No Free Lunch

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Some philosophers (see (Armstrong, 1997), (Cameron, 2008), (Melia, 2005), and (Schaffer, 2007, 2009, 2010a)) have recently suggested that explanations of a certain sort can mitigate our ontological commitments. The explanations in question, *grounding explanations*, are those that tell us what it is in virtue of which an entity exists and has the features it does. These philosophers claim that the existence and qualitative properties (call these *features*) of some entities can be given a grounding explanation solely by reference to the existence and properties of other things.[1] Call an entity *derivative* iff its existence and other features can all be explained solely by reference to the existence and properties of other things. These philosophers argue that derivative entities are "no addition to being," in the sense that an ontology is no less sparse for containing them than it is for containing the entities which ground them; derivative entities are an "ontological free lunch."[2]

Grounding explanations are exemplified by certain familiar scientific explanations, and are often marked by the locution "in virtue of". (In what follows, my use of "explain," "because," and cognate notions is artificially restricted to this kind of explanation.) A given isotope of gold has a certain atomic mass in virtue of containing a certain number of protons and neutrons. Ethanol is miscible in water in virtue of containing a hydroxide group. Diamond is hard because each carbon atom in its crystalline structure is bonded to each of its neighbors.

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[1]Here and generally throughout I use "properties" to stand in for both properties and relations.

[2]One striking feature of these authors' views that is not represented my exposition is that they have been developed in the pursuit of Armstrong-style truthmaker metaphysics. Here I assume that truth-making incurs an explanatory commitment, following, *e.g.*, (Cameron, 2010, p. 257) and (Schnieder, 2006). I also put the view in the material mode, as a view about what explains certain facts, rather than a view about what makes certain truths concerning those facts true. In this I follow (Lewis, 2001).

Theorists who claim that grounding explanations provide an "ontological free lunch" have concentrated their efforts on defending a novel view of ontological commitment. They argue that we should reject a familiar version of Ockham's Razor

> Do not multiply entities beyond necessity!

in favor of a less familiar variant

> Do not multiply fundamental entities beyond necessity![3]

where an entity is *fundamental* iff it is not derivative: either its existence or one of its other features is explanatorily basic. If they are right, then grounding explanations are not (or not just) causal: the availability of a complete causal explanation of an explosion in terms of causal laws, initial conditions, and the ignition of a fuse does not show that the explosion is "no addition to being," given the laws, conditions, and ignition.

The dispute over the proper application of Ockham's Razor has interest only if the fundamental entities are a subclass of all of the entities. If every entity is fundamental, then the application of the familiar version of Ockham's Razor yields the same results as the application of its restriction to the fundamental. As one might expect, the theorists in question claim that the fundamental entities are an elite class.[4]

Here I argue that they are wrong: barring reduction, every entity is fundamental, in the sense that either its existence or its possession of at least one other feature is explanatorily basic. Thus, the claim

(EXPLANATION) Many entities are derivative: their existence and other features can be explained solely by reference to the existence and properties of other things.

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[3]See esp. (Schaffer, 2009, p. 361), from which the formulation in the text is adapted. Schaffer's view differs from Cameron's (2008). Cameron argues that the ontological commitments of a theory are given by an inventory of fundamental entities; Schaffer, that ontological commitments are given by an inventory of the existent entities, but that only commitments to fundamental entities count when applying Ockham's Razor. See (Schaffer, 2008) for a defense of Schaffer's side of the dispute. Though the exposition in the main text fits Schaffer's view better than Cameron's, this dispute about the proper characterization of the technical notion of an *ontological commitment* is irrelevant for present purposes. Schaffer and Cameron agree that (*i*) existence claims concerning derivative entities are an "ontological free lunch," and (*ii*) the class of derivative entities is large and diverse.

[4]Schaffer (2010a), for instance, argues that every concrete entity other than the entirety of the concrete cosmos is derivative. Another example is Armstrong's (1997) contention that that most universals are derivative. Melia (2005) goes further, outlining a defense of the idea that all universals are derivative.

should be rejected. An upshot is that, whatever form Ockham's Razor should take, grounding explanations on their own do not provide an "ontological free lunch."[5]

Here's the plan. §1 sets out and defends the premises of the argument against (EXPLANATION). The argument itself is outlined in §2, and its import clarified in §3. §§4-5 discuss responses that might be made to the argument. I close with some remarks on the significance of the result in §6.

1 Determination, Diversity, Irreducibility

Consideration of a standard way proposals for grounding explanations may fail motivates a constraint on this sort of explanation: the explanation of the existence and other features of a given entity must trace how those facts are determined. A complete explanation of a derivative entity d's having a certain feature F in terms of facts $g_1, g_2, \ldots$ should show why d had to be F, given $g_1, g_2, \ldots$. The *explanans* thereby provides means for distinguishing d from entities which are not F, and thus showing why d, unlike those other things, is F. There's something wrong with or missing from a proposed explanation if there is something just like d so far as the *explanans* goes, but which lacks F. Call any entity which lacks F but is just like d so far as the *explanans* goes, a *confounding case* for the proposed explanation. For instance, a confounding case for the explanatory claim

(1) This diamond is hard because it has such-and-such crystalline structure

would be an entity which has the crystalline structure in question, but is not hard.

An explanatory proposal is *at best incomplete* if there is a confounding case for it: the proposal is either off on the wrong foot entirely, or requires supple-

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[5]Schaffer (Schaffer, 2010b, 2009) has suggested that the basic idea for priority theorists is not explanation but *grounding*. We explain facts by reference to other facts, but, by Schaffer's lights, grounding may obtain between items of any category, including objects, facts, and properties. Schaffer, however, agrees that grounding requires explanation: the existence and other features of the entities that ground an entity completely explain its existence and other non-relational features (private correspondence). See, for instance, the claim at (Schaffer, 2009, pp. 364-5) that grounding "... is the notion the physicalist needs to explicate such plausible claims as 'the fundamental properties and facts are physical and everything else obtains *in virtue of* them' (Loewer, 2001, p. 39))" [citation and emphasis in original]. (Cameron, 2010, p. 257) also endorses this link between grounding and explanation. The argument in this paper against (EXPLANATION) thus applies to views which rely on grounding rather than explanation to distinguish fundamental and derivative entities.

mentation. "At best incomplete" is awkward to negate. So, for reasons of style I'll call an explanation *good* if it is not at best incomplete; good explanations are not off on the wrong foot entirely, and do not require supplementation. Note that explanations that are "good" in this sense may fail to qualify as what we would ordinarily call "a good explanation": they may be complicated, long-winded, unenlightening, difficult to understand, *etc.*

Here is an intuitive way of appreciating the point that confounding cases indicate that an explanatory proposal is at best incomplete. A standard strategy for criticizing a proposed explanation of the form "x is F in virtue of being G" is to identify a confounding case: another object that's G but not F. Thus

(2) x is a stable nucleus in virtue of being an oxygen nucleus

is a transparently inadequate explanation, given the existence of short-lived radioactive oxygen isotopes. Even the mere possibility of a confounding case shows that a proposed explanation is at best incomplete. Suppose now that there happen not to be any short-lived radioactive oxygen isotopes, but it is possible to make some in a certain kind of research reactor. The proposed explanation is still at best incomplete. Explanatory proposals are thus subject to what I will call the *determination constraint*:

(Determination Constraint) An explanatory proposal of the form, "d has feature F because $\phi(d, x_1, \ldots, x_n)$" is at best incomplete if there is or might have been a confounding case for it: an entity e and some entities $a_1, \ldots, a_n$ such that e (together with $a_1, \ldots, a_n$) satisfies $\phi(y, x_1, \ldots, x_n)$ but lacks F.[6]

(EXPLANATION) requires that there be many derivative entities. Suppose that d is one of them, and that F is one of d's features. The argument against (EXPLANATION) will also use two further assumptions. The first is:

(DERIVATIVE DIVERSITY) There is a derivative entity e that lacks F.

(DERIVATIVE DIVERSITY) is innocuous: it's a natural concomitant of any view which proposes to use (EXPLANATION) to mitigate its ontological commitments. Without (DERIVATIVE DIVERSITY), such a view has a severely

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[6]Two technical notes. First, here and throughout, I am sloppy about use and mention whenever it is convenient and does not materially affect the argument. Second, I am not assuming that any formula of the form $\phi(d, x_1, \ldots, x_n)$ contains d (or, for that matter, any of the x's).

limited scope: it can only claim an "ontological free lunch" with respect to a class of qualitatively indiscernible entities.

The second assumption is:

(IRREDUCIBILITY) d's being F and e's not being F are irreducible.

The explication of the notion of reduction is highly contested. For present purposes I resort to stipulation: what I am calling a *reduction* of one fact to another involves the identification of those facts. No particular epistemological status is indicated, since an identity that undergirds a reduction, like many other identities, may not be *a priori*. A hallmark of reduction is necessary equivalence: if one claim is reducible to another, then, as a matter of necessity, they have the same truth value; and if one fact is reducible to another, then they obtain at all the same possible worlds. By way of contrast, explanation does not require necessary equivalence; a good explanation implies (by the determination constraint) that the *explanans* be modally sufficient for the *explanandum*, but it does not imply the converse. So (IRREDUCIBILITY), on this stipulation, requires that d's being F is distinct from any fact involving only entities other than d (and similarly for the fact that e is not F). Suppose, for instance, that d is a diamond and F is the property *being hard*. Then (IRREDUCIBILITY) implies that the fact that d is hard is distinct from the fact that certain carbon atoms $c_1, c_2, \ldots, c_n$ are bonded together in such-and-such a way.

Assuming (IRREDUCIBILITY) is mostly a matter of methodology. Reductions are a traditionally recognized way to mitigate one's ontological commitments (Quine, 1948). But grounding explanations are weaker than reduction. It is plausible to maintain that the average of my wife's and my heights is 5'6" solely in virtue of the fact that she is 5'4" and I am 5'8". But it is implausible to think that the fact that the average of our heights is 5'6" reduces to our having those particular heights, since it is possible for a different combination of heights to yield the same average. There is a reduction of average height ready to hand, but that should not distract us from the conceptual point: one fact can be explicable in terms of another without being reducible to it. Thus, (IRREDUCIBILITY) leaves open the hypothesis that, even though the diamond d's being hard doesn't reduce to the bonding together of certain carbon atoms, d's hardness is explained by that bonding. What's distinctive about the idea that grounding explanations mitigate our ontological commitments is that they

do so even in the absence of reduction.[7] Assuming (IRREDUCIBILITY) is designed to test this distinctive claim.

2 Against (EXPLANATION)

We are now in a position to state the argument against (EXPLANATION). Here is a quick gloss. On our assumptions, d is derivative, so d's being F ultimately obtains in virtue of facts which *do not involve d at all*. We get some explanation of the form, "d is F because $\phi(t_1, \ldots, t_n)$", where ϕ may mention certain entities and features, but doesn't mention d. That means that e meets exactly the same conditions: it will be equally true of e that (together with $t_1, \ldots, t_n$) it satisfies ϕ. Since e is not F, it presents a confounding case for the proposed explanation. Application of the determination constraint implies that the proposed explanation is at best incomplete.

Some technical notions are required to state the more formal and more general version of the argument. For present purposes, let's think of a fact as a distribution of certain properties and relations over certain entities, which I will term the entities *involved* in the fact. For instance, *being male* is possessed by George Bush; this is a very simple way in which this property is distributed over the individual in question. Likewise, Bush bears *being the husband of* toward his spouse Laura; this is a somewhat less simple way in which this relation is distributed over those two individuals. The latter fact involves both spouses; the former involves only George. An explanatory proposal for the fact that d has some feature F says that this fact obtains in virtue of certain further facts, each of which is to be identified with a distribution of certain properties and relations over certain entities. Thus, a proposal to explain d's having F can be expressed by a claim of the form,

(Prop) d is F because $\phi(d, t_1, \ldots, t_n)$

where all of the entities involved in the *explanans* are denoted by exactly one term among $d, t_1, \ldots, t_n$, and ϕ says how the properties and relations in question are distributed over those entities. When an explanatory proposal is expressed by a claim of this sort, I will say that the claim *perspicuously articulates* the proposal. A perspicuous articulation of an explanatory proposal names names:

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[7](Melia, 2005, p. 76) explicitly draws a contrast between explanation and reduction.

it specifies exactly which entities are involved in the proposed *explanans* and *explanandum*. Thus, the claim, "the diamond d is hard in virtue of the arrangement and bonding of certain carbon atoms" fails to be a perspicuous articulation of any explanatory proposal; on the other hand, if $c_1, \ldots, c_n$ name the carbon atoms in question, then "d is hard in virtue of the arrangement and bonding of $c_1, \ldots, c_n$" is a perspicuous articulation of an explanatory proposal. I will assume that every explanatory proposal that meets the needs of (EXPLANA-TION) has a perspicuous articulation.[8]

As a final bit of stage-setting, let's note a consequence of the determination constraint. The determination constraint implies that good explanations don't have confounding cases. Consider again a perspicuously articulated explanatory proposal of the form

(Prop) d is F because $\phi(d, t_1, \ldots, t_n)$

A confounding case for this explanatory proposal will be a situation in which some object d^*, along with some other objects $a_1, \ldots, a_n$, has the properties required to satisfy the *explanans* clause ϕ, but in which d^* lacks F. Thus, d^*, together with $a_1, \ldots, a_n$, witnesses the truth of

(3) $\quad (\exists y_1, \ldots, y_n)(\exists x)(\phi(x, y_1, \ldots, y_n) \wedge \neg F x).$

So, the determination constraint implies that any perspicuously articulated explanatory proposal of the form (Prop) is associated with a universal generalization

(4) $\quad (\forall y_1, \ldots, y_n)(\forall x)(\phi(x, y_1, \ldots, y_n) \Rightarrow F x).$

According to the determination constraint, if the explanatory proposal is good, then its associated universal generalization is true.

Here, then, is the argument. Assume (EXPLANATION) for *reductio*. Recall our ancillary assumptions: d is a derivative entity, F is one of its features,

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[8]This assumption might be resisted on a variety of grounds. (For instance, it might be held that some facts concerning the existence and other features of derivative entities can be adequately explained only by facts involving infinitely many entities, and that no infinitary perspicuous articulation exists.) If the assumption fails, then the argument of this paper will have to be made at the level of facts. This can be done by representing a fact (in the actual world) by a pair containing the set of entities I it involves and the set of properties and relations P it involves. The fact represented by $\langle I, P \rangle$ is the distribution of the properties and relations in P over the entities in I. These representations can, in effect, play the role of perspicuous articulations of explanatory proposals. This is not the place to work out the details of this alternative approach, so for present purposes I will rely on the assumption.

and d and F satisfy (IRREDUCIBILITY) and (DERIVATIVE DIVERSITY). Since d is derivative, its possession of F has a good explanation perspicuously articulated by a claim of the form,

(5) d is F because $R(t_1, \ldots, t_n)$,

where R stands in for some (possibly very complex) relation, and none of the terms $t_1, \ldots, t_n$ denote d.[9]   But the *explanans* clause $R(t_1, \ldots, t_n)$ is also of the form, $\phi(d, t_1, \ldots, t_n)$ (see the second remark of n.6). So the explanation in question is also of the form

(7) d is F because $\phi(d, t_1, \ldots, t_n)$.

The determination constraint implies that this explanation is good only if its associated universal generalization

(8) $(\forall y_1, \ldots, y_n)(\forall x)(R(y_1, \ldots, y_n) \Rightarrow Fx)$.

is true. Since $R(y_1, \ldots, y_n)$ is x-free, standard quantificational logic yields

(9) $((\exists y_1, \ldots, y_n)R(y_1, \ldots, y_n) \Rightarrow (\forall x)Fx)$.

An explanatory proposal is good only if the *explanans* clause is true. In this case, that requires that $R(t_1, \ldots, t_n)$ be true. But then the antecedent in (9) is satisfied, and so e is also F. (DERIVATIVE DIVERSITY) implies that e is not F. Contradiction.

3   Clarifications

Once this argument is stated, it is not difficult to see what's missing from the proposal to explain d's being F by $R(t_1, \ldots, t_n)$. We need only add explanatorily basic facts which indicate what the t's have to do with d. Suppose, for instance, that d is a diamond, and we are trying to explain its hardness in terms of the arrangement and bonding of certain carbon atoms. Then we could add the claim that d is composed of those carbon atoms; d is hard not just because some

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[9]This is where (IRREDUCIBILITY) comes in. If d's being F is reducible, then, for all we've said, it just comes to the obtaining of some relation S among $t_1, \ldots, t_n$. Then, one might object that (5) misrepresents the form of the explanatory proposal at hand, which is really

(6) $S(t_1, \ldots, t_n)$ because $R(t_1, \ldots, t_n)$.

This explanatory proposal does not succumb to the *reductio*.

carbon atoms are arranged and bonded in such-and-such a way, but because *its* carbon atoms are arranged and bonded in that way. This proposal does not succumb to our argument; it is crucial for the argument that the *explanans* not involve d. If the *explanans* clause mentions d, then the argument is invalid.[10]

But our choice of derivative entities d and e and of feature F was entirely arbitrary. Thus, admitting explanatorily basic facts involving d means giving up on (EXPLANATION) entirely. Our argument shows that there is a gap in any proposal for explaining any derivative entity's features that meets the demands of (EXPLANATION), so long as (DERIVATIVE DIVERSITY) and (IRREDUCIBILITY) are satisfied. But filling this explanatory gap in the most obvious way, by admitting explanatorily basic facts involving d, means giving up (EXPLANATION). The moral of our argument is: *barring reduction, there do not exist two derivative entities x and y that differ on some feature F*.

Our argument might be thought to show too much, on the grounds that it implausibly requires that every fact be explanatorily basic. But the argument allows non-basic facts involving d. For instance, the argument does not show that we must accept that

(10) d is a diamond.

is explanatorily basic. (10) imputes a sortal, "diamond" to our friend d. It is plausible to think that d's diamondhood is explicable in terms of the arrangement of its parts. But the argument does not establish that (10) appears among the explanatorily basic facts. The argument only shows that, among facts involving d, at least one is explanatorily basic; it does not show that any particular fact involving d is explanatorily basic. For this reason, the argument cannot show that there is no metaphysical utility in pursuing the explanation of such facts as (10) in, say, partly microphysical terms. For the same reason, there may even be a reasonable sense in which d might be said to be "less fundamental" than the particles of which it is made: certain features of d are, perhaps, explicable in part by reference to the particles, but not vice versa. In sum, our argument does not provide any reason to doubt that claims like (10) have explanations at all. It only shows that such explanations cannot be used to show that asserting the existence of d is ontologically innocent.

Further, no claim about the epistemological status of the explanatorily basic d-involving facts is required by the argument. For all the argument says, the

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[10]To be precise, the step from the analogue of (8) to the analogue of (9) is blocked.

missing facts might be knowable *a priori*. If so, when explaining d's hardness to a suitably sharp audience, the crucial facts might go without saying. Our argument shows that they still have to be among the explanatorily basic facts, no matter what their epistemological or conversational status. The alleged *a priority* of basic d-involving facts does not buy an ontological free lunch. We cannot evade the argument, then, by suggesting that the needed facts involving d are *a priori*, or have some other epistemological or semantic status that makes them easy to overlook.

4   The Determination Constraint Reconsidered

The best response to the argument is to deny the determination constraint.[11] Is rejecting the determination constraint plausible? It might be argued that it sets too stringent a standard. But note that lots of plausible explanatory proposals satisfy the determination constraint. For instance, the explanation

(11) A and B's heights average 5'6" because A is 5'4" and B is 5'8"

passes easily. Any possible pair of individuals who have A's and B's respective heights will also share their average height. So the determination constraint does not set a standard that couldn't be met in principle.

The determination constraint is motivated by general reflections on what a complete explanation must provide. The idea that animates the determination constraint is that a complete explanation of an entity x's having some feature F must show why that entity, unlike, say, some non-F entity y, is F. It must therefore mention what distinguishes x from y in respect of F-ness; more colloquially, together with the explanation for y's lacking F, it must provide the means for saying what *makes them different* in this respect.

The determination constraint is also motivated as a generalization from cases. Consider again the explanatory proposal, concerning a particular oxygen nucleus x,

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[11]Denying the determination constraint would not require us to abandon the claim that there is some sense in which the explanatorily basic facts fix everything else; there are lots of supervenience relations in the literature which would cause no trouble. For instance, we could still affirm *coincidents-friendly* supervenience (see (Zimmerman, 1995, p. 88) and (Rea, 1997)), or weaker forms of global supervenience, including *weak* (see (Stalnaker, 1996, p. 227), (McLaughlin, 1997, p. 214), and (Sider, 1999, p. 915)) and *intermediate* global supervenience (see (Bennett, 2004a, p. 503)).

(2) x is a stable nucleus in virtue of being an oxygen nucleus.

This proposal is transparently inadequate, given that there are radioactive oxygen nuclei. The proposal does not suffice to explain why this nucleus, unlike those radioactive nuclei, is stable; it doesn't tell us what makes this nucleus different from them with respect to radioactivity. It's inadequacy is a direct result, then, of its failure to meet the determination constraint.

This is no isolated phenomenon. Read any substantial swath of philosophy, and you will encounter explanatory proposals of the form

(Exp) x is F because $\phi(x)$.

You will also encounter arguments against such proposals of the form:

y is not F, but y is such that $\phi(y)$

(Exp) is at best incomplete.

The determination constraint says, in effect, that these arguments are valid. Consider a crude example. A utilitarian ethicist might propose that certain courses of action, like giving a substantial proportion of your income to OXFAM, are obligatory in virtue of the fact that they maximize utility. Others have objected that there are confounding cases for this explanatory proposal: courses of action, like framing and punishing an innocent person to stop a crime wave, that maximize utility but are not obligatory.[12] The utilitarian may dispute the premise, arguing, for instance, that framing the innocent in such circumstances is obligatory. The utilitarian may amend the original explanatory proposal, arguing, for instance, that giving to OXFAM is obligatory in virtue of being enjoined by a rule the adoption of which maximizes utility.[13] The utilitarian may *not* blithely accept the premise and stick with her explanatory proposal. The argument is valid, just as the determination constraint requires.

To take a less crude example, consider the state of the debate over material constitution. In the standard test case, a lump of clay Lumpl and a statue Goliath are coincident throughout the entirety of their careers. They are made of the same particles, subject to the same physical pushes and pulls, *etc. Pluralists* about material constitution hold that Lumpl and Goliath are nevertheless distinct, typically on the grounds that they differ in their sortal and modal properties. For instance, a pluralist typically argues that Lumpl differs from Goliath

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[12]See (Carritt, 1950).
[13]See the discussion in (Smart, 1973).

in that Lumpl, unlike Goliath, can survive being squashed. A common objection[14] to pluralism is that the pluralist cannot explain the sortal and modal differences he alleges between Lumpl and Goliath. This argument, called *the grounding problem*, uses an instance of the determination constraint. The idea is that Lumpl and Goliath are indiscernible with respect to all of the salient *explanans*. Lumpl, like Goliath, is composed of certain particles, in certain arrangements, and bearing certain causal and spatiotemporal relations to other things. Thus, on the pluralist's view, any perspicuously articulated explanatory proposal of the form

(12) Goliath cannot survive squashing because it is composed of particles
$p_1, \ldots, p_n$ in such-and-such arrangement

will find a confounding case presented by Lumpl, which can survive squashing. This is a reason, as the determination constraint says, to think that any such explanation is at best incomplete.[15]

Faced with this problem, pluralists either supplement the explanatory proposal (see, for instance, (Fine, 2008)), suggest that the salient sortal and modal features of Lumpl and Goliath are fundamental (see, for instance, (Bennett, 2004b)), or deny that Lumpl and Goliath are discernible in the relevant ways (see (Sider, 2008)). But if the determination constraint is rejected, they needn't bother: they can just blithely accept that the *explanans* clause fits Lumpl as well as Goliath, even though Lumpl lacks the modal and sortal features in question. This response is evidently unreasonable. The determination constraint should not be rejected.

Perhaps, however, there is an alternative constraint on good explanations that captures the inadequacies of the explanations we have been discussing, but cannot be used to establish the failure of (EXPLANATION). Consider once again the transparently inadequate explanatory proposal

(2) x is a stable nucleus in virtue of being an oxygen nucleus.

I have diagnosed the failure of this explanatory proposal as a failure to meet the determination constraint. But it might be suggested that a better diagno-

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[14]In fact, Wasserman (2002) dubs it "the standard objection."

[15]Thus, (Fine, 2008, p. 107):

> For if I use the fact that a given object ϕ's, for example, to explain why it has the modal profile that it does, then I had better be sure that a coincident object with a different modal profile does not also satisfy ϕ.

sis appeals instead to a failure of entailment: The suggested diagnosis of the inadequacy of (2) is that its *explanans* does not entail its *explanandum*.[16] The idea is that the explanation fails on the grounds that it is possible that x be an oxygen nucleus that's unstable, and so the fact that x is an oxygen nucleus does not entail that x is stable. In general, the suggestion is that explanatory proposals are subject to what I will call the *entailment constraint*:

(Entailment Constraint) An explanatory proposal of the form, "d has feature F because $\phi(d, x_1, \ldots, x_n)$" is at best incomplete if it is possible that $(\phi(d, x_1, \ldots, x_n) \wedge \neg Fd)$.

Notice that the entailment constraint is strictly weaker that the determination constraint. If the possibility that *something or other* is a confounding case suffices for the inadequacy of a proposal to explain some feature of d, then the possibility that d *itself* is a confounding case will also suffice. But an explanatory proposal can meet the entailment constraint without meeting the determination constraint. Consider, yet another proposal to explain the fact that diamond d is hard:

(13) d is hard because $R(p_1, p_2, \ldots)$

where $R(p_1, p_2, \ldots)$ exhaustively specifies the arrangement and other physical features of the totality of fundamental particles in the universe. Nothing in the argument of §2 rules out the idea that $R(p_1, p_2, \ldots)$ entails all of the facts, including the fact that d is hard. So, nothing in that argument tells against the contention that (13) passes the entailment constraint. But the argument did establish that (13) failed the determination constraint. Since it is so weak, the entailment constraint cannot be used to show the falsity of (EXPLANATION).

But the entailment constraint is also too weak to cover the cases plausibly diagnosed by the determination constraint. It is plausible to think that the entailment constraint explains why (2) is not a good explanation only if it is also plausible to think that x's stability is merely contingent: if x is necessarily stable (if it exists), then it is impossible for x to be radioactive, and so also impossible for x to be radioactive and an oxygen nucleus. Truth be told, I suspect that any oxygen nucleus that is in fact stable is necessarily so, though,

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[16]The sense of entailment in question is strict modal entailment: P entails Q in this sense iff $\Box(P \Rightarrow Q)$. Thanks to Chad Carmichael and an anonymous referee for emphasizing the need to discuss this suggestion.

of course, the idiosyncrasies of my modal opinions are no sound basis for the determination constraint. Still, it is easy to come up with explanatory proposals with the same kind of inadequacy as (2) which pass the entailment constraint. Even skeptics about the necessary stability of x may accept the necessity of x's being an oxygen nucleus. If so, then

(14) x is an oxygen nucleus in virtue of the fact that x contains at least two protons

will pass the entailment constraint. Still, given the existence of, *e.g.*, lithium nuclei, this explanatory proposal is obviously inadequate. Similarly, notice that the entailment constraint won't help us pose the grounding problem for the pluralist. Consider again the explanatory proposal

(12) Goliath cannot survive squashing because it is composed of particles $p_1, \ldots, p_n$ in such-and-such arrangement.

The feature of Goliath whose explanation is in question is typically taken to be a feature that Goliath had to have. Being unable to survive squashing is no merely contingent feature of Goliath; Goliath not only cannot survive squashing, it necessarily cannot survive squashing. If this plausible view is correct, the entailment constraint will not correctly diagnose the inadequacy of this explanatory proposal.

In general, explanatory proposals that are, intuitively, at best incomplete but meet the entailment constraint can be generated using this recipe:

1. Find a case in which some necessary feature F of an individual x is plausibly explained by facts $G_1 x, G_2 x, \ldots$.

2. Make sure the case is also one in which there might have been some individual y which has G_1 but lacks F and any of the other G's.

3. The explanatory proposal that meets the entailment constraint by is at best incomplete will, then, be:

    (15) x is F in virtue of the fact that it is G_1.

Here's one last example, derived using this recipe. Consider the paperweight sitting on the desk in front of me. This paperweight has, as a matter of necessity, both a rest mass and a location. Now consider the explanatory proposal

(16) This paperweight has both a rest mass and a location in virtue of having a location.

This proposal is obviously at best incomplete, since the paperweight's rest mass is not accounted for at all. The determination constraint says why, given the possible existence, *e.g.*, of particles that have locations, but no rest mass (as photons actually do, according to some physical theories). The entailment constraint will not deliver this result, because the paperweight's necessary features are trivially entailed by any feature that suffices for its existence. By virtue of its weakness, the entailment constraint is not an acceptable replacement for the determination constraint.

In summary, abandoning the determination constraint presents two challenges. First, we must state a plausible alternative constraint on adequate explanation with two features: (*i*) like the determination constraint, it correctly diagnoses the inadequacy of the explanatory proposals discussed in this section; but (*ii*) unlike the determination constraint, it cannot be used to establish the failure of (EXPLANATION). Second, we must deny the plausible view that the complete grounds for one entity's being F, together with the complete grounds for another entity's lacking F, provides the means for saying what makes these two particular entities different in this particular way.

5   Explaining Existence

I have, from the very beginning, been calling an entity *derivative* iff neither its existence nor any of its other features is explanatorily basic. The argument so far has been carried out in terms of this notion of derivativeness. An objector might contend that this notion of derivativeness is not the notion relevant to the application of Ockham's Razor in ontology. The relevant notion of "derivative" is weaker: where the notion I have been working with requires that both the existence *and other features* of a derivative entity be explicable in other terms, the objector's notion requires only that its existence be so explicable. To avoid terminological confusion, I will keep using *derivative* (and *fundamental*) as I have been, and call an entity *existentially derivative* iff its existence can be completely explained solely by reference to the existence and properties of other things. Call an entity *existentially fundamental* iff it is not existentially derivative. The objector may then contend that we should reject (EXPLANATION)

in favor of

(EXPLANATION)$_\exists$ Many entities are *existentially* derivative: their existence can be explained solely by reference to the existence and properties of other things.

Further, existentially derivative entities are an "ontological free lunch," so we should endorse an even weaker form of Ockham's Razor

Do not multiply existentially fundamental entities beyond necessity!

When this objection is stated in this raw, unvarnished way, it might appear *ad hoc*. But this appearance can be dispelled by attending to a particular case. Consider a group of marbles g, whose constituents are exactly the marbles $m_1, \ldots, m_n$. It is plausible to think that

(17) g exists because $m_1, \ldots, m_n$ are marbles grouped together

is a good explanation. Nothing more, it might seem, is required for g to exist than for its constituents to be grouped together.[17] But, if this explanation is good, then g is existentially derivative. The objector is suggesting that there is a large and diverse array of entities that are like g in this respect, and that commitment to them is "no addition to being", given commitment to the existentially fundamental entities.

Let's turn our attention to (EXPLANATION)$_\exists$. Is it true? There are two ways of defending (EXPLANATION)$_\exists$ against the sort of argument I have given against (EXPLANATION). The first defense is to notice that, as it stands, the argument of §2 does not generalize to show that (EXPLANATION)$_\exists$ fails. Consider again

(17) g exists because $m_1, \ldots, m_n$ are marbles grouped together.

Notice that no analogue of (DERIVATIVE DIVERSITY) for this sort of explanation is true: there is no entity e that lacks existence. For the same reason, there is no (actual) confounding case for this explanatory proposal. There is nothing that does not exist, and so *a fortiori* nothing that is just like g so far as the arrangement of $m_1, \ldots, m_n$ goes, but lacking existence. In the case of explanations of existence, the argument of §2 gets no purchase.

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[17]This particular case is due to Mark Moyer, but a similar case has been suggested independently by Fabrice Correia and Benjamin Schnieder. Thanks to Correia, Moyer, and Schnieder for suggesting the line of response explored in this section.

It turns out that a variant of the old argument can be mounted against (EXPLANATION)$_\exists$. The new argument relies on two new assumptions. The first new assumption is that the explanation of the existence of an existentially derivative entity like g should also provide fodder for the explanation of the *actual* existence of g. Consider again the proposed explanation of g's existence in terms of the grouping of $m_1, \ldots, m_n$. This explanatory proposal can be perspicuously articulated by a claim of the form

(18) g exists because $R(m_1, \ldots, m_n)$

This explanation concerns the existence of g in the actual world. We can therefore generate an explanation for the actual existence of g from the fact that it is actually the case that $R(m_1, \ldots, m_n)$. In brief, if the explanatory proposal (18) is good, then so is

(19) g *actually* exists because *actually* $R(m_1, \ldots, m_n)$

Call this assumption *actualization*.

The second new assumption constrains the range of candidates for explaining g's existence. Let g, e, *etc.*, exhaust the actual existent entities. The second assumption, which I'll call *permissiveness*, is that the facts (if any) that explain g's existence do not entail that the only entities are g, e, *etc.*[18]   The assumption of permissiveness implies that no explanation for g's existence rules out a world in which all facts in the *explanans* obtain and yet there are some *aliens*: some objects which don't actually exist.[19]   For instance, if (18) is good, then permissiveness says that there is a possible world in which a non-actual entity exists and $m_1, \ldots, m_n$ are grouped in the way specified by R. Permissiveness is very plausible in this case. The grouping of $m_1, \ldots, m_n$ does not necessitate the nonexistence, for instance, of alien concrete objects elsewhere.

Here, then, is a sketch of the variant of the argument. Suppose for *reductio* that (EXPLANATION)$_\exists$ is true. Then some claim of the form of (18) perspic-

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[18]Strictly speaking, the assumption needed for the argument is that there is at least one existentially derivative entity whose existence does not have an explanatory basis which entails that there are no entities other than g, e, *etc.* But it is plausible that g fits the bill if anything does.

[19]Permissiveness will be rejected by anyone who rejects the possibility of aliens (*e.g.*, (Linsky and Zalta, 1994)). It will also be rejected by anyone who thinks that the explanation for g's existence includes a "that's all" fact, to the effect that there are no entities other than the actual entities; see (Chalmers and Jackson, 2001). So the explanatory basis for g's existence, according to permissiveness, does not entail the non-existence of aliens.

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uously articulates a good explanation of g's existence. Apply actualization: an explanatory proposal of the form

(19) g *actually* exists because *actually* $R(m_1, \ldots, m_n)$

is also good. Now apply permissiveness. There is a world w containing an alien a, and in which $R(m_1, \ldots, m_n)$. The alien a, together with $m_1, \ldots, m_n$ present a possible confounding case for (19): at w, $m_1, \ldots m_n$ actually stand in R, but a does not actually exist. The determination constraint says an explanation is at best incomplete if it has possible confounding cases, so (19) is not good. Contradiction.

Given actualization and permissiveness, the determination constraint implies that (EXPLANATION)$_\exists$ faces the same sort of problem as (EXPLANATION). The argument can be avoided by denying either actualization or permissiveness. But each of the new assumptions has considerable plausibility in the present case. We have, however, another defense of (EXPLANATION)$_\exists$ close to hand: deny the relevant applications of the determination constraint. This is the second way to defend (EXPLANATION)$_\exists$ against the argument of §2. I have already argued that the determination constraint is supported as a generalization from cases. But none of the cases in question concerned explanations of existence. Thus, those cases can be accommodated if we deny applications of the determination constraint to explanations of the *existence* of entities (and to their *actual* existence), but accept its applications to explanations of other features. The argument against (EXPLANATION)$_\exists$ crucially depends on the application of the determination constraint to the explanation of g's (actual) existence. If that application fails, then the argument is unsound.

My worry about this way of defending (EXPLANATION)$_\exists$ is that denying the application of the determination constraint to explanations of existence threatens to trivialize its application to explanations of other features; call this the *trivialization worry*. Suppose we are confronted with an explanatory proposal of the form

(20) x has F because P

that fails the determination constraint. If the determination constraint's applications to explanations of existence are rejected, then this explanatory proposal can be rehabilitated by claiming that what's being explained is instead an existential claim. For instance, the proposal to explain the obligatoriness of giving

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a substantial proportion of your income to OXFAM can be recast as an explanation of the existence of a *duty* to give:

(21) There exists a duty for you to donate a substantial portion of your income to OXFAM in virtue of the fact that doing so would be utility-maximizing.

Similarly, a proposal to explain Goliath's modal or sortal features can be recast as a proposal to explain the existence of a certain *essence* for Goliath. More generally, a proposal to explain any entity's having some feature F can be recast as a proposal to explain the existence of a certain F-ness trope possessed by it. Such an explanatory proposal, on the view under consideration, can be good despite there being a confounding case. But it's obvious that the new explanation has just the same problem as the old one: recasting the explanation in existential terms makes the proposal no better. The applications of the determination constraint to explanations of (actual) existence say why.

A defender of (EXPLANATION)$_\exists$ should agree that these explanations of existence facts are at best incomplete, even though the restricted version of the determination constraint doesn't, by itself, deliver this verdict. But, the defender might urge, there is reason to deny that the problematic explanatory proposal can avoid the determination constraint by being recast as explanations of existence facts. Consider again the proposal to ground the existence of a duty to donate a substantial portion of your income to OXFAM in the fact that such a donation would be utility maximizing. The defender may argue that the existence of a duty is to be explained by reference to the obligatoriness of courses of action: if you have a duty to donate, then that duty exists in virtue of it being obligatory for you to donate. The proposed explanation of the existence of the duty in terms of utility maximization must, then, be understood as resulting from two explanatory claims:

(22) It is obligatory for you to donate to OXFAM in virtue of the fact that it would maximize utility

and

(23) There exists a duty for you to donate in virtue of the fact that donation is obligatory for you.

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The restricted version of the determination constraint still applies to (22), which is inadequate given the possibility of confounding cases. Similarly, the defender might argue, the existence of an essence for Goliath must be explained by appeal to Goliath's modal or sortal properties, and the existence of F-ness tropes must be explained by the relevant individual's being F. The determination constraint, restricted so as not to apply to explanations of existence, will still apply to the explanations of features other than existence that, the defender urges, are more explanatorily basic than the existence facts in question. So the trivialization worry is misplaced: the exception for explanations of existence facts cannot generally be used to skirt the determination constraint.

This response to the trivialization worry commits the defender of (EXPLANATION)$_\exists$ to some pretty controversial theses concerning how the existence of duties, tropes, and essences are to be explained. But let's suppose that the response is wholly convincing, and (EXPLANATION)$_\exists$ turns out to be true. There is now reason to deny that the existentially derivative entities are "no addition to being," and so provide an "ontological free lunch." Consider, for instance, a view on which the existence of mental states is completely explained by facts involving only microphysical entities, but those mental states had lots of explanatorily basic non-physical features, including irreducible phenomenological characters, primitive downward causal relations to microphysical entities, and the like. This is a view on which the only existentially fundamental entities are physical. Is it also a view which vindicates physicalism, the idea that, given the physical entities and features, mental states are "no addition to being"? Evidently not.[20]   This is a view on which mental states make a substantial "addition to being." *Existential derivativeness* is not the notion the physicalist needs to explicate the idea that there is nothing over and above the physical.[21] Existentially derivative entities are no "ontological free lunch" if some of their features cannot be explained in other terms.

But that is just what this defense of (EXPLANATION)$_\exists$ allows. The defender is granting in effect that the determination constraint applies to the

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[20]Extant physicalists agree. See, for instance, (Wilson, 2005) for discussion.

[21]Similarly, if grounding everything in the physical allows that some features of mental states cannot be explained in purely physical terms, then grounding is not the notion needed to explicate physicalism. This would contradict Schaffer's claim at (Schaffer, 2009, pp. 364-5). (I believe that Schaffer is committed to the idea that grounding an entity requires that no facts involving it be explanatorily basic; see n. 5. If that's right, then Schaffer's actual view is not subject to this criticism, but also cannot rest on (EXPLANATION)∃.)

proposed explanations of some facts involving the possession of a property F by d. The fact that d is F is not an existence fact. And the defense against the trivialization worry grants that we cannot evade the determination constraint, restricted so as not to apply to explanations of existence facts, by recasting a proposal to explain this fact as a proposal to explain the existence of something, *e.g.*, an F-ness trope. Thus, the argument of §2 still applies, and so a fact to the effect that d possesses some particular feature is explanatorily basic. For this reason, the defense against the trivialization worry does not vindicate the contention that existentially derivative entities are an "ontological free lunch."

The defender of (EXPLANATION)$_\exists$ who proposes to restrict the application of the determination constraint so that it does not apply to explanations of existence facts thus faces a dilemma. Either the exception for explanations of existence facts allows us to skirt the determination constraint for the explanation of other kinds of facts, or it does not. If it does, then the determination constraint is trivialized, and doesn't rule out explanations that are evidently at best incomplete. If it doesn't, then (EXPLANATION)$_\exists$ cannot be used to show that the existentially derivative entities are an "ontological free lunch".

In summary, there are two ways in which one might hope to use explanations of existence to evade the argument of §2: (i) notice that the analogue of (DERIVATIVE DIVERSITY) fails in the case of explanations of existence; or (ii) suggest that the determination constraint should be restricted so as not to apply to such explanations. Response (i) faces a version of the original argument. Response (ii) either falsely implies that recasting bad explanations as explanations of existence facts improves them, or won't secure the result that existentially derivative entities are an "ontological free lunch."

This still leaves unresolved the question of what, if anything, is wrong with the proposal to explain the existence of the group of marbles g in terms of the grouping of its constituent marbles $m_1, \ldots, m_n$. To tell the truth, I am unsure what to say about such a case. In particular, I am unsure what is entailed by the claim that g exists. If it turns out that g's existence does not tolerate replacement of its constituents over time, then I am tempted to think that its existence is reducible to $m_1, \ldots, m_n$'s being grouped together. If it turns out that g's existence does tolerate replacement of constituents, so that there can be Ship of Theseus-style cases,[22] then matters are more complicated. I

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[22]See (Salmon, 1979) and (Noonan, 1985) for discussion. The Ship of Theseus is a ship S_1 that was originally constructed from some planks $p_1, p_2, \ldots, p_n$. These have all been replaced

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suspect that Ship of Theseus-style cases show that the proposed explanation is inadequate,[23] but I am unsure how to supplement the proposal.

Perhaps we need to add the claim that g is composed of those marbles; g exists not just because some marbles are grouped together, but because *its* marbles are grouped together. It is tempting to characterize this proposal by appeal to some notion of essence.[24] The idea would be that the existence of a material thing is explained by some congeries of facts involving other things, together with some specification of the essence of the thing. In the case at hand, the claim is that the essence of g is given by the fact that it is composed of $m_1, m_2, \ldots, m_n$. The existence of g is explained by the fact that g has this essential feature. together with the fact that those marbles are grouped together. A notion of essence suited to play this role might be helpfully characterized in a variety of ways. For instance, if the argument of §2 succeeds, we can define a notion of essence that will do the trick: the *essence* of a thing is the totality of its features that are explanatorily basic. It is often held that the essential features of a thing play an important role in explaining its further features. This suggestion enshrines this claim as definitive of essence.[25]

So far I have suggested that g's existence be explained in part by appeal to its essence. Perhaps, instead, we should accept that g's existence is explanatorily basic. After all, given analogues of (IRREDUCIBILITY) and (DERIVATIVE DIVERSITY), the application of the determination constraint to the explanation of any of g's features other than existence implies that some of the facts involving g are explanatorily basic. Why not its existence? It should be noted that the argument of §2 can be adapted to show that g's existence is not the only fact involving g that is explanatorily basic. Consider, for instance, a perspicuously articulated explanatory proposal of the form

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one-by-one with completely different planks $p_{n+1}, p_{n+2}, \ldots, p_{2n}$. It is plausible to think that in some such case, it is possible that the post-replacement and pre-replacement ships are identical. If g tolerates replacement of its constituent marbles in a similar manner, then it is plausible to think that $m_1, \ldots, m_n$ can be traded out one-by-one, and then grouped to form a second group of marbles g^*.

[23]Argument: if a Ship of Theseus-style case is possible for g, then $m_1, \ldots, m_n$ can be grouped together to form an alien group g^*. It is plausible that, if those marbles explain g's existence, then they also explain its existence at every time at which it in fact exists. But, if they can be grouped to form g^*, then there can be a time at which the marbles are grouped as they actually are, and yet g does not exist. This strikes me as a compelling objection to the original explanatory proposal: the grouping of marbles at a given time fails to necessitate g's existence at that time.

[24]Thanks to Benjamin Schnieder.

[25]The exploration of this notion of essence is a task for another day. For two further alternatives, see (Almog, 1991) and (Fine, 1994, 2008).

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(24) d is F because d exists and $R(t_1, \ldots, t_n)$,

where none of the terms $t_1, \ldots, t_n$ denote d. (DERIVATIVE DIVERSITY) ensures that e is a confounding case for this explanatory proposal: e exists, is such that $R(t_1, \ldots, t_n)$, but is not F. So, if the argument is sound, it shows not only that some fact involving d is explanatorily basic, but also that some fact involving d *other than the fact that d exists* is explanatorily basic.

6 Conclusion

The argument of this paper has a general result: barring reduction, there do not exist two non-fundamental, qualitatively discernible entities. I have focused on the consequences of this result for ontology. In particular, I have argued that (EXPLANATION) cannot be used to claim that grounding explanations provide an "ontological free lunch." But the general result bears on a more popular conception of reality. On this conception, reality comes in layers: at the bottom are (perhaps) the physical entities. Higher up, we find chemical, biological, geological, psychological, sociological, economic, *etc.*, entities: molecules, human beings, diamonds, mental states, nations, interest rates, and so on. We might eliminate certain of these alleged higher-level entities from our ontology, denying their existence altogether; and we might hold that certain facts involving others are reducible. But, on the layering conception, after we have eliminated and reduced as much as we can, the features of the remaining higher-level entities are to be explained entirely in terms of the existence and features of entities at lower levels.[26]

If the argument of this paper is correct, this conception faces a problem. Barring reduction and elimination, the features of molecules, human beings, diamonds, *etc.* cannot be explained solely in terms of other things. Grounding explanations still allow us to acknowledge that some *facts* are more basic than others. But if there is any such thing as a diamond, then, barring reduction, some facts involving diamonds are explanatorily basic. Whether all of the explanatorily basic facts concerning erstwhile derivative entities are physical facts, or fit into any interesting category, is a matter for further investigation.

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[26]See (Kim, 1993) for a seminal critical discussion of this conception; in Kim's discussion, the higher-level entities in question are mental properties and the lower-level entities are physical properties.

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