Chapter 2
Berkeley's Metaphysical Instrumentalism[1]

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Berkeley is widely held to be a scientific instrumentalist, but the scope of his instrumentalism has been repeatedly brought into question. Some have asserted that Berkeley capitulated wholesale to a form of external realism at the end of his life,[2] others have supposed principled reasons for thinking that Berkeley is an instrumentalist about some things and not about others. Lisa Downing, for instance, has argued that Berkeley is an instrumentalist about forces but not about corpuscles,[3] and Douglas Jesseph contends that Berkeley rejects mathematical instrumentalism despite being a stronger instrumentalist in the sciences.[4] Here I suggest that there is a principled form of instrumentalism one may reasonably attribute to Berkeley, such that one need not claim that Berkeley is sometimes an instrumentalist and sometimes not; there is a consistent position that explains the variety of moves Berkeley makes.

2.1 Enter Instrumentalism

First we require a clear sense of what we mean by 'instrumentalism' to preclude our discussion from devolving into verbal games. Here I start by following the able characterization provided by Jesseph, who starts with the basic view. "Instrumentalism,

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[2] Catherine Wilson, "Berkeley and the Microworld," *Archiv für Geschichte der Philosophie* 76 (1994): 37–64.

[3] Lisa Downing, "*Siris* and the Scope of Berkeley's Instrumentalism," *British Journal for the History of Philosophy* 3 (1995): 279–300.

[4] Douglas Jesseph, *Berkeley's Philosophy of Mathematics* (Chicago: University of Chicago Press, 1993): 213.

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broadly speaking, is the doctrine that a theory can be accepted and applied for reasons of utility, even if the claims made in the theory or its application are not accepted as literally true."[5] One immediate concern with this definition when applied to Berkeley is to fix what one means by 'literally true.' With an immaterialist system, truths concern ideas and their orderings. To say that bodies are attracted towards one another according to an inverse square law is true, provided that one understands the proposition to involve regularities in what we experience in the perception of sensory ideas *and nothing further*. There are no deeper causal explanations than the regularities found in our sensory experiences. Materialists make the mistake of wanting a kind of realism that appeals to a causal ordering beyond what we perceive. As a result, they posit the existence of occult things like 'forces' to undergird our ideas. Berkeley remarks in the *Notebooks*, "The supposition that things are distinct from Ideas takes away all real Truth, and consequently brings in a Universal Scepticism, since all our knowledge and contemplation is confin'd barely to our own Ideas."[6] The order of ideas – the patterns we find in experience – are real and we do not *need* to appeal to a 'deeper' level to gain scientific knowledge.

Truth in Berkeley's system concerns a correspondence to God's decreed ordering of sensory ideas. If I make a claim about the world, then either my claim corresponds to what God has willed in the ordering of ideas (and my claim is true), or it does not. Truth for Berkeley concerns the order of ideas. He reveals his view in certain passages and the following is typical.

> But, say you, it sounds very harsh to say we eat and drink ideas, and are clothed with ideas. I acknowledge it does so, the word *idea* not being used in common discourse to signify the several combinations of sensible qualities, which are called *things*; and it is certain that any expression which varies from the familiar use of language, will seem harsh and ridiculous. But this doth not concern the truth of the proposition, which in other words is not more than to say, we are fed and clothed with those things which we perceive immediately by our senses.[7]

In this passage Berkeley is not reflectively outlining his theory of truth, but here and elsewhere it is apparent that what it means for a proposition to be true concerns the accuracy with which that proposition depicts ideas and their various relations to one another.[8] For Berkeley to be an instrumentalist in the basic sense implies that science accepts theories for their utility without referring to anything other than the regularities we find in our perception of sensory ideas.

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[5] Jesseph, *Berkeley's Philosophy of Mathematics*, 76.

[6] PC 606. All citations from Berkeley are from *The Works of George Berkeley, Bishop of Cloyne*, eds. A.A. Luce and T.E. Jessop, 9 vols. (London: Thomas Nelson and Sons, 1948–1957). The following abbreviations will be used for convenience: AN: *The Analyst*, 3D: *Three Dialogues Between Hylas and Philonous*, ALC, *Alciphron: or the Minute Philosopher,* PC: *Philosophical Commentaries* (the notebooks), PHK: *Principles of Human Knowledge*, IPHK: *Introduction to the Principles of Human Knowledge*, DM: *De Motu*, and S: *Siris*. Other texts of Berkeley, not abbreviated, are also from this source. Section numbers will be used for the *Principles, De Motu*, and *Siris*; all others will be page numbers from the *Works*.

[7] PHK 38.

[8] There are, of course, complications with propositions that concern active things and notions. Some of those concerns will be engaged later.

Jesseph next moves on to discuss a weaker version of instrumentalism where "a certain body of theory is regarded as false but is nevertheless used for purposes of simplicity and economy."[9] Euclidean geometry is taught to students around the globe, even though we no longer believe it accurately models the world. For Berkeley such a view would be to admit theories that predict future experiences generally well, but not perfectly. Owing to the complicated nature of the world, it might sometimes be best to employ theories that are less complicated because they are 'good enough' for their intended uses. It makes sense to employ Euclidean principles when playing billiards for instance; the added precision one acquires from using more sophisticated and accurate theories makes essentially no difference to even the expert player.

Lastly Jesseph describes what he calls 'an even weaker' version of instrumentalism, which applies only to background assumptions and not theories. According to this view, background variables are treated as irrelevant or insignificant even if the governing theory is thought to be literally true. Jesseph asserts that Berkeley is an instrumentalist of this sort when it comes to geometry. That is, he believes that Berkeley thinks that geometry is true, but not a completely accurate description of what we perceive.[10] These various divisions enable Jesseph to make distinctions within Berkeley's writings and separate his ontological commitments in mathematics and the sciences, although most of the purposes to which Jesseph puts these distinctions are not of concern to us in the present endeavor.

Here I make a case for the claim that Berkeley is an instrumentalist in the basic sense, even about geometry and mathematics generally. As a result, he is an instrumentalist provided he believes that scientific theories should be accepted on the basis of whether they are useful in terms of predicting future experiences. When I claim that Berkeley is a basic instrumentalist, I do not intend that the patterns of experience are not real, but only that there is no *other* underlying cause of those patterns (except God). In particular, we do not need corpuscles or material objects to explain the regular order of ideas we perceive.

2.2 Berkeley's Instrumentalism

We are now prepared to examine the details of my suggested interpretation of his instrumentalism. For Berkeley, both math and science depend on the manipulation of signs that stand for sensory content.[11] And it is a gross error to confuse the usefulness of a theory for its truth, even if they often coincide.[12] Science is one *method* for

[9] Jesseph, *Berkeley's Philosophy of Mathematics*, 76.

[10] Jesseph, *Berkeley's Philosophy of Mathematics*, 76–77.

[11] Although it does not depend *solely* on signs, since memory and imagination can play important roles as well. See PC 883.

[12] AN 10, *Works* IV, 70–71.

arriving at the truth, but should not be confused *with* the truth.[13] For example, the concept of force is permissible in science, provided one understands force as a sign for certain kinds of empirical regularities – but there are no metaphysical *things* 'forces.' We can form no idea of force, but the *word* can serve the useful purpose of organizing the experiences we do have.[14] Note that there is nothing about instrumentalism that precludes a theory from being true in its descriptions of the world; it must only be the case that even if its descriptions are true, only the utility of the theory matters.[15] In our vulgar utterances we seem to refer to a material world. Yet all that we actually require to *explain* and *function* in the world are appeals to the regular ordering of our sensory ideas.

As a result, Berkeley's instrumentalism is one about signs. Instead of supposing that the objects of mathematical and scientific inquiry are metaphysically real entities, we need to acknowledge that the objects of study are *signs* for ideas and their relations. Berkeley gives us a clear example in the 19th question of the *Analyst*.

> *Qu.* 19 When it is said or implied, that such a certain line delineated on paper contains more than any assignable number of parts, whether any more in truth ought to be understood, than that it is a sign indifferently representing all finite lines, be they ever so great. In which relative capacity it contains, *i.e.* stand for more than any assignable number of parts?[16]

The calculus, strictly speaking, concerns a particularly useful way of manipulating signs, just as the square roots of negative numbers help us more accurately predict future experiences. No matter how useful the sign it might be, for Berkeley no one ought to seriously think that there is such a 'thing' as *'i.'*

Theories, however, are complicated by the fact that we do not tend to separate active from passive elements in our thinking about the world. For Berkeley, we cannot have ideas of active things, since ideas are passive and represent only by likeness. Only an idea can be like an idea, hence we cannot represent (with ideas) objects that are active, or have causal powers, and so on. Berkeley has a clean way of dealing with such complications, however, and he borrows it from his mature metaphysics. We know spirits only by their effects. "Such is the nature of *spirit* or that which acts, that it cannot be of itself perceived, but only by the effects which it produceth."[17] The same point applies consistently for everything that has an essentially active nature, including our own volitions. "We see no variety or difference betwixt the Volitions, only between their effects."[18] We ought, then, to expect the same for objects of study in the sciences – and that is exactly what we find. Alleged

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[13] Compare AN 22, 78. For one example where Berkeley mentions true claims that might be useless or vain, see ALC 308.

[14] ALC 293–295.

[15] See PHK 131, where Berkeley argues that denying the literal existence of infinitesimals does not negate the usefulness of geometry and mathematics.

[16] AN Qu. 19, *Works* IV, 97.

[17] PHK 27.

[18] PC 788.

active objects, like forces, are known only through their effects. One might think that motion is an exception, since motion appears active yet Berkeley says that we can have ideas of motion. He denies, however, that motion is really active or an activity, despite how we talk about it. "Motion, though in metaphysical rigour and truth a passion or mere effect, yet in physics passeth for an action."[19] Although motion might be said to be an action, in fact it is a "mere effect." Emphasizing the perceivable effects of scientific posits also helps Berkeley deal with the potential concern that there is a principled difference between concepts that are not in principle perceivable (like forces) and those that are (the movement of the earth). In both cases, it is the *effects* that matter (and those are always perceivable because they are in fact perceived), and thus whether the *posit* is itself in principle perceivable is not really a worry on Berkeley's analysis. We have, then, a doctrine that is consistent between Berkeley's early and late works. We do not have ideas of volition, force, or activity, but we do use *signs* to represent them through their effects, which are sets of ideas, presumably well-ordered.

We accordingly should think of his views in terms of modeling sensory experiences. A theory for Berkeley is to be judged foremost (but not only) by its empirical adequacy – its ability to allow us to predict what sensory ideas we will have given current conditions and an understanding of the regularities we find in the perceived world. "If I mistake not, all sciences, so far as they are universal and demonstrable by human reason, will be found conversant about signs as their immediate object, though these in the application are referred to things."[20] Science is about *signs* and their connections. If we abandon thinking about mathematics as about *actual* infinities and infinitesimals (i.e. about things that allegedly underlie the experiences we have), then "those and the like objections vanish, if we do not maintain the being of absolute external originals, but place the reality of things in ideas …."[21] Science and mathematics amount in reality to nothing more than organizing and making sense of the experiences we have.[22]

Berkeley is an instrumentalist; he believes that these signs are valuable because of their usefulness – their predictive accuracy – rather than being faithful depictions of some underlying (beyond the train of ideas) reality. Thus far, all is well. Yet one might ask at this point what limits the *acceptability* of a theory. Is it mere utility? Not for Berkeley. In order to have an acceptable theory, it must be the case the objects being modeled are also antecedently logically possible. This constraint, as it turns out, is the same limitation Berkeley places on ideas in general. Just as every idea must have (or rather be) a possible object, every theory must model something that is logically possible (though not necessarily actual). One cannot have a *useful* sign for an impossible object. The constraint, I suggest, is perfectly reasonable. We now believe that science must involve only the observable world. There is no

[19] S 161.

[20] ALC 305.

[21] 3D 258.

[22] See PHK 58.

'science' for the soul, for instance, since by hypothesis it is not observable. Similarly, there is no science for the impossible, which is likewise unobservable. This second constraint, in conjunction with other textual moves, allows us to read Berkeley as a consistent basic instrumentalist about mathematics and science, and allows us to explain certain puzzles in the texts. In short, science is a useful method for organizing possible experience. For Berkeley, if a posit or theory is not useful, *or* it is not possible, then it is not part of science.

2.3 The Constraint of Possibility

Precedents exist for the kind of view I attribute to Berkeley. Leibniz arguably shifts to a phenomenal understanding of matter in part because of problems like the angle of the tangent, where the mathematical formalisms describe something that he thinks is 'literally' impossible in an actual material world. Berkeley, I believe, has a similar view. One of his principal objections against the existence of abstract ideas is that such ideas are metaphysically impossible, since they posit (or require) indeterminate particular beings.[23] Berkeley extends this kind of analysis to the sciences.

If we start with the simplest cases of instrumentalism in his writings, we can see that Berkeley wants to adopt theories on the basis of their usefulness rather than their accuracy in describing a mind-independent reality. The point of walking through one or two well-accepted cases is to confirm that they are examples in which the posited objects are also logically possible, even if obscure. In *De Motu* he is most clear:

> Force, gravity, attraction, and terms of this sort are useful for reasonings and reckonings about motion and bodies in motion, but not for understanding the simple nature of motion itself or for indicating so many distinct qualities. As for attraction, it was certainly introduced by Newton, not as a true, physical quality, but only as a mathematical hypothesis. Indeed Leibniz when distinguishing elementary effort or solicitation from impetus, admits that those entities are not really found in nature, but have to be formed by abstraction.[24]

Force, as Berkeley tells us in *De Motu* Section 5, is an occult quality. As a sign, however, it is describing something not only possible, but actual. That is, 'force' is our sign signifying sets of certain connected experiences. The error is to think that there is something – force – instead of recognizing that the word is only an instrument of the mind. Berkeley employs this language of the mind using 'instruments' significantly in the *Siris*.

Unperceived motion is another particularly clear case. At *Principles* 58 Berkeley engages the objection that his immaterialist version of science runs counter to established claims like *the earth moves*. The charge is that because we do not

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[23] See my *Idea and Ontology* (University Park, Penn State University Press, 2008), chapter 8. See IPHK 23 for the emphasis on the impossibility of *determinate* abstract ideas.

[24] DM 17.

actually perceive the earth moving, Berkeley's theory must be incompatible with the scientific claim that it does.

> Tenthly, it will be objected, that the notions we advance, are inconsistent with several sound truths in philosophy and mathematics. For example, the motion of the earth is now universally admitted by astronomers, as a truth grounded on the clearest and most convincing reasons; but on the foregoing principles, there can be no such thing. For motion being only an idea, it follows that if it be not perceived, it exists not; but the motion of the earth is not perceived by sense. I answer, that tenet, if rightly understood, will be found to agree with the principles we have premised: for the question, whether the earth moves or no, amounts in reality to no more than this, to wit, whether we have reason to conclude from what hath been observed by astronomers, that if we were placed in such and such circumstances, and such or such a position and distance, both from the earth and sun, we should perceive the former to move among the choir of the planets, and appearing in all respects like one of them: and this, by the established rules of Nature, which we have no reason to mistrust, is reasonably collected from the phenomena.[25]

To say that the earth moves is shorthand for observing that certain ideas we perceive are well-ordered in regular ways. Here again, there is nothing impossible about motion, and thus Berkeley's instrumentalism is fairly straightforward. We may safely conclude that the clearest and most uncontroversial cases of his instrumentalism satisfy the constraint of possibility.

Evidence of the added possibility constraint in more challenging cases appears in the *Analyst*, where Berkeley engages Newton's theory of fluxions in his calculus. Berkeley challenges Newton's theory not on the grounds that fluxions are not useful, but rather by arguing that the theory asks us to frame ideas that are inconceivable in virtue of their being impossible.

> The further the mind analyseth and pursueth these fugitive ideas the more it is lost and bewildered; the objects, at first fleeting and minute, soon vanishing out of sight. Certainly in any sense, a second or third fluxion seems an obscure mystery. The incipient celerity of an incipient celerity, the nascent augment of a nascent augment, i.e. of a thing which hath no magnitude: take it in what light you please, the clear conception of it will, if I mistake not, be found impossible; whether it be so or no I appeal to the trial of every thinking reader. And if a second fluxion be inconceivable, what are we to think of third, fourth, fifth fluxions, and so on without end?[26]

Berkeley goes on to oppose the Leibnizian concept of infinitesimals on the same grounds. Eventually he rejects the new calculus for a rather specific reason.

> But, notwithstanding all these assertions and pretensions, it may be justly questioned whether, as other men in other inquiries are often deceived by words or terms, so they likewise are not wonderfully deceived and deluded by their own peculiar signs, symbols, or species. Nothing is easier than to devise expressions or notations, for fluxions and infinitesimals of the first, second, third, fourth, and subsequent orders, proceeding in the same regular form without end or limit &c. or dx. ddx. dddx. ddddx. &c. These expressions indeed are clear and distinct, and the mind finds no difficulty in conceiving them to be continued beyond any assignable bounds. But if we remove the veil and look underneath, if, laying

[25] PHK 58.

[26] AN 4.

> aside the expressions, we set ourselves attentively to consider the things themselves which are supposed to be expressed or marked thereby, we shall discover much emptiness, darkness, and confusion; nay, *if I mistake not, direct impossibilities and contradictions.*[27]

When we use words as signs for objects that are themselves impossible, we have grounds for rejecting any theory that employs them, independently of whether there might be some usefulness to be had. The point is that instrumentalism does not *apply* except in cases where we already have a viable science. Note that Berkeley is attacking the *words* (expressions) used by Newton and Leibniz only insofar as they are *signs* for objects to be perceived by minds. I conclude that there are excellent grounds for thinking that Berkeley is an instrumentalist, provided we recognize that his instrumentalism is tempered by an additional metaphysical constraint that he imposes on the acceptability of theories that extends beyond their mere usefulness.

Having laid bare the basics of my reading of Berkeley's instrumentalism, there are two immediate challenges to its tenability. First, large portions of the *Siris* appear to run directly counter to my general claim that Berkeley is a consistent basic instrumentalist. Second, Jesseph has argued that Berkeley only endorses a weaker form of instrumentalism with respect to mathematics (from the *Analyst* in particular). I believe both concerns can be met, and I will engage each in turn.

2.4 The Complication of *Siris*

In her excellent article on Berkeley's instrumentalism, Lisa Downing notes what she takes to be his commitment to the existence of corporeal particles in the *Siris* and asks why Berkeley is an instrumentalist about force but a realist about aetherial particles, at least in that late work.

> Moreover, Berkeley seems to assume the existence of many of the theoretical entities he describes, including particles of aether …. In *De Motu* and *Alciphron*, Berkeley in effect develops a form of instrumentalism which he applies to Newton's mechanics. Why, one might well wonder, do corpuscles not receive a similar treatment in *Siris*, why does Berkeley not extend his instrumentalism to aetherial particles, for example?[28]

My answer, in short, is that he *does* extend his instrumentalism to *Siris*. Justifying my response, however, first requires some textual analysis.

I start with some brief observations about the *nature* of *Siris*; it is, by all accounts, an unusual text unlike the rest of Berkeley's published writings. Exactly what scholars of early modern philosophy ought to do with it has generated a flurry of activity early across the twentieth-century, with more recent commentators like Gabriel Moked arguing that Berkeley essentially gave in and changed his mind,

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[27] AN 8, my emphasis.

[28] Downing, "*Siris* and the Scope of Berkeley's Instrumentalism," 281.

embracing his own form of the new corpuscularian philosophy.[29] It lies outside the scope of this paper to engage Moked's book, but I shall present a view here that rejects his basic thesis. I take *Siris* to be a work where Berkeley is trying to insinuate and make more palatable some of his unique metaphysics into the mainstream views of the day. The book starts with a defense of the curative powers of tar-water – hardly a sage introduction to a weighty and serious philosophical tome. In the work, however, one can see Berkeley trying to make room for his own metaphysical claims within the corpuscularian and chemical traditions of his day. I shall endeavor to make this clear as I engage Downing's analysis.

Downing argues that Berkeley's attitude towards particles (especially aetherial particles, or pure fire) is "straightforwardly realistic," implying that Berkeley admits the existence of corporeal particles that are neither ideas nor collections of ideas.[30] As a result, *Siris* presents a special problem for people trying to understand the nature of Berkeley's instrumentalism. Downing concludes that Berkeley is an instrumentalist about dynamics and a realist about corpuscles in the *Siris*, but has a principled reason for excepting corpuscles from his general views. This reason saves the consistency of his instrumentalism throughout his works. It should be noted, however, that Downing's reading leaves us with the unpalatable result that Berkeley was, at least to some degree, not absolutely consistent in his metaphysics even if he was with respect to his instrumentalism.

I freely admit that many passages in *Siris* initially read as if Berkeley were an unreflective realist about particles, but even Downing notes how hard it is to pull out a consistent interpretation of Berkeley as a realist throughout the text. We have passages that superficially seem to indicate that aether or pure fire is corpuscular in nature, as in the following:

> We are not therefore seriously to suppose, with certain mechanic philosophers, that the minute particles of bodies have real forces or powers, by which they act on each other, to produce the various phenomena in nature. The minute corpuscles are impelled and directed, that is to say, moved to and from each other, according to various rules or laws of motion.[31]

The contrast here with dynamical forces appears striking. Right after denying the reality of forces Berkeley goes on to speak of corpuscles as if they really existed. He even speaks of light as corporeal.

> But it is now well known that light moves; that its motion is not instantaneous; that it is capable of condensation, rarefaction, and collision; that it can be mixed with other bodies, enter their composition, and increase their weight (Sects. 169, 192, 193). All which seems sufficiently to overthrow those arguments of Ficinus, and shew light to be corporeal.[32]

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[29] Gabriel Moked, *Particles and Ideas: Bishop Berkeley's Corpuscularian Philosophy*, Oxford: Clarendon, 1988, 25. For a further discussion of the varying views, see Wilson, "Berkeley and the Microworld," 37–39.

[30] Downing, "*Siris* and the Scope of Berkeley's Instrumentalism," 283.

[31] S 235.

[32] S 207.

Berkeley does often write as if aether is composed of corporeal bodies that interact with other corporeal beings.[33] I have no intention of denying how the texts readily appear.

The problem, however, is that Berkeley also says things in *Siris* that are flatly at odds with the corpuscularian understanding of aether. Downing is smartly aware of these passages and lists a few of them. Here are some key passages, the first three of which Downing cites as well.

> The pure fire is to be discerned by its effects alone…. (S 190)
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> …fire is a subtle invisible thing, whose operation is not to be discerned but by means of some grosser body, which serves… for a vehicle to arrest and bring it into view… (S 197)
>
> The pure invisible fire or aether doth permeate all bodies, even the hardest and most solid, as the diamond. (S 200)
>
> This pure spirit or invisible fire is ever ready to exert and shew itself in its effects…. (S 157)

If the aether is *invisible* and known *only* by its effects, then it is not perceivable in the way that bodies are within Berkeley's system. In short, the very corpuscles about which Downing believes Berkeley is a realist at a minimum do not seem to be real in the same way that bodies are according to materialist theories. What are we to do with these passages? Downing concludes that "there does seem to be unresolvable tension between Berkeley's championing of the aether in *Siris*, and the particular *esse est* [sic] *percipi* position defended in his early works. It appears that Berkeley, whether knowingly or not, has relaxed his earlier criterion for actual existence."[34] In sum, Downing's account of Berkeley's instrumentalism leaves us with an unpleasant inconsistency in his metaphysics.

I want to suggest that something else is going on, based on a reading of *Siris* as it unfolds towards those sections where he discusses aether. In the sections starting around 140, Berkeley argues that air is key to life, but only because it acquires a property that makes it life giving. The attraction of an *active* subtle substance called fire, aether, light, or vital spirit is required (S 147). At this point Berkeley starts discussing the nature of aether, and when he does so he is careful to emphasize that the strict nature of aether is known only by its effects. "This pure spirit or invisible fire is ever ready to exert and shew itself in its effects (Sect. 152), cherishing, heating, fermenting, dissolving, shining, and operating in various manners, where a subject offers to employ or determine its force."[35] Note that this spirit is active. Just like minds from the early metaphysical works, we only know active things by the

[33] Compare S 162. Downing claims that S 207 and 162 show that Berkeley's aether have some 'determinate size, shape, weight, etc.,' although as I shall argue I think she has over-read the passages.

[34] Downing, "*Siris* and the Scope of Berkeley's Instrumentalism," 289–290.

[35] S 157.

effects they produce.[36] Berkeley's descriptions of pure fire or aether are consistent. Pure fire is an "active principle" (reminiscent of 3D 233–4 where Philonous describes himself *qua* mind as 'a thinking active principle'). Berkeley even apparently connects his account of aether to the nature of spirits/minds in *Siris* Section 159.

> No eye could ever hitherto discern, and no sense perceive, the animal spirit in a human body, otherwise than from its effects. The same may be said of pure fire, or the spirit of the universe, which is perceived only by means of some other bodies, on which it operates, or with which it is joined. What the chemists say of pure acids being never found alone might as well be said of pure fire.[37]

By the time we have reached Section 160, we have the core account in place. Berkeley writes, "The mind of man acts by an instrument necessarily."[38] Before Berkeley introduces the discussions of aether he is telling us that by 'aether' he means a *sign*, itself invisible, of experiences we have in the phenomenal world. He does not want to emphasize the fact because he wants the work to have the sort of appeal to the vulgar that his earlier, more avowedly philosophical, works did not. He posits aether as an instrument the mind uses to organize certain kinds of regular experiences.

As a result, there is no need to provide an account that squares Berkeley's instrumentalism about dynamics with his realism about corpuscles because he is an instrumentalist about both. Recall that Berkeley's instrumentalism does not deny that ideas (and their orderings) are real; he denies that there is an *additional* underlying reality to which one must appeal in order to do science. One may *talk* about corpuscles and use all sorts of signs, but Berkeley is quite clear that, in reality, there is nothing beyond the effects we perceive. Thus his mentions of corpuscles (and similar items) are meant to be understood as signs used to explain regularities in the ordering of our ideas. Berkeley is 'speaking with the vulgar' in order to connect his other views with the popular intellectual currents of his day, including not only the new corpuscularian science, but also chemistry and views like the Great Chain of Being to which he alludes late in *Siris*.[39] Berkeley's invocation of the chain of being strikes me as evidence that he is only trying to make his philosophical system more palatable by showing it to be consistent with already well accepted views.

To make instrumentalism work with respect to aether, we need only note first, that the words like 'aether' he uses are signs for sets of effects (ideas or experiences) that are useful, and second, that these posits are logically possible (hence science can apply to them). From the previous cited passages I think it quite clear that Berkeley asks us to understand pure fire and aether only through their observable effects. I can find no better explanation for why he carefully inserts

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[36] I am leaving aside considerations of intuitive or notional knowledge, which Berkeley does not invoke in these specific discussions in any event.

[37] S 159.

[38] S 160.

[39] See S 303: "There runs a chain throughout the whole system of beings …. The meanest things are connected with the highest."

and repeats claims about the active nature of aether in a work clearly designed to have appeal to an educated but lay audience.

I also want briefly to comment on Downing's own theory about the scope of Berkeley's instrumentalism based on his distinction between ways in which theories are generated. I think her analysis here is essentially correct, and so my aim is only to demonstrate how her distinction is compatible with my reading of Berkeley's instrumentalism.

Downing argues that Berkeley distinguishes between two types of scientific method, an inductive method based on sensory experiences and a hypothetic-deductive method.[40] The key passage upon which she relies appears in *Siris*.

> It is one thing to arrive at general laws of nature from a contemplation of the phenomena, and another to frame an hypothesis, and from thence deduce the phenomena. Those who supposed epicycles, and by them explained the motions and appearances of the planets, may not therefore be thought to have discovered principles true in fact and nature. And, albeit we may from the premises infer a conclusion, it will not follow that we can argue reciprocally, and from the conclusion infer the premises.[41]

We are 'naturally' realists about the results of induction, but hypotheses should be handled with care and only evaluated on the basis of their usefulness. In particular, we should not infer the existence of any posited entities, accepting as real only those things we actually perceive. Newtonian dynamics is hypothetical (and Downing cites a passage from Newton's *Principia* that confirms her assertion), but the science of aetherial corpuscles Berkeley advances in the *Siris* is experiential and inductive. As a result, Downing has a principled basis on which to argue that Berkeley is an instrumentalist about some things (those involving the hypothetical method), but not others (inductive methods).

About the distinction and that Berkeley held it I am convinced. He separates two methodologies in the conduct of science. The issue now is whether Berkeley's claims about the alleged reality of aetherial particles is evidence that he is not an instrumentalist. If my supposition that words like 'aether' and 'pure fire' are simply signs for collections of well-ordered experiences is correct, then we might question whether the use of such a method automatically excludes instrumentalism. Nothing in the above passage (or elsewhere in *Siris*) requires that we understand Berkeley to think that we must believe in anything beyond the ideas we perceive. Inducing and anticipating ideas from previous experiences is a separate method, but it is not one that *requires* that we posit 'real' entities that underlie those ideas. We use signs as useful 'instruments' of the mind (remembering *Siris* 160), even though those signs do not necessarily pick out mind-independent things. There is no reason to think Berkeley must be appealing to an underlying causal order here. In fact, his emphasis seems clearly otherwise. At least part of the *point* of the discussion of aether in *Siris* is to explain *why* tar water is such a potent curative.

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[40] Downing, "*Siris* and the Scope of Berkeley's Instrumentalism," 293–294.

[41] S 228.

That aim is instrumental. Berkeley's alleged realism about particles thus has to be understood under two constraints. First, Berkeley *tells us* what he means by those words (e.g. 'aether') in the *Siris*, namely that they are known only by effects. Second, we must bear in mind that the *Siris* is an unusual work arguably designed to make his core metaphysical views more acceptable to the educated lay audience of his day. These would be readers with at least a passing familiarity with curatives and alchemy, as well as other intellectual currents – many of which Berkeley discusses. In short, *Siris* is not a sober 'in truth and strictness' hard work of 'pure' philosophy. We thus need to allow Berkeley some latitude in his expression given his larger aims.[42]

2.5 The Challenge of Geometry

A second challenge awaits my account. Douglas Jesseph has argued that Berkeley retreats from a full-blown instrumentalism with respect to his discussion of the calculus in the *Analyst*. Berkeley there argues that the conclusions of the Newtonian and Leibnizian calculi are correct, but the methodologies are in serious error. Jesseph rightly asks why an instrumentalist would care whether the methodologies were right, so long as the theories were useful. I am in the odd position here of agreeing with virtually all of Jesseph's claims. He even notes the roughly same constraint (of possibility) that I articulated earlier. That said, I think Jesseph draws a less charitable conclusion about Berkeley's instrumentalism even as his analysis of Berkeley's philosophy of mathematics and science is otherwise excellent. If we ignore the constraint of possibility, then I believe Jesseph is probably right: Berkeley is no instrumentalist about mathematics *simpliciter*. When we add the constraint, however, I think we can fairly attribute to him a consistent form of instrumentalism.

Consider Berkeley's attack on the calculus. He explicitly admits that the conclusions are true, choosing instead to focus on the underlying methodologies.

> I have no controversy about your conclusions, but only about your logic and method. How you demonstrate? What objects you are conversant with, and whether you conceive them clearly? What principles you proceed upon; how sound they may be; and how you apply them? It must be remembered that I am not concerned about the truth of your theorems, but only about the way of coming at them; whether it be legitimate or illegitimate, clear or obscure, scientific or tentative.[43]

In short, Berkeley claims that the methodologies are flawed, but happen through the good fortune of 'compensating errors' to yield true conclusions. I am not interested

[42] I am absolutely *not* arguing that Berkeley is being disingenuous in *Siris*. Instead, my claim is that the work is self-reflectively less explicit about issues of presentation in order to make the claims advanced in it more accessible to readers who might otherwise find the unadulterated metaphysics of immaterialism less than palatable.

[43] AN 20.

here in the quality of his unusual diagnosis, which Jesseph has ably shown to otherwise be suspect. What matters for my present purpose is whether this sort of analysis precludes Berkeley from being a consistent instrumentalist.

Jesseph argues that "Berkeley's struggle to use compensating errors in accounting for the success of the calculus is also part of his rejection of a thorough-going mathematical instrumentalism. His effort to explain away the paradox of true conclusions drawn from false premises is exactly the kind of work an instrumentalist need not bother with."[44] Exactly right, provided one is already convinced that we are actually *doing* scientific work. If, however, we add the constraint of possibility, we might see Berkeley's concern as the following. If the methodologies Newton and Leibniz employ invoke impossible entities, then there is a sense in which *they are not doing science*. Jesseph diagnoses the difference between works like *De Motu* and *Alciphron* on the one hand, and the *Analyst* on the other, as the difference between metaphysical and logical critiques. But if Berkeley's aim in the *Analyst* is to preserve the conclusions of the calculus by making it a science when it otherwise would not be, then perhaps we have a more charitable position to attribute to him.

At the conclusion of his discussion of the compensating errors thesis, Berkeley writes:

> This hint may perhaps be further extended, and applied to good purpose, by those who have leisure and curiosity for such matters. The use I make of it is to shew, that the analysis cannot obtain in augments or differences, but it must also obtain in finite quantities, be they ever so great, as was before observed.[45]

As Jesseph aptly notes, the point is to replace the use of infinitesimals with something that is possible: his "finite quantities, be they ever so great."[46] We saw earlier (AN 8, quoted above) what the problem was: Berkeley thinks that infinitesimals and fluxions are not possible entities. As a result, I speculate that he believes that the calculus, as presented, is not really a science or proper mathematics at all. To the degree to which it uses abstract (i.e. impossible) ideas, it *cannot* be.

Jesseph himself later admits something like what I have called the constraint of possibility I am here invoking.

> Thus, only those terms that have observable content 'taken in concrete' are, in Berkeley's view, properly scientific: 'In illuminating nature it is vain to adduce things which are neither evident to the senses nor intelligible to reason. Let us therefore see what sense, what experience, and lastly what reason resting up them recommend' (*De Motu* §21). Clearly, Berkeley's instrumentalism does not extend so far as to permit theories whose terms lack all experiential content.

In essence, my disagreement with Jesseph is rather minor. He notes the constraint and uses it to conclude that Berkeley is not an instrumentalist whereas I want to fold the constraint into Berkeley's thinking about what it is to do science.

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[44] Jesseph, *Berkeley's Philosophy of Mathematics*, 213.

[45] AN 29.

[46] Jesseph, *Berkeley's Philosophy of Mathematics*, 212–213.

2.6 Metaphysical Instrumentalism

Central to my argument in this paper is my here unsupported contention that one ought not distance Berkeley's metaphysics from his thinking anywhere else. His unusual commitments to stark metaphysical principles permeate his philosophy. Thus, in order to be charitable to Berkeley and his views we need to interpret his claims in light of these principles. He argues at length against the existence of abstract ideas on the grounds that they are impossible entities. Applying this bit of his metaphysics to this thinking about science yields a more charitable reading of him. By taking seriously how Berkeley unpacks and introduces the concepts of aether, light, etc. in *Siris* and by adding the metaphysical constraint of possibility to what counts as science (including mathematics), we find ourselves with a way to resolve some of the tensions that appear in the Berkeleian corpus with respect to both his instrumentalism and his metaphysical system.

Berkeley holds that science properly speaking is concerned with possibilia and their use. If one attempts to apply scientific methodology to impossible (contradictory) entities, then one is not even doing science. And when applying the methods of science to the world one does not require recourse to a 'deeper' causal reality underneath the ordering of ideas set down by God. That, I suggest, may make him a consistent instrumentalist.

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