Journal of Modern Philosophy

Ott, Walter 2019 Berkeley's Best System: An Alternative Approach to Laws of Nature. *Journal of Modern Philosophy,* 1(1): 4, pp. 1–13. DOI: https://doi.org/10.32881/jomp.10

RESEARCH

Berkeley's Best System: An Alternative Approach to Laws of Nature

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Contemporary Humeans treat laws of nature as statements of exceptionless regularities that function as the axioms of the best deductive system. Such 'Best System Accounts' marry realism about laws with a denial of necessary connections among events. I argue that Hume's predecessor, George Berkeley, offers a more sophisticated conception of laws, equally consistent with the absence of powers or necessary connections among events in the natural world. On this view, laws are not statements of regularities but the most general rules God follows in producing the world. *Pace* most commentators, I argue that Berkeley's view is neither instrumentalist (since law statements have truth values and descriptive content) nor reductionist. More important, the Berkeleyan Best System can solve some of the problems afflicting its Humean rivals, including the problems of theory choice and Nancy Cartwright's 'facticity' dilemma. Some of these solutions are available in the contemporary context, without any appeal to God. Berkeley's account deserves to be taken seriously in its own right.

Keywords: Berkeley; laws of nature; instrumentalism; Hume; philosophy of science

George Berkeley rejects necessary connections in the physical world with just as much clarity and vigor as his successor, David Hume. Unlike Hume, however, Berkeley develops a careful and nuanced picture of laws of nature.[1] There is an irony here, since Hume has long since ascended into the ranks of the suffixed: the 'Humean' Best System Account of F.P. Ramsey and David Lewis owes much, though hardly everything, to its namesake. For his part, Berkeley has been classed with the instrumentalists, an approach that hardly enjoys the same support now as it did in its positivist heyday.

The Humean begins with the idea that laws are a special kind of regularity: those regularities the statements of which feature as axioms of the best deductive system.[2] I shall argue that Berkeley consistently, and with good reason, abjures this starting point: his laws are not regularities. But neither is Berkeley an instrumentalist: statements of Berkeleyan laws have descriptive content and a truth value. On my reading, Berkeleyan laws are the most general rules God follows in producing sensations. This move allows Berkeley to admit laws involving non-referring terms such as 'gravity' and 'force.' Moreover, Berkeley's alternative allows him to solve some of the most vexing problems afflicting Best System Accounts, especially the problems of theory choice and Nancy Cartwright's famous 'facticity' dilemma. Some of these solutions are possible only in the context of Berkeley's theological position; others, I argue, survive the transplant into a contemporary context. If I am right, it is to Berkeley, not Hume, that proponents of the Best System Account should turn for inspiration.

[1] David Braddon-Mitchell is not far off when he says, '[t]he peculiar thing about being an Humean about laws is that Hume himself rarely talked about laws' (2001: 260). Hume of course talks about laws a great deal in his *Enquiry concerning Human Understanding* (1748/2007), though he does not give an explicit analysis of them.

[2] The central idea is well stated by F.P. Ramsey: 'if we knew everything, we should still want to systematize our knowledge as a deductive system, and the general axioms in that system would be the fundamental laws of nature' (1978: 131). David Lewis adds that the deductive system must be the best one available, that is, the one that maximizes strength and simplicity. See Lewis (1973) and (1986), as well as Barry Loewer (1996) and Helen Beebee (2000/2004).

I begin by laying out the basic picture of laws in the *Principles of Human Knowledge* (1710).[3] Nearly all commentators read this early work as offering a regularity theory; it is allegedly only in *De Motu* (1721) that Berkeley arrives at his mature view. In contrast, I argue that Berkeley holds a single conception of laws of nature throughout his career, one that distinguishes the laws God follows from the regularities he produces in accordance with them.

Still, the *Principles*' basic picture suffers from a serious flaw: Berkeley has no account of how different forces might conspire to produce an effect. As a result, he is compelled to see the 'fixed stars' and the upward growth of plants as exceptions to the law of gravity. I argue in the second section that Berkeley offers a more sophisticated analysis of forces in *De Motu* that allows him to make sense of exceptions to individual laws.

The third section leverages these points against competing interpretations. The instrumentalist reading is quite right to point out Berkeley's opposition to positing active forces in nature. Instead, Berkeley insists that propositions involving force-terms can be useful for prediction and explanation, even though such terms do not refer to 'the natures of things.' This has encouraged commentators to go further and assert that Berkeleyan law statements lack descriptive content and a truth value. I argue that to reject dynamical realism is not to deny propositions involving force-terms meaning and even truth. The axioms of a completed Berkeleyan science would be straightforwardly true: they would state the propositions in God's mind that function as rules for the production of effects. And from a human perspective, these rules are precisely the axioms that would allow us to deduce and predict phenomena. All of this makes for a more interesting position than has so far emerged in the literature and, I argue, reveals seeds of truth that are worth cultivating. Berkeley's position merits a suffix of its own.

1. The *Principles of Human Knowledge*: the basic picture

Most readings of Berkeley cast the young philosopher as a regularity theorist: what counts as a law of nature is simply a fairly general regularity.[4] I shall argue that such readings ignore the difference between laws and the patterns they generate. The difference is easy to miss, however, because of the dialectical context in which Berkeley first introduces the laws of nature.

Bodies are ideas, and ideas are always passive (PHK 25). What then makes the difference between reality and dreams or illusions? All of them are equally made up of ideas, and so on the same ontological level. In response, Berkeley insists that ideas of sense, as opposed to ideas of imagination, are more lively and vivid. But the difference is not exhausted by their intrinsic qualities: what makes an idea part of reality includes its connection to other ideas. God produces our ideas in an orderly way, and this provides us with 'a kind of foresight' (PHK 31) that enables us to navigate the world. God's orderliness justifies induction and makes the difference between dreaming and seeing.

It then becomes natural to think that when Berkeley speaks of 'laws of nature,' he means the patterns we cotton on to in everyday life: propositions such as 'food nourishes, sleep refreshes' (PHK 31).[5] It is striking, then, that Berkeley's first explicit mention of laws blocks this natural reading:

> The ideas of sense…have likewise a steadiness, order, and coherence, and are not excited at random, as those which are the effects of human wills often are, but in a regular train or series, the admirable connexion whereof sufficiently testifies the wisdom and benevolence of its Author. Now *the set rules or established methods wherein the mind we depend on 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. (PHK 30, my emphasis)

Experience shows us that ideas of kind A are regularly conjoined with ideas of kind B. From these regularities, we are able to infer the laws or rules God follows in producing them.[6] This notion of laws as divine rules, and patterns in experience as our evidence for them, runs right through Berkeley's last work, *Siris*. There, Berkeley

[3] With the exception of *Alciphron*, references to Berkeley are to the section number in the relevant volume of the Luce and Jessop edition of his works (Berkeley 1949–58). References to *Alciphron* are to Berkeley (1993), and are to dialogue number, section, and page number. I use the following abbreviations: PHK (*A Treatise concerning the Principles of Human Understanding*); DM (*De Motu*); ALC (*Alciphron*); S (*Siris*).

[4] See esp. Richard Brook (1973: 91), Lisa Downing (2005: 233), Timo Airaksinen (2010), and Tom Stoneham and Angelo Cei (2009: 76), the last of whom read Berkeley as beginning with a regularity theory and changing his mind during the course of the *Principles*.

[5] As Downing puts it, 'Berkeley holds [in PHK] that laws of nature are regularities in the phenomena… [A]ny simple inductive generalization describes a law of nature for Berkeley' (2005: 233).

[6] See PHK 150, where Berkeley says, in part: 'by Nature is meant only the visible series of effects or sensations imprinted on our minds, *according to certain fixed and general laws*…' (my emphasis; see also PHK 62, 107, 108, and 153).

describes the laws of motion as 'rules or methods observed in the productions of natural effects' (S 231), and only God produces natural effects. A bit later, he speaks of 'the laws and methods observed by the Author of nature' (S 243) and calls the patterns we observe in nature 'a foundation for general rules' (S 252).[7]

What, then, accounts for Berkeley's tendency to speak as if laws were simply patterns? For in the very next section of the *Principles* (PHK 31), Berkeley tells us that we know 'that food nourishes, sleep refreshes, and fire warms us; that to sow in the seed-time is the way to reap in the harvest…only by the observation of the settled Laws of Nature.' If laws are aspects of the divine will, there is no such thing as observing them. Berkeley must mean we observe the patterns that result from God's will. If so, the laws just are the patterns.

I submit that Berkeley is exploiting a usually harmless ambiguity. Ordinary language permits us to slide between speaking of a pattern and of the rule followed by someone producing the pattern. The same answer could serve to enlighten someone about either. If I say that the series '2, 3, 5, 8, 13' is part of the Fibonacci sequence (each number is the sum of the two preceding numbers), I am equally describing the rule followed in producing the series.

Nevertheless, rules and patterns are not the same thing. Laws or rules license inferences mere patterns do not; these inferences need to be underwritten by claims about the agent producing the pattern. If I came across the series written above, I could not conclude that the next number would be 21 unless I knew the series was deliberately produced by someone intending to go on in the same way.

This last point helps explain why Berkeley does not think even an ideal epistemic agent could predict the future with Laplacean certainty. Knowing the laws allows us to 'deduce the other *phenomena*, I do not say *demonstrate*; for all deductions of that kind depend on a supposition that the Author of Nature always operates uniformly, and in a constant observance of those rules we take for principles: which we cannot evidently know' (PHK 107).[8] Nothing stops God from making exceptions if he chooses, as when he transforms Moses's rod into a serpent (PHK 84).

The distinction between laws and patterns becomes all the more evident when we turn to Berkeley's response to what we might call the 'superfluity' objection: if bodies are passive, why would God need to create their intricate parts and 'all the clockwork of Nature' (PHK 60)? In reply, Berkeley points to the laws of nature: even if God could have produced all the macro-level phenomena we experience without any micro-structure, his decision to produce effects according to natural laws requires him to create the intricate clockwork first revealed by the invention of the microscope. But now consider what becomes of this reply if the laws are just the rules of thumb familiar from everyday life. 'Acting according to laws' would just mean 'acting in a predictable way, from our macro-level point of view.' That is hardly the sort of constraint on God's action that Berkeley's reply requires: God could just as easily produce the macro-level patterns without bothering with the micro-structure. Berkeley's reply only works if the laws are aspects of the divine will that govern God's activity, at whatever level of nature we examine.[9] True, the simple heuristics are useful because God operates according to laws; but that does not make the heuristics the laws themselves.

In making this reply to the superfluity objection, Berkeley is, whether consciously or not, following Nicolas Malebranche.[10] For although Malebranche is not an immaterialist, as an occasionalist, he faces the same problem: why would God need to create the internal structures of plants, if he is the only cause? Malebranche replies that of course God can do whatever he likes, but that he could not, say, make a plant grow without water 'by natural ways, i.e., according to the general laws of the communication of motion He has established, and according to which he almost always acts.'[11]

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[7] It is worth observing here that even to call the laws of nature the *general* rules is to imply a structure: there must be subsidiary, less general rules. Berkeley's idea seems to be that only the most general rules merit the title 'laws'' the others must be deducible from this core. The hierarchy is more explicit in *De Motu*: 'from [the 'primary laws of motion'] are derived both general mechanical theorems and particular explanations of the phenomena' (DM 36).

[8] Berkeley is here using some Aristotelian terminology that might obscure his meaning. An Aristotelian demonstration is more than a deduction because it proceeds from first principles, which are necessary truths (see *Posterior Analytics* 70b9 f., in Aristotle (1984: 115 f.)) To use a tired example: the definition of human being (a necessary truth) allows us to infer that human beings are risible. One might be forgiven for thinking that Berkeley is making two distinct points at PHK 107: (a) that we might be mistaken in thinking the general principles of Newtonian science really are the rules God follows (since we merely 'take them for principles') and (b) that even if they are the rules God follows, we cannot rule out the possibility of miracles, since God's other attributes (such as benevolence) might require him to violate his own rules. Given the Aristotelian pedigree of 'principles,' however, it seems clear that Berkeley is making only point (b). To say that we take the rules we've discovered for principles is to say that we assume (wrongly) that they are necessary truths that can support demonstrations, rather than mere deductions.

[9] Again, this is not to say that God is necessarily constrained by the laws of nature; nothing stops him producing miracles (PHK 107 and 84, discussed above).

[10] Downing (2011) notes Berkeley's debt to Malebranche on this point; see Malebranche (1997: 663–8).

[11] 'Elucidation Fifteen,' in Malebranche (1997: 663).

Indeed, Berkeley seems to owe much of his basic approach – though not its refinements – to Malebranche. It is not hard to see why the first readers of the *Principles* dubbed Berkeley a '*Malbranchiste de bonne foi*' and named Malebranche 'his master.'[12] Nevertheless, Berkeley's departures from Malebranche are significant. One of the many puzzles for readers of Malebranche is the ontological status of laws. Malebranche insists that laws are causes: God 'willed certain laws according to which motion is communicated upon the collision of bodies; and because these laws are efficacious, they act, whereas bodies cannot act.'[13] What *kind* of thing must a law be, if it is to be an efficient cause?

It is notable then that Berkeley, who was clearly aware of Malebranche and his views, nowhere says that laws are causes. His argument for God's existence depends on God himself being the sole and immediate cause of any involuntary ideas of sense (see PHK 29; 146–7). And in his most Malebranchean moment – *De Motu* 34, when he pilfers an argument directly from Malebranche – he conspicuously avoids saying that anything but God himself is the cause of motion.

That does not mean Berkeley's view is without its puzzles. If the laws are not themselves causes, what role do they play in his picture? Berkeley seems to treat them as reminders God gives himself: in situation x, bring about ideas y–z. And yet that hardly seems consistent with divine omniscience.[14]

I am not sure Berkeley has a persuasive reply, but that's because I think a great deal about a divine being would necessarily be mysterious. In the context of omniscience, is there any cash value to the distinction between simply knowing all the particulars that will ever and have ever been, and knowing the rules from which such particulars may be deduced (though not demonstrated)? If there is, then I am tempted to put the objection in reverse: being omniscient, God could hardly help knowing the laws of nature, construed as rules. Someone might well be able to 'know-how' to speak French without 'knowing-that' the grammatical rules are as they are, but an omniscient being would by definition be powerless to avoid knowing them in any sense one could mention, whether he needed to refer to them when speaking or not. So the mere fact that God doesn't *need* to know the rules wouldn't preclude his in fact knowing them and indeed consciously following them. (Whether these considerations are at all persuasive is, of course, a separate question from the content of Berkeley's view).

To sum up the basic picture: the laws of nature are the general rules God observes when producing ideas of sense. A Berkeleyan law is an axiom of the system God has devised for producing effects, and that system is the 'best' in the sense that, as much as or more than any others God could have chosen, it enables God to achieve his ends in ways consistent with his other attributes.[15] These rules, not the regularities that flow from them, serve as the truthmakers for law-statements. The rules themselves don't describe anything; they fit the world differently. Suppose God, for example, decides that nothing shall move faster than the speed of light.[16] The content of that decision doesn't describe a state of affairs; it prescribes one. But of course that fact doesn't rob our *statements* of the law of their descriptive content: they describe the rules God is following.

1.1. A problem for the basic picture

Berkeley's reply to the superfluity objection presupposes that God observes the same rules at whatever level or part of space one can imagine. It is this constraint that explains the existence of the clockwork structures of microscopic bodies. And yet in other places, Berkeley seemingly endorses a much weaker position, which requires only that God observe *some* rules or other in each domain. This move is problematic on two counts: it both robs the reply to the superfluity objection of its force and restricts the scope of the Newtonian principles Berkeley lauds throughout his career.

This restriction emerges in Berkeley's attack on gravitation as a power possessed by bodies (PHK 106). Although Berkeley is well aware that it is not Newton's own position, he is keen to block the conclusion that attraction is a force or power inherent in matter.[17] In response, Berkeley argues that gravity is not in fact a

[12] These are from early anonymous reviews of the *Principles* quoted by McCracken (1983: 205–6).

[13] Malebranche (1997: 449).

[14] I am grateful to an anonymous referee for pressing me on this question.

[15] For the connection between divine perfection and the general rules of nature, see esp. PHK 32, 62, and 107. I do not mean to suggest that Berkeley goes as far as Leibniz in thinking our world the best of all possible worlds, though I see no evidence he rejects that claim. The point is just that Berkeley's God at least has 'wise ends' (PHK 62 and 107), among them enabling human minds to navigate their world, and that serving these ends requires him to operate according to rules. Given his omniscience, it seems clear that God will light on the best set of rules (or at least one of the equally and maximally good sets of rules).

[16] I am indebted to an anonymous referee for this example.

[17] In *De Motu*, Berkeley emphasizes Newton's agnostic position on the true causes of gravitational attraction; see esp. DM 17. For more on Newton, see especially John Henry (1994). As Andrew Janiak (2018) shows, there was a lively debate in the aftermath of

universal feature of matter. The structure of the dialectic is not entirely clear, but he appears to reconstruct his opponent's reasoning in this way:

a) gravity is a very common phenomenon; therefore
b) it is universal; therefore
c) it is essential to matter (PHK 106).

We already know that Berkeley objects to (c), since it conflicts with the passivity of matter. The natural move to question is from b) to c): why think that the universality of gravitation entails that it is the result of the essential properties of matter?

But that is not where Berkeley chooses to attack the argument. Instead, in a move that at first must seem not just odd but comical, he rejects step b).

> Whereas it appears the fixed stars have no such tendency towards each other; and so far is it that gravitation, from being *essential* to bodies, that, in some instances, a quite contrary principle seems to shew itself: as in the perpendicular growth of plants, and the elasticity of the air. (PHK 106)

The notion that a plant's upward growth should serve as a counterexample to the universal claims of gravity on all bodies should leap out as very strange indeed. Though it will take some work to see it, I think Berkeley has a profound point here.

If to be universal, gravitational attraction must always and everywhere be exhibited by any set of bodies one cares to mention, then daily experience shows that it is not universal. The natural reply in defense of b) is that even in these alleged counterexamples, gravity is operating. After all, without it, the plant's upward growth would be unchecked by gravity, and limited only by the availability of nutrients and sunlight. A different example is provided by the Shanghai magnetic levitation train, or 'maglev,' which uses magnetism to float above the tracks. The force of gravity is being counterbalanced, not erased, by the magnetic forces at play.

Note, however, that this reply assumes the reality of forces. We have to be thinking of gravitational force as making a real contribution to the movement of the train, or, in Berkeley's example, as exerting real downward pressure on the plant. From the perspective of someone who rejects mind-independent forces and powers, as Berkeley does, the simple denial of the universality of gravity becomes intelligible, even if, as we'll see, it's not the only option.[18]

In fact, I suspect this hidden dialectic explains Berkeley's otherwise puzzling reconstruction of his opponent's argument in a)–c). Why would anyone think that gravity's being universal entails that it is essential to matter? The obvious counterexamples can be parried, Berkeley might think, only if gravity is a real force each body is imbued with. These forces then struggle against each other, with one body's force sometimes pre-empting or limiting the operation of another's. This preserves the universality of gravitational attraction but only by making bodies active in a way Berkeley cannot abide.

However that may be, I shall argue that in the later works, Berkeley finds his way to allowing the universality of attraction without reifying forces. His path through this thicket requires recognizing that the laws of nature operate together.

2. A refinement of the basic picture: composition of forces in *De Motu*

Berkeley apparently submitted *De Motu* to a competition for the best essay on motion held by the Paris Academy of Sciences.[19] That would explain why he never appeals to immaterialism, as well as the general air of friendliness to post-Cartesian occasionalists such as Malebranche.[20] Right from the start, he is keen to

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the *Principia* over whether Newton took gravity to be essential to matter. Newton himself declares 'I am by no means affirming that gravity is essential to matter' (in Newton 1999: 796, quoted in Janiak 2018: 52), it's not quite clear just what position Newton meant to reject.

[18] At times, Berkeley seems not much bothered by talk of forces in the first edition of the *Principles* (see the end of PHK 115 in the 1710 edition, which Berkeley cut in the 1734 edition). Downing argues that 'one must assume that Berkeley thought forces existed' (2005: 236). Given that this would conflict with the passivity of matter (as Downing notes), it seems more likely to me that Berkeley simply didn't bother to render his claim in language consistent with his denial of causal powers to bodies; he might have removed the passage later on because it encouraged precisely this misunderstanding of his view.

[19] Here I rely on Downing (2005: 237 and 259), who lists Berkeley's first biographer, Joseph Stock, as the original source of this claim.

[20] As others have pointed out, that friendliness is not feigned: Berkeley's view has much in common with Malebranche's. See esp. Charles J. McCracken (1983), Kenneth Winkler (1989: 104–5), and Downing (2013).

point out that one can accept the Newtonian laws without ascribing causal powers to bodies. This comes out in two crucial passages:

> *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 clearly introduced by Newton, not as a true, physical quality, but only as a mathematical hypothesis... (DM 17)
>
> A similar account must be given of the composition and resolution of any direct forces into oblique ones by means of the diagonal sides of the parallelogram. They serve the purpose of mechanical science and reckoning; but to be of service to reckoning and mathematical demonstration is one thing, to set for the nature of things is another. (DM 18)

'Attraction' and 'gravity' need not earn their place in science by naming distinct qualities. There is much to debate here, and we'll return to these passages below. For now, the important point is Berkeley's claim about the composition of forces. It might seem to be an afterthought; but in light of the problems evident in the *Principles*, it takes on new significance.[21]

In his notes on *De Motu*, Douglas Jesseph directs us to Corollary I, Book I, of the *Principia*.[22] Newton has just stated part of the second law of motion: 'to any action there is always an opposite and equal reaction.' The corollary to this law is meant to tell us what happens when a body is acted on by two forces at the same time. Newton writes, '[a] body acted on by [two] forces acting jointly describes the diagonal of a parallelogram in the same time in which it would describe the sides if the forces were acting separately.'[23]

The passage from *De Motu* in effect anticipates and replies to an objection based on Newton's text. How, one might wonder, can we reject realism about forces, if we need to mention competing forces to explain events, as Newton's corollary shows? But for Berkeley, the truthmakers for law statements are the rules God follows, not the natures of bodies. Statements of the rules mentioning forces can be true, full stop, even when there are no forces. Casting the laws themselves as divine rules is precisely what allows Berkeley to accept laws about gravity and force without according these 'things' any place in his ontology.

How does this 'combination of laws' move extend the scope of gravitation? What the Newtonian laws together tell us is that any apparent counterexample – such as the 'fixed' stars – must be due to the operation of other forces besides the attraction of the stars one to another. If we applied the inverse square law just to two bodies in the universe, it would give us the wrong prediction of their behavior. On Berkeley's revised view, the laws of the composition of forces permit accurate calculation even if the forces being compounded are not real.[24]

3. The instrumentalist and reductivist readings

For most commentators, the shift from the *Principles* to *De Motu* is much more dramatic than I have described. On the orthodox view, Berkeley begins as a crude regularity theorist and shifts to a radically new position in *De Motu*. What exactly this new position amounts to is, of course, controversial. I shall deal here with the two most prominent readings: instrumentalism and reductivism. Both take comfort from Berkeley's approach to terms such as 'force' (DM 17, quoted above). As we've seen, Berkeley distinguishes between the use of these terms to refer to qualities and their use in calculation and prediction. For some of his contemporaries, '*dead force* and *gravitation* by the aid of metaphysical abstraction are supposed to mean something different from moving, moved, motion, and rest, but, in point of fact, the supposed difference amounts to nothing at all' (DM 11).

W.H. Newton-Smith (1985) construes this kind of remark as an episode of reductivism, according to which all theoretical terms are meant to be replaced by terms for observables. That issue, however, is orthogonal to Berkeley's concerns. The problem with force is not that it is unobservable; later on, in *Siris*, Berkeley will happily go on to postulate aetherial corpuscles, which are not observable by human beings by definition.[25]

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[21] That Berkeley does not explicitly tell his readers that DM 18 corrects a problem in the *Principles* is to be expected, given his intended audience and evident desire to keep his immaterialist views concealed.

[22] Jesseph (1991: 80, n.13).

[23] Newton (1999: 417).

[24] Here we have another advance over Malebranche: I can find nothing in the latter's work to suggest the 'web of laws' approach Berkeley develops.

[25] See Downing (1995: 288–9) on the imperceptibility of the particles of the aether. Downing directs us to sections 190, 197, and 200 of *Siris*, which together seem to show that there are in principle no circumstances under which we would perceive these particles. See also Stathis Psillos (2017) and (2018).

Qualities such as force are unobservable *because* they are incoherent: 'we cannot conceive' what they are, still less, how they can do anything (DM 4).

The source of Berkeley's opposition makes sense, given his goals in *De Motu*. He is suppressing not just his idealism but his empiricism. Rather than complain that forces are not observable, which any empiricist might do but would hardly impress a Cartesian audience, Berkeley appeals to just the same line of reasoning one finds in Descartes and Malebranche. To attribute force to bodies is to make a category mistake, since only minds, for all three thinkers, are agents.[26] When Berkeley says that force terms do not add anything by way of reference to new entities (DM 11), he is not proposing a translation of theoretical into observable terms. Instead, as Downing argues, Berkeley's claim is that force, *construed as a quality or thing*, is nonsensical.[27]

In fact, the reductivist position is one Berkeley would actively oppose. Throughout his writings, Berkeley warns against what Gilbert Ryle would later call the 'Fido'-Fido mistake: thinking that every noun or name corresponds to some entity or other.[28] To look for a quality to which 'force' corresponds, or to offer a reductivist account of 'force,' are equally instances of the 'Fido'-Fido mistake.

Perhaps the majority of commentators take Berkeley to follow the path of instrumentalism instead.[29] On this reading, Berkeley takes terms such as 'force' to be to be useful for calculation but to lack any meaning of their own. Propositions involving these terms, including the theoretical statements of laws of nature, are neither true nor false; they are, as Downing puts it, devoid of 'descriptive content,'[30] presumably because they are prescriptive, not descriptive. What makes this reading instrumentalist, as opposed to flat-out anti-realist, is the added claim that law statements are useful and have a role in scientific practice. So construed, instrumentalism about statement S says that S lacks a truth value, lacks descriptive content, and is *merely* of use in making predictions. Whether all three of these features must go together, or whether instead some but not others could be true of law statements, is a question we'll pursue in the final section. And I should note that there are surely other meanings associated with 'instrumentalism' throughout the history of philosophy. But the instrumentalism I've set it out here is the version at issue in the Berkeley literature.

Let me pause to remove a potential confusion.[31] There are two distinct issues here: how to treat statements or theories that mention otherwise 'occult' qualities, and how to understand laws of nature. One might give an instrumentalist—in the precise sense just specified—treatment of statements mentioning, say, force, while not giving a wholesale instrumentalist reading of *all* laws of nature. Still, such a treatment of force commits one to giving an instrumentalist reading of all law statements that mention that term. Nowhere in *De Motu*, as far as I can tell, does Berkeley propose a candidate law statement that is innocent of any such term. So while it is true that instrumentalism with regard to laws mentioning forces does not by itself entail blanket instrumentalism about *all* law-talk, such a middle ground does not seem to have struck Berkeley at the time of writing *De Motu*.

Instrumentalism about the laws of nature—in the sense I've specified—seems to be on firm textual ground. But notice just how Berkeley sets up the alternatives. The choice is between thinking that law statements reveal the natures of things and that they are useful in mathematical demonstrations. Since there can be no such thing as force or gravity construed as a quality in the physical world, the first option is clearly ruled out. And equally clearly, Berkeley endorses the second. But that endorsement falls short of instrumentalism: the instrumentalist must take the further step of thinking that law statements are *merely* of use in prediction and have neither a truth value nor descriptive content.

That further step is open to question. Berkeley purports to leave the 'famous theorems of mechanical philosophy' 'untouched' (DM 66); that promise would be hollow if he deprived those theorems of truth in the literal sense. Moreover, if I am right so far, there is no need for drastic interpretive measures. Law-statements can be true in an unproblematic sense: they correspond to the rules God observes in producing his effects. That some terms figuring in these law-statements do not answer to any ideas is no barrier.[32] For confirmation of this picture, we need to turn to Berkeley's late work, *Alciphron*.

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[26] For Descartes's use of the 'little souls' argument, see esp. the *Sixth Replies* in Descartes (1984, vol.2: 297), as well as Malebranche (1997: 658).

[27] See Downing (2005: n.51, 263–4).

[28] See Ryle (1957). As Berkeley says in the *Principles*: 'Though indeed we are apt to think that every noun substantive stands for a distinct idea, that may be separated from all others: which hath occasioned infinite mistakes' (PHK 113).

[29] Even the most prominent defender of the reductivist reading, W.H. Newton-Smith, thinks Berkeley at times defends this instrumentalist view; for her part, Downing reads Berkeley as rejecting reductivism and embracing instrumentalism, though she thinks Berkeley's instrumentalism is limited in various ways in *Siris*; see her (1995).

[30] Downing (2005: 251).

[31] I am grateful to an anonymous referee for pointing this out.

[32] Note that I am not saying that God understands force and gravity even though we do not. There is nothing there to understand. To suppose that there is, is to suppose that these words must function as referring terms in order to have any significance. And as the next section shows (3.1), Berkeley rejects that assumption.

3.1. Meaning and truth in Alciphron

Alciphron is in large part an exercise in Christian apologetics.[33] Berkeley's goal is to vindicate the use of terms such as 'grace' in light of the fact that they cannot be paired with any single idea. What we might call his 'companions in virtue' strategy points to other areas of discourse that are acceptable to his opponent even though they, too, fail to match up neatly with ideas. Berkeley's spokesman, Euphranor, adduces the corollary to Newton's second law, which we encountered in *De Motu*:

> [T]here are very evident propositions or theorems relating to 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. (ALC 7.7: 128–9; my emphasis)[34]

Berkeley goes on to make the parallel with grace explicit. Given that we are ready to countenance the conjunct force propositions even when we have no idea of force,

> Ought we not, therefore, by a parity of reason, to conclude there may be divers *true and useful propositions* concerning the one as well as the other? (ALC 7.7: 129, my emphasis)

Note that Berkeley conjoins, and does not identify, 'true' and 'useful.' The propositions involving force are supposed to be useful because they are true; they are not 'true' merely by virtue of being useful.

What can the truth of a mathematical formula consist in? All sciences, Berkeley tells us, are 'immediately conversant about signs as their immediate object, though these in the application are referred to things' (ALC 7.13: 138). The general theorems of natural philosophy are expressed with the help of numbers to profit from the generality of arithmetic. Still, 'the signs, indeed, do in their use imply relations or proportions of things: but these relations are not abstract ideas' (ALC 7.12: 138). Here we have another reason why the theorems of physics fail the Lockean criterion: there can be no ideas, only notions, of relations.[35] The lack of ideas no more deprives such theorems of descriptive content and truth than does the lack of ideas in a proposition describing any relation at all: 'that London is North of the Equator' is senseful and true, for all that.

4. God's best system

I have been arguing that throughout his career, Berkeley embraces a single concept of a law of nature, namely, a rule God follows in producing events. *Pace* the instrumentalist reading, law statements have sense and can be true or false. Two key features also distinguish this view from Humeanism. First, the truthmaker of a Berkeleyan law statement is not a regularity. This is just as well, since, as Marc Lange points out, 'many a claim we believe to describe no regularity at all, nomological or accidental, we nevertheless accept as a law-statement.'[36] Moreover, law statements need to be evaluated and deployed as a group, not one-by-one. The law of gravity on its own, Berkeley points out, tells us nothing about electrical charge; if we were to use the law of gravity to generate a set of predictions about highly charged bodies, we would get the wrong results (S 230–4). None of this means that the inverse square law is not a rule that God follows. It just means that God is following other rules besides.[37]

It is illuminating, I think, to come at this second issue from the opposite direction. So far, I have approached these matters from what we might call the user end: inferring from phenomena to the rules God follows and back down to the phenomena. Suppose we begin instead from the designer side, with God's own intentions prior to producing anything in the world of sense. Imagine that God sets out to produce effects that are consistent with his benevolence and overall design plan. Being perfect, he acts in the simplest ways consistent with achieving his goals. Perfection also ensures that God's operations are uniform and consistent (miracles aside). God then formulates a set of rules he will follow: axioms that allow him to deduce, from any given set of initial conditions, what must follow. For Berkeley, laws are the axioms of God's system: they are the maximally general rules God observes in causing events.

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[33] As others have noted; see, e.g., Jonathan Bennett (1971: 55).

[34] This is an odd sentence, from a grammatical point of view; and yet every edition I've examined includes it.

[35] See PHK 89.

[36] Lange (1993: 233).

[37] Berkeley thus pre-figures Stathis Psillos's 'web of laws' maneuver; see Psillos (2002: 148 f.) Since Psillos is still construing laws as generalizations that capture regularities, I confess I'm not sure how he can consistently hold that the laws individually do not capture regularities.

Before going forward, it makes sense to pause and consider the virtues of Berkeley's theistic position, shelving for the moment the whole question of God's existence. A persistent set of worries afflicting the Best System Account focuses on whether there will end up being just one privileged set of laws. One such worry is the problem of immanent comparisons: how can we calibrate competing deductive systems, in order to decide which wins the simplicity/strength contest? Without some means of quantifying these virtues, and evaluating the inevitable trade-offs between them, we are in danger of ending up with multiple, equally good candidates for 'the laws of nature.'[38] A closely related problem is that simplicity and strength are relative to the language in which the systems are formulated. The choice of simple predicates will affect which theorems are simple: as Barry Loewer points out, if a language takes 'grue' as simple and 'green' not, it 'will count "All emeralds are green" as more complex than will a language that contains "green" as a simple predicate.'[39]

There is an obvious advantage to making the laws the axioms of God's system: there is a perfectly objective fact about which system is the right one. It is whichever one God actually uses. Now, this solution to the problem of immanent comparisons still leaves us with the epistemic problem of deciding among actual competing deductive systems. But Berkeley seems to think that we know enough about God's nature and purposes to break any potential ties. Whether this is right or not is in part a theological question.

Nor is Berkeley without resources with regard to the choice of simple predicates. Consider David Lewis's own solution: he imposes a further requirement on the best system, namely that it trade only in 'natural' predicates.[40] Just what makes a predicate natural is, of course, a vexed question. But Berkeley's theological view can point to God's nature and intentions: it is his will that fixes the preferred language.

We now come to perhaps the most influential argument against there being any laws at all: Nancy Cartwright's dilemma. The inverse square law, in its unqualified form, is simply false: there are cases where other laws, such as laws governing electrical charge, operate. To save the 'facticity' of the law, we have to introduce a *ceteris paribus* clause: *if* no other forces are operating, bodies will behave as the inverse square law dictates. But we have then saved facticity at the price of utility: there are few or no cases where gravity is the only force operating.[41] The dilemma is plain: either surrender facticity or embrace vacuity.[42]

The first step in resolving the dilemma is to see that facticity is not quite the same problem for the Berkeleyan as it is for the Best System Account. The Humean needs true statements of exceptionless regularities to serve as laws.[43] But that is not what the facticity of laws consists in, on Berkeley's view. As we've seen, the inverse square law can be true even when there are no regularities to underwrite it; its truthmaker is not of this world.

The dilemma then takes a new form: how can the inverse square law serve as a rule for the deduction of phenomena, if there are no cases in which it operates on its own? We seemingly have to choose between having a rule with no predictive power or having a rule so complex it is useless.

But the answer Berkeley would favor is among those Cartwright herself considers: vector addition. Why not just say that what happens in any given case is a result of the composition of forces? If we have a case where both gravity and electricity are relevant, we can say that each force obeys its own laws. The forces then add vectorially.

The problem is that neither component force is really there. It is not as if the gravitational force is produced as normal, as is the electrical force, and the two really fight it out to see who wins and to what degree. The only real force, Cartwright argues, is the resultant force. The component forces, she writes, 'are not there, in any but a metaphorical sense, to be added.'[44]

And with this issue, we return to *De Motu*. Berkeley doesn't believe, any more than Cartwright does, that the component forces are there on the scene. But he has discovered a way to preserve the laws, and the procedure of vector addition, without reifying the forces those laws mention. Humeans are not entitled to

[38] See Cohen and Callender (2009: 5–8); as Backmann and Reutlinger (2014: 376–7) note, other philosophers have seen the problem as well, e.g., Lewis (1983), Bas van Fraassen (1980), and Loewer (1996 and 2007).

[39] Loewer (1996: 109), quoted in Backmann and Reutlinger (2014: 377).

[40] See Lewis (1983: 42).

[41] See Cartwright (1980), reprinted in Carroll (2004: 74), as well as Cartwright (1983). There is a closely related dilemma posed by Hempel (1988) and Lange (1993).

[42] Backmann and Reutlinger (2014) provide a thorough catalog of attempts to deal with the problem of *ceteris paribus* laws within the context of the Best System Account. I find their critiques of Cohen and Callender's 'better best systems' account (2009) and Marcus Schrenk's (2007) proposed solution, among others, persuasive, and will not rehearse them here. Schrenk's (2007) and (2014) contain very useful discussions of the range of possible analyses of *ceteris paribus* clauses on offer.

[43] Backmann and Reutlinger (2014: 386) similarly argue that the Humean account cannot avail itself of Braddon-Mitchell's (2001) 'lossy laws' proposal, since on his views the laws do not state regularities and turn out false if so construed.

[44] Cartwright (1980) in Carroll (2004: 75).

this response, since they must identify each law with a set of exceptionless regularities. What Berkeley sees is that no *one* law entails or summarizes a regularity; no one law can ever be expected to give the right prediction or explanation. It is only taken singly that laws require a *ceteris paribus* modifier, and only so taken do they seem in danger of vacuity.

5. A Berkeleyan Best System without God?

All of this, one might well say, is fanciful. And I would fully agree. Berkeley's story depends on the existence of a divine being, and even theists should be suspicious of deploying God on this particular battlefield. But what do we lose in giving up this invisible means of support? True, the contemporary Berkeleyan account can offer no guarantee that there will be a single, unique Best System at the ideal end of all inquiry. As Lewis himself argues, we can only hope that nature will be 'kind' to us; we lose nothing by giving up our claim to know for certain that she will be.[45] Nor is there any divine guarantee of a single preferred set of natural predicates: the best one can do is defer to the sciences, and invite them to tell us what predicates they need.[46]

The two central points we've focused on—that laws do not explain or predict anything on their own, but only as a web; that laws do not summarize regularities—are entirely detachable from Berkeley's theistic context. They are what set my proposed Berkeleyan Best System Account from its Lewisian cousin. And they bear fruit that will not grow from the Humean tree.[47]

Without God in the picture, we will have given up Berkeley's preferred truthmaker for law-statements. Suppose all we have is the mosaic of particulars, and we are at the ideal end of science, when all the returns are in. The axioms of our best system will not state regularities, but that is because no law on its own is enough to explain or predict any developments in the mosaic. Taken on its own, as a claim of the form 'All F's are G's,' any law will turn out to be false. But, again, that is because so taking the law is perverse. BBS-laws need no *ceteris paribus* qualifiers because they are implicitly 'web'-qualified: they function only in tandem.

So the unit of evaluation is the entire system of laws, that is, the whole set of axioms. Anyone persuaded of the Quine/Duhem thesis—that theories must meet the tribunal of experience as a whole, and not piecemeal—will happily follow the Berkeleyan that far. But now we face a further question: what would the truth of such a system consist in, if not correspondence with mythical divine intentions?

Suppose our best system is such that its axioms, together with whatever set of conditions one puts in and counts as 'initial,' is sufficient to predict every relevant part of the mosaic (that is, every part that occupies a time after whatever one is counting as the initial conditions.) Input all the conditions at t, and our best system predicts the ambient temperature of Battambang at $t + n$. And suppose that the system works symmetrically: you can run the axioms on the conditions at t, and figure out conditions at $t - n$. Now, the Berkeleyan proposal is to think of the axioms of the system not as regularity statements but as rules or algorithms. Rules are not the kinds of things that can be true or false; but that doesn't mean there is no way to evaluate them other than on pragmatic grounds. When these rules issue in predictions, we have a straightforward way of evaluating them: are the predictions correct?

Imagine a set of algorithms that enabled the accurate prediction of hurricanes. How could one answer the question, 'are the algorithms true?' but by looking to see whether their predictions are correct or not? And having found them to be correct, what extra element could the algorithms be missing, such that its addition would make them true in some other sense, or 'more' true in this one? If the revised Berkeleyan view counts as instrumentalism, it is of a very anodyne sort.

Let me come at this point from another direction. Some proponents of truthmaker theory appeal to a slogan: 'truth supervenes on reality.' As John Bigelow puts it, '[i]f something is true then it would not be possible for it to be false unless either certain things were to exist which don't, or else certain things had

[45] If there really are, in the end, incompatible systems running 'neck and neck' in the competition for best, Lewis would 'blame the trouble on unkind nature, not on the analysis [of laws]' Lewis (1994: 479).

[46] Here I mean to endorse a version of Barry Loewer's (2007) 'package deal account,' which still strikes me as the best way of dealing with the problem of natural properties.

[47] An anonymous referee made a very interesting suggestion: perhaps the original (as opposed to Lewisian) Hume can tell a similar story. Although Hume never defines a 'law of nature,' he does speak of 'general causes' such as gravity and elasticity (Part 1 of *Enquiry* §4 in Hume 1748/2007: 112). The referee suggests that Hume might think there's one 'super-regularity,' such that the particular laws are abstractions from it. I suspect this suggestion merits a paper of its own. For now, I would only point out that Hume seems to require that statements about 'general causes' be literally true statements of regularities: if they are to be causes at all, they must meet at least one of his two definitions of cause (*Enquiry* §7 in Hume 1748/2007: 146), both of which require constant conjunction. If laws-as-abstractions are just incomplete statements of the one regularity, then they can indeed turn out to be literally true. But in that case, Hume faces all the problems of *ceteris paribus* laws: there are just too few regularities to go around. Nor does this version of the proposal capture Berkeley's 'web of laws' approach. Alternatively, the proposal might be that laws-as-abstractions need not be true. But then I don't think they count as statements of general causes for Hume, which are just regularities.

not existed which do.'[48] The axioms of the best system, construed as Berkeleyan rules, have just this kind of responsiveness to the mosaic: if any tile of the mosaic were removed, such that the system generates a false prediction, then the system would no longer count as the 'best.' Now, there is no way to make sense of the rules' corresponding to some state of affairs; but that standard seems inappropriate, since rules are not the right kind of thing to correspond (or not) to the world, except in the sense I've just specified.

I do not pretend to have given, much less defended, the full-dress incarnation of a contemporary Berkeleyan account of laws; I have at most advertised a research program I hope will attract others. Nor do I claim that the Berkeleyan view is right. I do hope to have established that Berkeley's two central claims—that laws function only as a group, and that laws do not state regularities—make for a view superior to the Humean position. And both maneuvers are available within the austere confines of the Humean's ontology. Such a view is not Berkeley's, for it has no need of the supernatural. For that reason, it is best to accord it a suffix. Given its virtues, I think the Berkeley*an* Best System Account should be admitted to the list of combatants on the field of laws of nature.[49]

Competing Interests

The author has no competing interests to declare.

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[48] Bigelow (1988: 133).

[49] I am indebted to Stathis Psillos, Antonia LoLordo, and Manuel Fasko for helpful comments. I would like to thank two anonymous referees for their penetrating criticisms and Aaron Garrett for his patience. A related paper was presented at the '*Causa sive ratio*' conference in Milan, Italy, November 2017; I thank the organizer, Tzuchien Tho, as well as the participants, particularly Katherine Brading, Ansgar Lyssy, Jeff McDonough, and Andrew Platt, for their help.

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How to cite this article: Ott, Walter 2019 Berkeley's Best System: An Alternative Approach to Laws of Nature. *Journal of Modern Philosophy,* 1(1): 4, pp. 1–13. DOI: https://doi.org/10.32881/jomp.10

Submitted: 14 September 2018 **Accepted:** 23 February 2019 **Published:** 02 May 2019

Journal of Modern Philosophy is a peer-reviewed open access journal published by Virginia University Press.

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