenth-century, Le Clerc was a Remonstrant who supported Arminianism in the long Dutch Reformation period.²⁷ He settled

²⁴ On my definition of causation and causal relations, see Introduction §0.1.2.

²⁵ For example, Burgersdijk defines the term ‘definition’, I think mechanistically, as follows (*Institutionum* II, ch. 23, 350): ‘quâ, quid res sit enunciamus; ut, Corpus naturale est, quod constat materiâ & formâ: Natura est principium & causa motûs & quietis, ejus, in quo est primò, per se, & non per accidens.’ This chapter 23 in Book II is entitled: *Quot sunt conditiones spectandæ in præmissis sive principiis demonstrationis?*

²⁶ See Burgersdijk, *Institutionum* I, ch. 17 ‘De Causa Efficiente’, 72: ‘Causa efficiens dicitur duobus modis proxima, nempe vel generaliter, vel specialiter. In genere dicitur causa proxima, quæcunque cum effecto vel existentia, (vulgò dicunt suppositio) vel virtute conjungitur’; I. ch. 25 ‘De Etymologia & Conjugatis’, 109: ‘*Scholastici loquuntur suppositio*’; II, ch. 12 ‘De syllogismo hypothetico, disjunctivo, & relativo’, 194ff, etc.

²⁷ Krop 2015; Schuurman 2004, 70.

down in Amsterdam, where he became intimate with John Locke and Philippus van Limborch and then published his *Logica* in 1692 along with *Ontologia* and *Pneumatologia*.

The *Logica* soon became one of the textbooks in Dublin. It shows a clear influence of not only Locke's *Essay* but also Malebranche's *De la recherche*, the Port-Royal Logic, and Pascal's *De l'Esprit géométrique*.²⁸ In other words, it seems hard to find the originality of Le Clerc's definitions in his *Logica*, whereas the discussion is suggestive when it comes to the term 'supposition' or 'hypothesis'.²⁹ For example, Le Clerc treats it in the context that mathematicians require evidence and manifest possibility in axioms and postulates (*Logica* III, ch. 13, §6 [my translation]):

Hypotheses novæ passim, prout res requirit, adhibentur, ut vix Caput ullum, sine novis aliquot Hypothesibus, conscribatur. [New hypotheses are applied everywhere in proportion as a thing requires, so that hardly should any Chapter be written without some new hypotheses.]³⁰

This suggests that in this mathematical context, inasmuch as it is valid without anything newer, the term 'hypothesis' is given a role of demonstration in the deduction within a set of axioms and postulates. In my interpretation, for Le Clerc, such hypotheses are factors *indispensable* for inferring the effects or phenomena by mathematical deduction in our practice.³¹ Similarly to the sense of Śmiglecki's *signa suppositiva*, the 'hypothesis' in Le Clerc can be embedded in the causation of mathematical, mechanical reasoning. Hence, I construe that it is assumed to be both a causal term and an antecedent sentence that implies the consequent in a premise of mathematical argument. In [Chapter 3](#), I further consider, rather reformulate, that identifying the collective term 'hypothesis' as determinate supposition is of paramount importance in Berkeley's *DM*. This is because we can better clarify why causal terms are meant to be determinate or indispensable components of true propositions that we define and thus confirm for our linguistic needs and operational mechanics (in the three steps: sensation, experimentation, whereby geometrical reasoning).

Thus far, for the sake of Berkeley's learning of causation in logic or in scientific domains, the samples in the three logic textbooks highlighted the mathematical uses or operations of 'hypotheses' or 'suppositions'. The causation from a hypothesis, i.e. object that means the cause, is embedded in the deductive inference, which must be operationally applied to scientific explanation in mechanics and dynamics. On my view, the above early modern logicians' background contexts underpin Berkeley's primary learnings and critical attitudes to his contemporary practice of mechanics based on logic and mathematics. As a result, I continue to argue that we can operationally or pragmatically

²⁸ Dawson 2007, 36; Schuurman 2003, 148. Also the book division of Le Clerc's *Logica* structurally resembles that of the *Port-Royal Logic*. See a footnote above.

²⁹ See Le Clerc, *Logica* I, ch. 8, §4: 'Qui Cartesii dogmata sequuntur, duobus hisce substantiis suppositis, putant se omnia expedire posse'; *Ontologia* ch. 8 'De Supposito & Persona'; ch. 9 'De Causa & Effectu'.

³⁰ See also the prior sentence, *Logica* III, ch. 13, §6): 'In aliis autem doctrinis innumera ferè proponuntur Axiomata, Postulatorúmque vix ullus est modus, dum verisimilis quævis aut non prorsus impossibilis Propositio, quasi jure concedenda, supponitur.'

³¹ For example, a hypothesis is an astronomical supposition in Le Clerc (*Logica* II, ch. 8, §23): 'Si quærat quæ Hypothesis circa dispositionem Solaris Volticis, in quo Terra nostra est, sit similior vero Ptolemai, Tychonis, aut Copernici? hujus Hypothesis aliis præferetur, quia ejus operatio aliqua omnium φαινομένων.'

define and reason mechanical causation to be true in our judged or correctly confirmed use of mathematical hypotheses in causal terms.

A3.2 Loan books on the mathematical hypothesis

In fact, the above books are not unequivocally suggestive of the mathematical aspects of suppositions or hypotheses. Thus, one ought to examine a wider range of the mathematical definitions from the other sources, so that we can see a clearer meaning of the term ‘hypothesis’. Here, it is worth examining type (ii), a certain number of loan books recorded on the scribbled notes of TCD library.³²

During his early and long life in Dublin, it is spotlighted that Berkeley borrowed at least fourteen books in the academic year 1711–12, some of which were borrowed before 17011 and the other were returned after 1712 (my transcription):³³

- | | |
|----------------------------------|--|
| 1. Albericus Gentilis de nuptijs | 8. Hebrew Bible Tom. 3. ^{us} |
| 2. A treatise of humane reason | 9. Cartesii Geometria tom. 2. ^s |
| 3. Grotius de j. belli et pacis | 10. Ludovici Gramaticum |
| 4. Thucydides | 11. Erchinus de Latines |
| 5. Philip de Comines | 12. Barrow’s Sermons |
| 6. Elemens de Mathematique | 13. Aschini & Orationes |
| 7. Quintilian | 14. Vossius de Historicis Latinis |

‘A treatise of humane reason’ had been in his possession since 1707. Due to a misplacement in the library, this might be identified with Albert Warren’s *Apology for the Discourse of Humane Reason* (London, 1680), which defended Martin Clifford’s *Treatise of Humane Reason* (1674).³⁴

Amongst the above loans, with reference to Berkeley’s *DM*, I will particularly review two books on mathematics: first Descartes’ work on geometry (9), *Geometriae*, and second a late seventeenth-century mathematics textbook in French (6), *Éléments des mathématiques* by Jean Prestet.

Descartes’s *Geometria*

According to the scribble at times illegible (TCD MS 2089, f. 12r), ‘Cartesii Geometria tom. 2s. B.L. I.12.’ is one of Berkeley’s loan books in 1711–12. Assuming Descartes in his Latin name,

³² Boran 2013, 79–83; TCD MS 2087–2090, for the TCD-recorded list including Berkeley’s loan books. The four manuscript loan books cover the collegiate body’s borrowing during the period 1684–1731, although the records of the years 1701–1711 and 1715 are currently unbound. If any extant record of the 1700s (i.e. Berkeley’s formative period in mathematics and philosophy) were found, then my textual analysis might immensely change.

³³ On the recorded loans, see TCD MS 2089, ff. 12r, 29r, 62r, 102v, 120v.

³⁴ Boran 2013, n. 1. Whilst I have no space here, it should be noted that Warren’s *Apology* was sincerely dedicated to Anthony Ashley Cooper, 3rd Earl of Shaftesbury, whose moral philosophy Berkeley later argued against in his *Alciphron* III. See e.g. Rickless 2020.

this probably was a Latin book. The French version, *La géométrie*, Descartes's pioneering work (in 3 vols.) appended to his *Discours de la méthode*, was originally published in 1637.³⁵ This was translated into Latin in 1649 by Frans van Schooten (1615–1660) with his copious commentary, etc. The second Latin edition by van Schooten (1659–61) has been stored in the library of TCD.³⁶

Unfortunately, both in the original French and translated Latin texts of Descartes, the nouns 'hypothesis [hypothèse]' and 'supposition' are not found.³⁷ However, it is noteworthy that Descartes frequently uses the verb 'supposer' ('*supponere*' in Latin), which is understood as assuming a postulate or premise in geometrical demonstration or formulating that proposition.³⁸ Such a premised proposition is thus deductively called 'supposition' or 'hypothesis', but as I suggested in the above A2.1, what is supposed or the hypothesis itself is also concerned with the pre-propositional or terminological level in its formation of mathematical and mechanical causation. As Śmiglecki put it, the term is *sigma suppositiva* for what is expressed or formulated as its concept or *sigma manifestiva*. Hence, in Descartes's geometrical sense with his logical method in the background, I take it that geometrical or mathematical hypotheses *frame* the basis of the demonstrative or deductive process. This operational process, on my view, integrates both terms as causal terms and propositions to be judged either true or false. This I consider a rather pragmatic process about causal relations in supposing or suppositing theories as causal laws for our operational needs, as for mechanical causation in Berkeley's *DM*.

Prestet's *Éléments des mathématiques*

Another mathematics textbook in French that Berkeley borrowed in 1711–12 is the 'Elemens de mathematique' [sic] (TCD MS 2089, f. 12r). This is most likely the work of Fr Jean Prestet (1648–91),³⁹ protégé of Fr Nicolas Malebranche (1638–1715). Putting aside occasionalism, they were

³⁵ Descartes's *Géométrie* contains the three books entitled: I. *Des problemsmes qu'on peut construire sans y employer que des cercles & des lignes droites*; II. *De la nature des lignes courbes*; III. *De la construction des problemsmes qui sent solides, ou plus que solides*. See *AT VI*, 369–485.

³⁶ TCD library owns the 2nd edition of Cartesius's *Geometria* (1659–61) with two volumes in one book, within which the three parts (books) of his *Géométrie* (van Schooten's translation) were included.

³⁷ In effect, after the main part of Cartesius's *Geometria*, van Schooten's commentary on it contains the terms 'hypothesis' (*ex hypothesi*) and 'suppositione'. See *Geometria* (*ibid.*, Commentary, 178, 286, etc. Although Berkeley might have perused the commentary part, light should be shed to Descartes's own use in the main text.

³⁸ For example, see *Geometria/Géométrie II* (*AT VI*, 389, emphasis added): 'le ne diray pas aussy que ce soit a cause qu'ils n'ont pas voulu augmenter le nombre de leurs demandes, & qu'ils se sont contentés qu'on leur accordast qu'ils pussent ioindre deux points donnés par une ligne droite, & desirer un cercle d'un centre donné, qui passast par un point donné : car ils n'ont point fait de scrupule de supposer, outre cela, pour traiter des sections coniques, qu'on pust couper tout cone donné par un plan donné. Et il n'est besoin de rien supposer, pour tracer toutes les lignes courbes que ie pretens icy d'introduire, sinon que deux ou plusieurs lignes puissent estre meuës l'une par l'autre, & que leurs intesections en marquent d'autres : ce qui ne me paroist en rien plus difficile.' In this context explaining the conic sections/curves, the *supposition* is a set of four postulates: (1) two points are given by a straight line, (2) a circle of a given centre passes through a given point, (3) any cone can be cut by a given plane (i.e. intersection), and (4) two or more lines can be moved, by which the respective intersections are determined.

³⁹ Confusingly, there have been a number of French books with the same title (just main title). There were (i) Prestet, *Éléments des mathématiques, ou Principes généraux de toutes les sciences* (Paris, 1675); (ii) another Oratorian, Bernard Lamy (1640–1715), *Éléments des mathématiques, ou Traité de la grandeur en general* (Amsterdam, 1685); Pierre Polinrière, *Éléments des mathématiques* (Paris, 1704), etc. Hereby I thank Catherine Goldstein (email correspondence, 2021),

two of the Oratorians in Paris, devoted to natural science. Initially for the purpose of mathematics education in the Oratory Order, Prestet wrote this textbook concerning algebra, analysis, and arithmetic about the *idea* of number (not primarily geometry).⁴⁰ Not the first edition of Prestet's *Éléments* (1675),⁴¹ but the third edition, *Nouveaux éléments* (1694)⁴² have been in TCD library. This I assume Berkeley borrowed.⁴³ There is no mention of the term 'hypothèse' (hypothesis) but more than 800 cases of the noun 'supposition' and the verb 'supposer' in the second edition of *Éléments* (two volumes consisting of 1,100 pages). Near the beginning of the book, along with the definitions of 'axiome', 'problème/question', 'lemme', and 'corollaire/conséquence', Prestet defines the concerned term as follows (1689 I, 6):

Supposition ou *demande* est une proposition un peu moins générale qu'un axiome & moins évidente, mais qu'on ne peut raisonnablement ni contester ni refuser. Et ainsi on demande qu'on l'accorde, afin de n'être pas inutilement obligé de prouver qu'elle est véritable, ou qu'il est aisé d'exécuter ce qu'on veut que l'on fasse.

This definition illuminates that the supposition (hypothesis or '*demande*') is a proposition or sentence. More importantly, the supposition is what one 'can neither reasonably contest nor refuse', such that it is taken for granted that we are not 'uselessly [*inutilement*] forced to prove that it is true'. In other words, on my reading of Prestet's definition, if eschewing any uselessness, the supposition is rather meant to be useful or pragmatic in mathematical deduction from an axiom. Thus, the last part of the quotation is telling in the pragmatic sense that the supposition makes it 'easy to execute' what one wants to do for oneself. But then, a question may be raised: providing classical logic, do we judge any useful supposition in a sense either true or false?

In one sense, it can be read that the supposition makes us suspend the judgement about it, as long as it is *useful* in mathematics without truth-conditions and as long as it is *useless* in proving its truth. This is an instrumentalist reading, which requires neither truth nor falsity of a proposition

who confirmed that the most circulated *Éléments des mathématiques* in late seventeenth-century British Isles was that of Prestet. It is not probably that of Lamy, although his other works, such as *Rhétorique ou l'art de parler* (co-authored with Arnauld and Nicole, Paris, 1675; London, 1676), were circulated and well recognised. See Goldstein, [forthcoming](#).

⁴⁰ Schubring 2005, 52–53; Goldstein 1992, 181.

⁴¹ Prestet's *Éléments* substantially developed from the first edition (1675) in one volume with 418 pages (without preface) to the second/third *Nouveaux* editions (1689; 1694) in two volumes with 1,080 pages (the third one slightly modified). This voluminous change is due to his involvement, as the disciple and defender of Malebranche, in the controversy with Arnauld over the extent to which empirical knowledge represents theoretical concepts (e.g. negative numbers or quantities) by 'suppositions'. Correspondingly, Arnauld also revised his textbook, *Nouveaux éléments de géométrie*, in 1683 in the section edition (first 1667, which was pioneering in his algebraised style with his criticism of Euclid's *Elements of Geometry*). See Schubring 2005, 49–51, 57–61.

⁴² The second *Nouveaux* edition (1689) has also been stored in TCD library, but I confirmed in the manuscript office that this was bequeathed in 1743 from the collection of Claudius Gilbert, former Vice-Provost. For this reason, Berkeley did not borrow the second one in 1711/12. The third edition contains a good number of handwritten notes, but I cannot identify which notes were possibly Berkeley's. However, an important correction was made on the page including the quotation in body text (I, 6), underlining 'progression' regarding the definition of *théorème*, on the left side of which 'proposition' is handwritten.

⁴³ In fact, there has been Lamy's *Éléments* (1692, 3rd ed.) in TCD library, whilst it is unknown since when it has been stored. But I do not consider it for the reason in the above footnote.

(supposition) but it can stay fictitious, inasmuch as it is useful for us.⁴⁴ In the other sense that I endorse, any supposed or hypothetical proposition cannot avoid having its truth-value (either true or false) inasmuch as it is effectively used or operationally expressed. That is, by this pragmatism distinct from the broad class of instrumentalism, sentences are required to be judged (accepted or confirmed) to be true if and only if it is pragmatically used for our need of mathematical deduction to enjoy the useful consequence. Therefore, by hypothetically or tentatively accepting it to be true (confirming not false), the supposition makes what we want to demonstrate easy or sets out our reasoning for deducing a pragmatic consequence. In effect, following the above quote from Prestet, the mathematician does not have to rationally reject but accept the supposition or hypothesis. This does not mean the instrumentalist evasion but the pragmatist confirmation of a hypothetically true supposition in (mechanistic) operation.

Hence, it is my view that Berkeley incorporated some essences from Descartes's and Prestet's mathematical works into his mathematical thinking in *De motu*. In particular, Prestet's definition of the supposition or hypothesis, albeit not called the 'term', is the closest thus far to my construal of Berkeley's theory of causation from 'mathematical hypotheses'. On the other hand, outside logic and mathematics books themselves, it is high time that we saw the final type of his lexical sources, as below.

A3.3 Own books on the mathematical hypothesis

The above (i) logic textbooks and (ii) loan mathematics books are far from exhaustive in view of a full range of Berkeley's studies and periods, including his life outside Ireland. He had long been in Italy and France in the 1710s before returning to TCD in 1721⁴⁵ In fact, his reading materials during the European trips are much unknown, except for his correspondence and notes for his planned but unpublished 'Journals of Travels in Italy'.⁴⁶ Therefore, what I regard as the last resort is (iii) Berkeley's own books—his properties listed on his family auction catalogue.⁴⁷ This type (iii) provides a lexical background of the causal term, 'hypothesis' or 'supposition', in addition to the primary uses in the domains of logic and mathematics.

Many of his purchased books, if not all, came to light through the *catalogue of the valuable library of the Berkeley family*, whose private collections were auctioned in 1796.⁴⁸ However, in 1733, shipping from London (taking about nine weeks), Berkeley donated tons of his books to Harvard and Yale Colleges.⁴⁹ Unfortunately, the details of the donation to Harvard were lost, because the library in Harvard Hall was entirely burnt by a fire in 1764 (Keogh 1933, 3). On the other hand,

⁴⁴ The instrumentalist reading is disputed in main chapters, especially in [Chapter 4](#).

⁴⁵ Jones 2021, chs. 6–8.

⁴⁶ As the editor Luce notes (*Works* VII, 232), the edition does not include the text in full. The manuscripts are in the British Library, Add. MS 39307–39310.

⁴⁷ BL S.C.S.28, Leigh and Sotheby 1796.

⁴⁸ Maheu 1929; Aaron 1932.

⁴⁹ Keogh 1933, 3, referring to the Boston News-Letter, August 2–August 9, 17.

those books in Yale, nearly 1,000 volumes of books (valued at £400 back then), preserve the record of one logic book and sixteen mathematics books, according to the classification of then President Thomas Clap in the 1742 Yale catalogue.⁵⁰ But examined earlier as to types (i) and (ii), here I do not focus on them.

Berkeley might have referred to those books before his American donation when writing *DM*, but this is unknown and too speculative. On the other hand, regarding the 1796 auction catalogue, more seriously, it does not exclude books that Berkeley's families (at least his son and grandson) purchased.⁵¹ This means that we find it difficult to identify who exactly purchased books, even those published before the 1721 publication of *DM*. Despite this invisible quagmire, nonetheless, I still hold a view that several books in this catalogue are potentially influential on the formation of Berkeley's philosophical, i.e. logical and mathematical, terminology, especially about the 'hypothesis' and 'supposition'.

On my close reading of the auction catalogue, the following are worthy of note:⁵²

26. Claude Fleury, *Traité du choix et de la méthode des études* (1687)

⁵⁰ Uncertain as it may be, the only book that President Clap classified as logic in the Yale Collections is (Keogh 1933, 12–14):

1. Malebranche, Nicolas. *Treatise concerning the search after truth*. 2d ed. Lond., 1700. 2 v. in 1.

And the following are the sixteenth mathematics books, classified into Arithmetic (1); Algebra (2, 3, 4); Geometry (5); Optics (6, 7, 8); Conic Sections (9); Astronomy (10, 11); A Mixture of all sorts of Mathematics (12, 13, 14, 15, 16):

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Wells, Edward. <i>The young gentleman's arithmetick and geometry</i>, 2d ed. Lond., 1723; 2. Kersey, John. <i>The elements of that mathematical art commonly called algebra</i>. Lond., 1725; 3. Newton, Sir Isaac. <i>Universal arithmetic</i>. 2d ed. Lond., 1728; 4. Wallis, John. <i>A treatise of algebra</i>. Lond., 1685; 5. Euclid. <i>The elements of Euclid</i>, By C. F. Milliet de Chales. Done out of French by Reeve Williams. 4th ed. Lond., 1731; 6. Newton, Sir Isaac. <i>Opticks: or, A treatise of reflections, refractions, inflections, and colours of light</i>; 7. Newton, Sir Isaac. <i>Optical lectures, read at Cambridge</i>, 1669. Lond., 1728; 8. Wells, Edward. <i>The young gentleman's trigonometry, mechanicks and opticks</i>. 2d ed. Lond., 1731; | <ol style="list-style-type: none"> 9. Archimedes. <i>Opera</i>. Apollonii Pergaei Conicorum libri IIII. Theodosii Sphaerica; ed. Barrow. Lond., 1675; 10. Keill, John. <i>An introduction to the true astronomy</i>. Lond., 1730; 11. Wells, Edward. <i>Young gentleman's astronomy, chronology, and dialling</i>. 3d ed. Lond., 1725; 12. Newton, Sir Isaac. <i>The mathematical principles of natural philosophy</i>. Lond., 1729. 2 v; 13. Ozanam, Jacques. <i>Cursus mathematicus</i>. Lond., 1721. 5 v; 14. Bion, Nicolas. <i>The construction and principal uses of math struments</i>; tr. Edmund Stone. Lond., 1723; 15. Hayes, Charles. <i>Treatise of fluxions</i>. Lond., 1704; 16. Ditton, Humphrey. <i>An institution of fluxions</i>. 2d ed. Lond., 1726. |
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On the whole Yale collections, see *ibid.*, 7–26. See also W. S. Lewis 1946; Catir 1964, 79; Jones 2021.

⁵¹ BL S.C.S.28, 1796, the auction catalogue cover was: 'together with the Libraries of his Son and Grandson, the late Rev. George Berkeley, D.D. Prebendary of Canterbury, and the late George Monk Berkeley, Esq.'

⁵² BL S.C.S.28, 1796, original pp. 1–46. Amongst them, it should also be noted that there were 393. *Newtoni principia Mathematici* (1687); 432. *Newtoni Optice* (1706); *974. *Barrow's Works*, 2 vol. (1687), etc.

222. Holyoke's Dictionary (1677)⁵³
231. Philips's New World of Words (1658)
245. Chauvin Lexicon Philosophicum (Rotterdam, 1692)
253. Harris's Lexicon Technicum, 2 vol. (1704)
276. (also 389) Bouhours, la Maniere de Bien Penser (Amsterdam, 1688)
974. Power's Experimental Philosophy, plate (1696)
- *976. Wilkins's Essay on Language (1668)
1060. Bos Expereitationes Philologicae (1713)
1243. Diomedis de Arte Grammatica (Venet. ap. Rubeum 1511)

These references blend a certain essence of Berkeley's lexicon or dictionary sources in natural philosophy. In what follows, I will primarily review two of them, with regard to lexical meanings of the concerned terms.

Phillip's *New World*

231, the English dictionary of Edward Phillips (1630–c.1696), *The New World of English Words: Or, a General Dictionary* (London, 1658), is much earlier than the celebrated Chambers's *Cyclopædia* (1728), which then inspired Diderot and D'Alembert's *Encyclopédie* (1751–80, 35 vols.). Put differently, before the eighteenth-century encyclopedism, Phillips's dictionary is pioneering in the English language. To this effect, it is important that the Berkeley family owned the first edition of Phillips's *New World*, which may be Berkeley's own. Here are the definitions (Phillips 1658, 175, 320):⁵⁴

Hypothetical, (Greek) belonging to a Hypothesis, *i. e.* a supposition, also a Hypothetical Syllogism in Logick, is that which begins with a conditionall conjunction.

⁵³ Holyoke's Latin-English dictionary (1677, 12): 'Hypothesis, is, vel eos; f. g. Gr. ὑπόθεσις, Suppositio, fundamentum, item argumentum, causa, Gloss. *A supposition, or ground, an argument, or matter whereon one may dispute*'; 'Suppositio, ðnis; f. verb. Col. ὑπόθεσις. *A putting of a thing under another, or in place of another.*'

⁵⁴ See also the related terms 'abstract'/'abstraction' in different editions of Phillips's *New World* (1658, etc.). Supposing that Berkeley also encountered the later editions, I quote below regarding how the entry 'abstract' developed:

- 1658: Abstract, (Latin) a small book, or writing, taken out of a greater.
- 1671: Abstract, (Lat.) separated, or drawn away, also a small book, or writing, taken out of a greater; also a Term in Logick signifying any quality as it is taken abstracted or excluded from its subj. etc.
- 1720: Abstract, a Copy, or short Draught of an Original Writing, an Abridgment of a Record, Deed or Book, In Logick, any Quality, as it is considered a-part, without regard to its Concrete or Subject : see Concrete. / Abstraction, a Faculty or Power peculiar to the Mind of Men, in Contradistinction to the natural Capacity of Brutes ; whereby he can make his Idea's, or Conceptions relating to particular Things become general, so as to represent all of the same Kind. Thus if my Eye represent to me Whiteness in a Wall, I can abstractedly consider that Quality of Whiteness, and find it may be attributed to many other things besides ; as to Chalk, Milk, Snow, etc.

Supposititious, (lat.) laid in the place or room of another.

Suppository, (lat.) put under; also in Physick it is used substantively for any solid composition put up into the body to make it soluble.

Although there is no entry of the nouns themselves,⁵⁵ this English dictionary confirms the uses of the terms in logic and physics. These uses can readily be applied to talk of causation or causal laws in the mathematical science of mechanics. In my interpretation of Phillips's lexicon, what is 'suppository' or supposed is hypothetically 'put under' the demonstration in mathematics and mechanics, so that one can deduce the consequent from the antecedent or hypothesis. Irrespective of a lack of concrete examples in the dictionary, it can be read that there is a causal inference from the supposit or supposed hypothesis to the deductive consequence of natural phenomena (such as the solution of 'any solid composition').

Wilkins's *Essay*

What I finally examine in this section is a lexical book of John Wilkins (1614–72), a savant member of the inchoate Royal Society (1660–). It is uncertain whether Berkeley read Wilkins's more relevant *Mathematical Magick, or, The wonders that may by performed by mechanical geometry* (1680), whereas the first edition of his *Essay towards a Real Character, and a Philosophical Language* (1668) was in Berkeley's own library (*976). In the *Essay*, by 'philosophical', Wilkins means '*Universal Philosophy*' in the scientific part of 'language or character', which establishes each of 'things and notions, to which marks and names ought to be assigned according to their respective natures' (1668, 1).

From this linguistically universal perspective, Wilkins structures the taxonomy of every linguistic component imaginable. In particular, in Pt. II, Ch. I (*ibid.*, 44ff), Wilkins classifies 'discourse' composed of 'several notions belonging to *Grammar* or *Logick*', whereby one's internal thought is externally made known to the others. Concerning 'the business of proving or perswading', a variety of 'modes of discourse' are sorted out; one of them is (*ibid.*, 50):

Conditional; allowing a thing to be so for the present, that we may thereby the better judge of the consequences from it, or owning the truth asserted by another.

⁵⁵ However, the later 1720 edition (Phillips 1658), which Berkeley neither owned nor perhaps consulted, added the nouns:

Hypothesis, a Supposition; the laying down of certain Principles in any Art or Science, which are to be supposed or taken for granted, in order to solve proposed Question, Phenomena, or Appearance, especially in Natural Philosophy, Astronomy, &c. It is also taken for a System of the World, ingeniously contriv'd, to shew the Disposition of the Heavens, and Course of the Stars, as those of *Ptolemy*, *Copernicus*, and *Tycho Brahe*.

Supposition or Supposal, is supposing, a thing taken for granted; an uncertain Allegation.

Supposititious, put in the room of another thing, that is real or proper; false, forged, counterfeit.

This suggests that if a supposition was *supposititious*, then it was judged to be 'false'. However, this does not mean a given supposition or hypothesis to be necessarily false, but rather, on my view, the supposed sentence is true when used in mathematical deduction from an axiom. This concerns my pragmatist reading later on.

SUPPOSITION, *Admit, premise, presuppose, Condition, Proviso, Hypothesis, put case.*

CONCESSION, *Grant, yield, allow, acknowledge, admit, agree.*

This ‘conditional’ mode is one of the three categories of ‘antecedently; denoting such forms of speech as imply’, under the larger three categories of ‘antecedently’, ‘concomitantly’, and ‘subsequently’. In view of the whole modes of discourse, the conditional term ‘supposition’ or ‘hypothesis’ can clearly be distinguished from ‘concession’ as above. That is, neither yielding nor acknowledging, the supposition as hypothesis can be regarded as the antecedent that conditions our discursive ‘thing’ or sentence, so that the consequent implied from it can be judged as having the truth. In other words, it is the sentence or proposition that the hypothesis/supposition refers to, so as to be judged either true or false (nothing *fictitious* without truth-values). Nonetheless, it can also be read that the hypothesis itself is a cause as causal *term* within the antecedent sentence in the inference of a judged consequence or effect. This construal is key to my thesis interpretation of Berkeley’s pragmatist theory of causation.

Conclusion

To wrap up, this appendix featured three types of sources for Berkeley’s likely learning of the significance of ‘mathematical hypotheses’. This varied body of textbooks and dictionaries that I examined is yet underappreciated, but it continuously reinforces his theoretical understanding outside of his more famous critiques of his precursors, such as Newton, Locke, and Malebranche. Thus, it can be clearer to see a seamless flow of Berkeley’s background sources about the mathematical ‘hypothesis’ or ‘supposition’ before the 1721 *DM*. From the perspectives of three types, (i) logic from curricular textbooks, (ii) mathematics from 1711–12 loan books, and (iii) lexicon from his own books, here is the upshot. On my rendering, the definitions of ‘hypothesis’, such as the causal antecedent operationally having the truth-value, frame causation (or causal relations) for the utility and truth of causal laws in mechanics. This pragmatic inclination underlies Berkeley’s theory of causation in the context of *DM*.

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