Ground grounded*

Theodore Sider May 4, 2017

Metaphysics has always needed a "level-connector". One doesn't get far in metaphysics without some sort of distinction between fundamental and nonfundamental facts, or between more and less fundamental facts. And given such a distinction, one will want to say that nonfundamental, or less fundamental, facts "rest" in some way on fundamental, or more fundamental, facts. Higher levels of reality must somehow be connected to lower levels.

We've flirted with various ways to connect the levels: meaning, apriori entailment, supervenience. But consider the connection between the high-level fact that New York City is a city and the underlying physical reality—some facet of the global quantum state, perhaps. This connection is clearly not a matter of meaning in any ordinary sense; language *per se* knows nothing of quantum mechanics. Nor is it apriori.[1] Supervenience is a step in the right direction since it's a metaphysical account of the connection between levels, but it too is inadequate. It provides no useful account of the connection for noncontingent subject matters: mathematical truths supervene on any facts whatsoever, but do not "rest" on just any facts. Supervenience isn't an asymmetric relation, whereas the level-connecting relation is. And—most importantly, I think—supervenience here is metaphysically epiphenomenal: the conditional "if the quantum-state is such-and-such then NYC is a city" is necessarily true *because* of its status as a level-connector, and so its necessary truth cannot explain the connection between between NYC's cityhood and the quantum state.

So there's a niche for a metaphysical but nonmodal conception of the connection between levels. That niche has been filled by ground. Friends of ground have made the above criticisms of semantic, epistemic, and modal conceptions of level-connection, and have proposed that we accept a notion of ground that is metaphysical in nature but not defined as necessitation or supervenience. We are encouraged to speak in good conscience of facts grounding one another (holding "in virtue of" one another, "making true" one another, etc.) even if we cannot define ground in other terms.[2]

The grounding revolution of the past decade has certainly been a socio-

*Thanks to Karen Bennett, Shamik Dasgupta, David Kovacs, Jon Litland, Kris McDaniel, Jonathan Schaffer, ...

[1] David Chalmers (2012) notwithstanding. See Schaffer (2017) for a defense of this.

[2] See Fine (2001, 2012); Rosen (2010); Schaffer (2009).

logical success (just look at the journals). I also think it's been an intellectual success in many ways.[3] But there's an awkward dilemma at its foundation.

Suppose some fact, Q, about the quantum state grounds the fact, N, that New York City is a city. What is the grounding status of this grounding fact, the fact that Q grounds N? Is it itself grounded or not?

The first horn of this dilemma appears to be unacceptable. For it implies that one of the rock-bottom facts—namely, the fact that Q grounds the fact that NYC is a city—involves the concept of being a city. Surely the ultimate story of the universe can be told without talking about cityhood at all.

This argument can be generalized. Let C be any concept whose presence we're reluctant to allow in an ungrounded fact.[4] Then facts about how C-involving facts are grounded—facts of the form $X \twoheadrightarrow A(C)$—cannot be ungrounded.[5] In my preferred terms, the argument appeals to a principle of "Purity": no ungrounded fact can involve a "nonfundamental concept". Thus grounding facts involving nonfundamental concepts (like being a city) must themselves be grounded.[6]

The argument from Purity doesn't quite rule out all ungrounded grounding facts, since some grounding facts might be "pure" in the sense of involving only fundamental concepts. Suppose A is a fact involving only fundamental concepts. Then some ground X of A might also involve only fundamental concepts. Further, one might hold that ground itself is a fundamental concept. Then the fact $X \twoheadrightarrow A$ would involve only fundamental concepts, in which case Purity would allow it to be ungrounded. For example, where E is the fact that something has charge and M is the fact that something has mass, one might hold that $E \twoheadrightarrow (E \vee M)$ involves only fundamental concepts and is ungrounded. Still, the argument from Purity prohibits any "impure" grounding facts from being ungrounded. This includes all level-connecting grounding facts, assuming that facts at higher levels involve nonfundamental concepts. Thus for all such

[3] I do have some concerns. 1. Enthusiasm for ground sometimes leads to its application in places where it doesn't belong (Sider, 2017). 2. Ground's "conditional" nature encourages positing too little at the fundamental level (Sider, 2013*b*, pp. 741–6). 3. A more linguistic variant on ground is more appropriate for accommodating nonfactual discourse (Sider, 2011, 125–7).

[4] Fans of Fine (2001) might say instead "…in an ungrounded fact that holds in reality", and make corresponding adjustments to what follows.

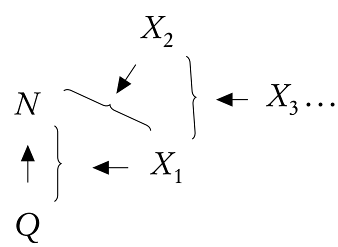
[5] I will use expressions like "$X \twoheadrightarrow A(C)$" as names of facts when this makes for smooth prose.

[6] See Sider (2011, sections 7.2, 7.3, 8.2.1). There I used the term "structural" instead of "fundamental concept", and spoke of metaphysical semantics rather than ground.

grounding facts, the first horn of the dilemma—that the grounding fact is ungrounded—is unavailable.

The second horn of the dilemma is that the fact $Q \rightarrow N$ is grounded. This is the horn that I think we should embrace. But, one might object, isn't ground meant to be "primitive"? Friends of ground do say such things. But what they usually mean is that ground cannot be *defined* in more familiar terms,[7] and all friends of ground agree that grounding does not require definability. Just as facts about cities can have quantum mechanical grounds even if 'city' cannot be defined (in any ordinary sense of 'define') in quantum mechanical terms, so facts about ground can be grounded even if 'ground' cannot be defined.

Another concern about the second horn is Karen Bennett's (2011) regress. If grounding facts are grounded then some X_1 must ground $Q \rightarrow N$, some X_2 must ground $X_1 \rightarrow (Q \rightarrow N)$, and so forth. Here is Bennett's picture of the situation:



This is indeed a regress in the sense that there does indeed exist an infinite series of facts $Q \rightarrow N, X_1 \rightarrow (Q \rightarrow N), X_2 \rightarrow (X_1 \rightarrow (Q \rightarrow N)) \ldots.$ The increasingly complex grounding facts $X_n \rightarrow \ldots X_1 \rightarrow (Q \rightarrow N)$ at the various stages in the regress always contain N and thus always involve the concept of being a city, and hence must always be grounded in some X_{n+1} (given Purity), continuing the regress.

But the regress is not vicious. In particular, the existence of the regress does not imply that grounding fails to be well-founded, in the sense of there being infinite descending chains of ground.[8] An infinite descending chain of

[7] Or that we know of no such definition, or that speaking of ground is acceptable even if we possess no such definition, etc. See, for example, Rosen (2010, p. 113) and Schaffer (2009, p. 364).

[8] Rabin and Rabern (2016) also make this point. (They then go on to provide much-needed clarification of the notion of grounding being "well-founded" (as does Dixon (2016)). They argue that lacking infinite descending chains is an overly strong formulation of the intuitive constraint of well-foundedness, but that is not a concern here since I am arguing that not even this constraint is violated.)

grounding is an infinite series $Y_1, Y_2, Y_3 \ldots$ where each member in the series is grounded by the next member. Bennett's regress does yield a series of facts $Q \to N, X_1 \to (Q \to N), X_2 \to (X_1 \to (Q \to N))\ldots$, and each member of this series is indeed grounded, but not by the next member of the series. For example, the first member of the series, $Q \to N$, isn't grounded by the second member, $X_1 \to (Q \to N)$. $Q \to N$ *is* grounded by X_1. But there's no reason to suppose that it's *also* grounded by $X_1 \to (Q \to N)$. (In the spirit of Lewis Carroll (1895), we should reject the idea that if A is a ground of B, then the fact that A grounds B is also—perhaps together with A—a ground of B.)

More pictures might help here. In order for the regress to establish an infinite descending chain of ground, we'd need something of this form:

$$\bullet \leftarrow \bullet \leftarrow \bullet \leftarrow \bullet \cdots$$

Instead, we've got this:

$$\begin{tikzcd}
(Q \to N) & (X_1 \to (Q \to N)) & (X_2 \to (X_1 \to (Q \to N))) \cdots \\
X_1 \arrow[u] & X_2 \arrow[u] & X_3 \cdots \arrow[u]
\end{tikzcd}$$

The crucial point is that the diagram does *not* contain these dashed arrows:

$$\begin{tikzcd}
(Q \to N) & (X_1 \to (Q \to N)) \arrow[l, dashed] & (X_2 \to (X_1 \to (Q \to N))) \cdots \arrow[l, dashed] \\
X_1 \arrow[u] & X_2 \arrow[u] & X_3 \cdots \arrow[u]
\end{tikzcd}$$

If it did, the top row would describe an infinite descending chain of ground. But it doesn't. Each fact on the top row is grounded by the fact below it. (The facts in the bottom row could be fundamental, or they could hold in virtue of further fundamental facts, but there's no argument that they have infinite descending chains of ground below them.) To be sure, each fact on the top row (other than the first) *is* the fact that the previous top-row fact is grounded by the fact below it:

$$\begin{array}{ccccc} (Q \to N) & = & (X_1 \to (Q \to N)) & \qquad & (X_2 \to (X_1 \to (Q \to N))) \ \cdots \\ \uparrow & & \uparrow & & \uparrow \\ X_1 & & X_2 & & X_3 \ \cdots \end{array}$$

But these identifications don't undermine the point that the facts on the top row aren't grounded by the facts immediately to their right.

So the regress does not imply that there are infinite descending chains of ground. Might the regress be vicious in some other sense? Bennett (2017, chapter 7) tentatively suggests two reasons for thinking it might be. First, she says that the regress is problematic in a way that's analogous to the way in which an infinite descent of ground would be (allegedly) problematic:[9]

> For one thing, there is something bothersome about the fact that there is no satisfying end to the line of questioning that produces the above list. I take it that something like this concern motivates those who insist that building (or at least grounding) must be well-founded.

But I don't agree that this is the motivating concern. The mere fact that there's a systematic way of generating infinitely many grounding questions which all have answers isn't problematic at all. I can ask "what grounds the fact that there is at least one number?", "what grounds the fact that there are at least two numbers?", "what grounds the fact that there are at least three numbers?", and so on without end, expecting an answer in each case, without anything being amiss. What strikes many as problematic about infinite descending chains of ground is something very specific: if Y_1 is grounded in Y_2, Y_2 is grounded in Y_3, and so on, then this is regarded as undermining the claim that Y_1 (or any later Y_i, for that matter) is grounded at all: as Schaffer (2010, p. 62) puts it, "Being would be infinitely deferred, never achieved". Whatever the merits of this thought, it's specific to infinite descending chains of grounding, and does not speak against the sort of infinite series of grounding claims—which are *not* "chained" in the relevant sense—involved in Bennett's regress.

[9] Building is the central concept of Bennett's book, which is distinct from (though related to) grounding.

Bennett's second suggestion is that the regress is ontologically profligate, because it apparently leads to an infinity of grounding facts ($Q \rightarrow N$, $X_1 \twoheadrightarrow (Q \rightarrow N)$, $(X_2 \twoheadrightarrow (X_1 \twoheadrightarrow (Q \rightarrow N))\ldots)$ and grounds of those facts ($X_1, X_2 \ldots$). But the infinity of grounding facts seems unavoidable, given the principle of Purity. The infinity of grounds of those facts isn't unavoidable; it can be avoided by adopting Bennett's own view (to be discussed below), which is that a single fact, the fact Q, grounds each of the infinitely many grounding facts. (That is, Q grounds each of the following: $Q \twoheadrightarrow N$, $Q \twoheadrightarrow (Q \twoheadrightarrow N)\ldots$.) But that doesn't on its own make her view any less profligate. For as will become apparent, the kinds of facts $X_1, X_2 \ldots$ that I think ground the grounding facts ($Q \rightarrow N$, $X_1 \twoheadrightarrow (Q \rightarrow N)$, $(X_2 \twoheadrightarrow (X_1 \twoheadrightarrow (Q \rightarrow N))\ldots)$ are facts that Bennett (and everyone else) already accepts. We disagree over whether these facts ground grounding facts, but not over whether these facts exist, so the disagreement does not mark a difference in ontological profligacy.

Setting aside, then, the regress, a final concern about the second horn—about the idea that grounding facts have grounds—is that it's hard to see what those grounds might be. Two proposals have been offered recently, one by Bennett (2011) and by Louis deRosset (2013), the other by Shamik Dasgupta (2014*b*). But in my view neither is correct.

According to both Bennett and deRosset, any grounding fact $A \twoheadrightarrow B$ is grounded simply by A. But the quantum mechanical fact Q, for example, just doesn't seem like a metaphysical basis, all on its own, for the grounding fact that Q grounds the fact that NYC is a city, since Q contains nothing relevant to the relation of ground. The grounding fact $Q \twoheadrightarrow N$ is a relational fact, and relational facts normally are grounded by something that connects the relata in question (or else something that connects the grounds for the existence of the relata, if those relata do not exist fundamentally). The ground of the relational fact that Harry met Sally must, in some sense, involve some connection between Harry and Sally (or, perhaps, some connection between the grounds of Harry's existing and the grounds of Sally's existing). So one would expect $Q \twoheadrightarrow N$ to have a ground that connects the facts Q and N (or anyway one that connects grounds of Q and N). Further: grounding is meant to be a kind of metaphysical explanation, or perhaps a quasi-causal fact backing metaphysical explanation. Thus the facts that ground grounding facts ought to be analogous to the facts that ground explanatory or causal facts. The nature of the grounds of causal and explanatory facts are disputed, but everyone can agree that, e.g., the ground of the fact that c causes e won't just encompass c, but will rather extend to e

and the connection between c and e.[10] [11]

According to Dasgupta (2014*b*), the grounding fact $A \twoheadrightarrow B$ is grounded in the essences of the constituents of B (together with the truth of A). The fact that Q grounds NYC's being a city, for example, is grounded in some fact about the essence of cityhood (together with NYC's actually being a city), perhaps this fact:

(E) It's essential to cityhood that if Q then NYC is a city

It is indeed natural to take the the essence of cityhood to specify which sorts of facts are sufficient for a thing's being a city. But as Dasgupta notes, this reintroduces our dilemma. For we may now ask whether facts like (E) are grounded. On the one hand, since (E) involves cityhood, Purity implies that it must be grounded. But on the other hand, it's hard to see what might ground a fact like (E).

In response to this dilemma, Dasgupta makes his most distinctive claim. (E), he says, is ungrounded, but nevertheless isn't fundamental. Rather, he says, it's "autonomous", meaning that it's "not apt for being grounded".[12] And it's not problematic, Dasgupta says, for an *autonomous* ungrounded fact to involve a nonfundamental concept like cityhood. Purity ought to be understood as allowing this.

But shouldn't we reject the existence of *any* ungrounded facts involving cityhood? If a fact is ungrounded then it must be included in any telling of the complete story of the world. So even if (E) is not apt for being grounded in some sense, if it involves cityhood then it remains the case that any telling of the complete story of the world must bring in cityhood; and that remains hard to stomach. To descend into metaphor: when God was creating the world, she

[10] Dasgupta (2014*b*, pp. 572–3) makes a similar objection. He also makes the further objection that $P \twoheadrightarrow P \vee Q$ and $P \twoheadrightarrow {\sim}{\sim}P$ would, according to Bennett and deRosset, have the same ground, whereas "the grounds are surely different and involve something about disjunction in the first case and negation in the second" (Dasgupta, 2014*b*, p. 573). I agree, though I suspect the underlying thought is the same as the original objection.

[11] It might seem that a similar objection could be made to Litland (2017), who defends a view similar to that of Bennett and deRosset, namely that nonfactive grounding claims are zero-grounded (in Fine's (2012) sense). But Litland adds that although grounding claims all have the same (zero) ground, different grounding claims are grounded in different *ways*, and he goes on to explore the idea of ways of grounds further in subsequent work. This seems to be a fruitful idea, but our concerns about what grounds the facts of grounding would seem to reappear as concerns about what grounds the ways of grounding.

[12] A variant of Dasgupta's view would say that grounding claims themselves are autonomous.

must have decreed the autonomous ungrounded truths, since nothing is true other than God's decrees and what they ground; but surely God's decrees when creating the world didn't need to involve cityhood at all.

In explaining the status of autonomy, Dasgupta gives two analogies. In one he compares autonomous truths to definitions in an axiomatic system. Definitions, Dasgupta says, are not apt for being proven from the axioms. This status differs, he says, from the status of simply not being provable; a definition is unlike, say, the axiom of choice relative to the other axioms of standard set theory, from which it cannot be proved. Rather, the question of whether a definition is provable is somehow illegitimate. The second analogy involves causal explanation. Some facts have causal explanations, such as the fact that I am typing right now. Other facts, perhaps, lack causal explanations; perhaps there is no causal explanation of why the universe began as it did. But even if this fact about the initial state of the universe lacks a causal explanation, it still *makes sense* to ask what causally explains the universe's initial state; it's just that the answer is *nothing*. The situation is quite different, Dasgupta claims, with mathematical truths, say; the question of their causal explanation "simply doesn't arise".

What these examples illustrate, it seems to me, is just that certain relations between sentences or facts are explicitly and intentionally limited in scope. A definition isn't the sort of thing that can be proven from axioms because the definition is a statement in the metalanguage ("$\ulcorner \alpha \subseteq \beta \urcorner$ abbreviates $\ulcorner \forall z(z \in \alpha \to z \in \beta)\urcorner$") whereas theorems are stipulated to be sentences in the object language.[13] Provability from axioms is—explicitly—limited in scope to sentences in a certain specified language. Similarly, causal explanation is understood to be restricted in scope to events in time. Our causal explanatory ambitions simply do not extend to the realm of the mathematical.

It's a little misleading to say that questions of provability and causal explanation "don't arise" for definitions and mathematical truths, since in each case the questions have answers. Definitions are *not* theorems because they're not formulas in the object language; mathematical truths are *not* causally explainable because only events in time have causes. What's true is that the explicit limitation in scope of the concepts of provability and causal explanation *im-*

[13] One might instead take the definition to be an act of stipulation. Since acts of stipulations aren't sentences of the object language, the definition could not be a theorem. Or, one might take the definition to be "$\forall x \forall y(x \subseteq y \leftrightarrow \forall z(z \in x \to z \in y))$". This is an abbreviation for "$\forall x \forall y(\forall z(z \in x \to z \in y) \leftrightarrow \forall z(z \in x \to z \in y))$", which *is* a theorem (since it's a logical truth).

mediately yield negative answers to the questions, without the need for further examination of the case. Compare the question of whether a rock is witty: since wittiness is (in some sense) restricted by definition to sentient things, we know that a rock is not witty without consulting the details of the rock's situation. Still, the question of whether the rock is witty does have a straightforward answer: no.

Now, does metaphysical explanation have a similar "limitation of scope"? Surely not; surely there are no antecedently imposed limitations on what sorts of facts we can query for metaphysical explanation. And so, since ground is (or anyway is closely connected to) metaphysical explanation, ground also lacks the restriction in scope. No one would say that a mathematical fact, for example, is outside the scope of metaphysical explanation; if there are indeed mathematical facts, then we may ask what their obtaining consists in. Similarly, if it is indeed a fact that murder is wrong, then we can ask what constitutes that fact, what grounds it. So similarly, if it's a fact that it's of the essence of cityhood that if Q then NYC is a city, we may surely ask what if anything accounts for this fact. Metaphysical explanation is disanalogous to causal explanation and provability at precisely the crucial point, because of the expansive ambitions of the project of metaphysical explanation. Perhaps those ambitions are somehow doomed, but at any rate no restriction of scope is built into the *meaning* of 'ground' in the way that a restriction to sentences of the object language is built into the meaning of theoremhood. Perhaps there is some deeper sense of "restriction of scope", but no such deeper sense seems to be illustrated by the examples of theoremhood or causal explanation.

Jonathan Schaffer (2017, section 4.3) has offered a response to the concern that is structurally analogous to Dasgupta's. According to Schaffer, a metaphysical explanation has three parts: the derivative fact to be explained, the fact doing the explaining, which grounds the derivative fact, and a *metaphysical bridge principle* linking the two. And like Dasgupta's autonomous facts, Schaffer's bridge principles (some of them, anyway) are said to lack grounds despite involving nonfundamental concepts. As with Dasgupta's autonomous facts, I object that no ungrounded fact ought to contain nonfundamental concepts. At the very least, we need an argument for the existence of Schaffer and Dasgupta's third status, a status of fact partly obeying the rules of ungrounded facts, and partly obeying the rules of grounded facts. Perhaps the argument is the lack of an alternative; but as I will now show, there is an alternative.

The way forward is to recognize that the question of what grounds $A \twoheadrightarrow B$ needn't have a simple answer, an answer formulated as a simple function of

A and B. The only simple answers with any plausibility would seem to be those we've considered and rejected: Bennett and deRosset's answer "A", and Dasgupta's answer "the nature of B". But why assume the answer must be simple? High-level facts in general depend on low-level facts in complex ways; why should grounding facts be any different? When asked what grounds a high-level fact such as the fact that New York City is a city, friends of grounding will normally gesture at the *kind* of fact that does the grounding—a fact about the quantum state, perhaps, or about the parts of New York City—without giving any specific account of which particular fact that is.[14] Similarly, I suggest, it is appropriate to provide an account of the kinds of facts that play a role in the grounding of grounding facts, without knowing exactly what those facts are. Grounding facts may be grounded in complex ways about which we know little.

To be sure, in certain cases one can have in-principle reasons to doubt that grounding is possible. But there's no reason to suppose that the case of grounding facts themselves is such a case, since we can identify the kinds of facts that play a role in this grounding: i) patterns in what actually happens, ii) modal facts, iii) facts about the form or constituents of the grounding fact in question, iv) metalinguistic facts, and even (according to some friends of grounding though not me), v) certain "pure" grounding facts.

Let a be some table, and consider the fact that a's being a table grounds its being either a table or a chair:

(1) $Ta \rightarrow (Ta \vee Ca)$

For the remainder of the paper we'll investigate in detail the categories of fact i)–v), which might well be involved in a ground of (1). As we'll see, in each case the facts in question can be ultimately grounded in a way that's consistent with Purity.

The sorts of facts to be discussed aren't meant to be exhaustive: perhaps other facts can help ground grounding facts.[15] Nor do I mean to commit to each: perhaps some of the facts I mention play no role at all. The point is to mention enough kinds of facts that *might* help to ground grounding facts to satisfy ourselves that grounding facts can indeed be grounded, consistent with Purity.

Before proceeding, it's worth (re-)emphasizing that it is not incumbent on a friend of ground to say how exactly the facts i)–v) ground the facts of ground.

[14] See Sider (2011, section 7.6) for a discussion of this issue.

[15] For instance Wilson's (2014) "little-g" grounding relations.

Granted, one *might* accept the challenge to try to *analyze* ground; and then one would need to be more specific about i)–v). But friends of ground have usually insisted on the propriety of speaking of ground even in the absence of an analysis. And if no analysis is required, then why should greater specificity about i)–v) be required? Compare an analogous attitude towards causation:

> "The concept of causation is central to our understanding of certain sciences as well as to ordinary thought, and so it's fine to employ it in theorizing about those domains without analyzing it. Saying this does not require thinking that causation is somehow metaphysically basic. On the contrary, the causal facts are ultimately grounded in the non-causal facts, perhaps in laws of nature, or counterfactuals, or modal facts, or some other facts. The question of exactly how they are so grounded is, like the question of the analysis of causation, a difficult one, but one needn't have an answer to either question in order to use the concept of causation in good conscience."

On, then, to the discussion of categories i)–v) of facts that might play a role in grounding the grounding facts:

General facts (1) might be grounded in part by the general fact that all tables are either tables or chairs:

(2) $\forall x(Tx \rightarrow (Tx \vee Cx))$

According to some, grounding facts just are facts about explanations, and explanations are naturally taken to consist in part of subsumption under patterns. According to others (such as Schaffer (2016)), grounding facts are more like causal facts; but Humeans anyway think of causation as being grounded by patterns. To be sure, the more "anti-Humean" one's approach to ground is, the more one will prefer to rely instead on the other potential grounds for grounding facts to be discussed below.

(2) involves nonfundamental concepts, so it's worth pausing to think about what might ground it. (But if (2) cannot be grounded consistently with Purity, the friend of grounding has a problem bigger than finding grounds for grounding facts.) (2) is universally quantified, so we need to ask what grounds such facts in general. Perhaps, as Fine (2012, section 1.7) says, they're grounded in the plurality of their instances plus a "totality fact" insuring that there are no additional entities beyond those in the instances.[16] In that case (2) will have a

[16] But see Sider (2017), section 2.5.2.

ground that looks like this:

(3) $Ta_1 \to (Ta_1 \vee Ca_1), Ta_2 \to (Ta_2 \vee Ca_2), \ldots, \mathrm{Tot}(a_1, a_2 \ldots)$

Moreover, each instance $Ta_i \to (Ta_i \vee Ca_i)$ is a material conditional, which, let us assume, is ground-theoretically equivalent to:

(4) $\sim Ta_i \vee (Ta_i \vee Ca_i)$

Now, consider cases where the second disjunct is true. Then, since disjunctions are grounded in their true disjuncts, (4) would be grounded by:

(5) $Ta_i \vee Ca_i$

Side point: one such case is the case where $a_i = a$; thus (5) here would be $Ta \vee Ca$. And since partial ground is transitive, we have that $Ta \vee Ca$ partially grounds (1). But this doesn't mean that $Ta \vee Ca$ partially grounds itself; it means that it partially grounds the fact that it's grounded by Ta. And that's unproblematic. (This is particularly clear if the fact that Ta grounds $Ta \vee Ca$ is an explanatory fact, since it's natural to take explanation to consist in part of subsumption under patterns; the pattern in question will in part be constituted by the facts subsumed.)

Returning to (5): it will be grounded in whichever of its disjuncts is true. And that disjunct will in turn be grounded in some complex physical (or whatever) fact about a_i—whatever makes it a table or chair as the case may be. Thus we have drilled down to the fundamental without violating Purity.

Now, in cases where the first disjunct of (4)—i.e., $\sim Ta_i$—is true, there is a question of what grounds it, which raises the general question of what grounds negations. But assuming this can be answered (we'll discuss it further in a minute), and assuming the totality fact in (3) doesn't raise any problems with Purity, we have seen that in the case of (2) anyway, "pure" grounds—i.e., grounds not involving any nonfundamental concepts—for (1) can be reached. Moreover, the output of this drill-down procedure leading to pure grounds is sensitive to the fact that it is $Ta \vee Ca$, as opposed to some other fact, that is being grounded in (1). This is in contrast to Bennett and deRosset's proposal, according to which variation in B does not result in variation in the ground of $A \twoheadrightarrow B$.[17]

(2) isn't the only extensional fact that might be part of (1)'s ground. In addition to all tables being tables-or-chairs, the fact that not all tables-or-chairs are tables might also be relevant (recall the asymmetry of ground), as might be the way in which (2) fits into larger patterns. (The latter is in the spirit of the best-system theory of laws (Lewis, 1994).) I'm not in a position to say exactly which facts are relevant, or how they're relevant. It would certainly be nice to do so, and indeed, to give a definition or analysis of ground. But as I've been saying, we needn't produce a definition to convince ourselves that there are grounds for grounding facts (consistent with Purity).

Modal facts Another source of grounds of (1) is modal claims. For instance, (1) might be partially grounded in (6):

(6) $\Box\forall x(Tx \to (Tx \vee Cx))$

(6), though, involves the nonfundamental concepts of being a table and being a chair; how to continue the drill-down procedure to pure grounds so that those are eliminated?

For a modal reductionist this is unproblematic: (6) will be grounded in nonmodal facts, and the drill-down procedure can proceed as with any other sort of fact.

Modal antireductionists will deny that (6) is grounded in nonnmodal facts. But that does not commit them to the Purity-violating claim that (6) is ungrounded. They can instead hold that (6) is grounded in modal facts which do not involve nonfundamental concepts like being a table or being a chair.

To get a handle on how impure modal facts might be grounded in pure ones, consider first a simpler case. It would be natural for a modal antireductionist

[17]To be sure, there are particular elements cited in the preceding paragraphs that are not unique to the right-hand-side of (1). For instance, one partial ground of (1) might be a pure ground of Ta_{17} (since such a fact grounds Ta_{17}, which grounds $Ta_{17} \vee Ca_{17}$, which grounds $\sim Ta_{17} \vee (Ta_{17} \vee Ca_{17})$, which partially grounds (2), which (I say) partially grounds (1). And this partial ground would also be cited if we were dealing with the following rather than (1): $Ta \twoheadrightarrow (Ta \vee Fa)$, for some $F \neq C$. However, this repetition of grounds is of *partial* grounds. Also, even setting that aside, it's just a consequence of a more general fact about ground, that distinct facts can have the same grounds; P (fully) grounds both $\sim\sim P$ and $P \vee Q$, for instance. Despite this fact, the appropriate sensitivity to what is on the right-hand-side of (1) is present in the totality of facts that ground (1), even if not in each such fact.

to regard the impure modal fact $\Diamond\exists x\, Tx$ as being grounded in $\Diamond\exists x\, T_i x$, where T_i is any "realizer" of being a table—any specific microphysical property that would ground a given thing's being a table.

The situation with (6) is more complicated. Before broaching it, let's return to the question of what grounds a negative fact, such as the fact $\sim Tb$ that a certain thing b is *not* a table. One answer might be that the ground is a fact of the form $\sim\tau(b)$, where τ is a "metaphysical definition" of 'table'. (The proposed ground isn't $\sim\tau(b)$-and-τ-is-a-metaphysical-definition-of-'table', but rather just $\sim\tau(b)$.) Like a ground, a metaphysical definition of 'table' gives an underlying account of being a table, but unlike a ground, a metaphysical definition must be both necessary and sufficient for being a table. For the sake of definiteness,[18] let's suppose that τ is the disjunction of all possible realizers of the property of being a table; thus the ground of the fact that b is not a table is that b is neither T_1 nor T_2 nor....

(Side point: friends of ground often provide, as a ground for a positive claim, a sufficient but not necessary condition for the claim. They say, for instance, that Ta is grounded in just one of its "realizers", $T_1 a$, and don't insist that the ground must be something like $T_1 a \vee T_2 a \vee \ldots$, which includes all the realizers, and thus is perhaps necessary as well as sufficient for Ta.[19] Indeed, the ability to provide "small" underliers of high-level facts might be regarded as a great advantage of the ground-theoretic framework over accounts of levels in which underliers must be both necessary and sufficient.[20] But in the case of negative claims, this kind of strategy won't work. Thus the apparent advantage is in fact illusory.)

It may be replied that the negative claim $\sim Tb$ can be grounded in some positive feature of b that rules out its being a table. But what might that positive feature be? Not a complete intrinsic description of b: such a description needn't necessitate b's failing to be a table since being a table is a relational matter (how a thing is used, for instance, can affect whether it's a table). A complete intrinsic and extrinsic description of b would necessitate its not being a table, but it contains too much information to be a ground of that fact. It contains irrelevant information about the exact physical state in the center of Alpha Centauri, for instance, and the ground of a fact must not contain anything

[18] I don't really think this view is plausible; a more likely view is that τ is a functional definition of 'table'.

[19] This is enabled by the fact that ground is "conditional", not "biconditional" (see note 3).

[20] See, for instance, the exchange between Schaffer and me (Schaffer, 2013; Sider, 2013*a*) on the virtues of the ground-theoretic and metaphysical semantics in light of multiple realization.

irrelevant to that fact.[21]

Back to the ground of (6). One idea for how it might be grounded is like the ground for $\sim Tb$ considered above: simply replace 'table' and 'chair' in (6) with their metaphysical definitions:[22]

(7) $\Box\forall x((T_1x \vee T_2x \vee \cdots) \rightarrow ((T_1x \vee T_2(x) \vee \cdots) \vee (C_1x \vee C_2x \vee \cdots)))$

Note that Purity allows this to be ungrounded (provided the logical concepts involved—including necessity—are fundamental concepts).

Let me address some objections. The first says that (7) can't be a full ground of (6) because a full ground of (6) would need to include something that connects the disjunction of the T_is to T, i.e., to being a *table*. But if that's a good objection, it would also refute paradigmatic claims of grounding, such as the claim that T_1a grounds Ta. If in the case of the simple, positive claim that a is a table, the ground is just the realizer, T_1a, and nothing connecting the realizer to tablehood is needed, why should such a thing be needed in more complex claims involving tablehood?

The second objection is that the approach suggested above to negations, and applied again when (7) was said to ground (6), would imply violations of the irreflexivity of ground. For example, the result of replacing each predicate in (7) with its metaphysical definition would seem to be (7) itself, assuming that fundamental predicates are their own metaphysical definitions. One might quarrel with this assumption; some of the directedness of ground might emerge from a corresponding directedness in the notion of a metaphysical definition. But more importantly, I didn't mean to be suggesting the general principle that whenever A results from B by replacing expressions with their metaphysical

[21] Compare Dasgupta's (2014*a*) argument against grounding Obama's existence in a description of an overly large region of space.

[22] There are other plausible candidate grounds of (6) in the neighborhood:

(7a) $\Box\forall x((T_1x \rightarrow (T_1x \vee (C_1x \vee C_2x \vee \cdots))) \wedge (T_2x \rightarrow (T_2x \vee (C_1x \vee C_2x \vee \cdots))) \wedge \cdots)$

(7b) $\Box\forall x((T_1x \rightarrow (T_1x \vee C_1x)) \wedge (T_1x \rightarrow (T_1x \vee C_2x)) \wedge \cdots \wedge (T_2x \rightarrow (T_2x \vee C_1x)) \wedge (T_2x \rightarrow (T_2x \vee C_2x)) \wedge \cdots)$

In (7), it is only the entire disjunction of the realizers of 'a is a table' that is said to suffice for something (namely, the disjunction of the disjunction of realizers of 'a is a table' with the disjunction of realizers for 'a is a chair'). Whereas in (7a) and (7b), each individual realizer of 'a is a table' is said to be sufficient for something—for the disjunction of itself with the disjunction of all realizers of 'a is a chair', in the case of (7a), and for the disjunction of itself with, in turn, each realizer of 'a is a chair' in (7b).

definitions then A grounds B. I meant to be proceeding more piecemeal, to be saying that this looks like a plausible line to take in certain cases, while leaving open how far it generalizes. Remember our guiding thought: ground is a complex, high-level matter, and there need be no simple rules governing how it is grounded.

The third objection is that the suggested approach would have implausible results in other cases. The approach apparently implies that

(T) $\Box\forall x(Tx \leftrightarrow (T_1x \vee T_2x \vee \cdots))$

is grounded in

(T′) $\Box\forall x((T_1x \vee T_2x \vee \cdots) \leftrightarrow (T_1x \vee T_2x \vee \cdots))$

For (T′) results from (T) by replacing 'Tx' with its metaphysical definition '$T_1x \vee T_2x \vee \cdots$'. But how can (T′) be a ground of (T)? (T′) is a logical truth, whereas (T) seems to concern the "substantive" matter of what the modally necessary necessary and sufficient conditions for being a table are. (Grounding orthodoxy says that nonlogical truths can ground logical truths; P grounds $P \vee {\sim}P$, for instance. It is the converse that is at issue here, the grounding of a nonlogical truth by a logical truth.)

I could reply again that I'm not committed to the general principle mentioned above. But in the present case I think the principle may well deliver the right result; the appearance of oddness dissolves upon closer inspection. Whether a sentence is a logical truth is sensitive to patterns of recurrence amongst its constituent expressions: $a = a$ is a logical truth whereas $a = b$ is not. If one extends the notion of logical truth to structured propositions (or facts), the analogous point is then that whether a proposition or fact is a logical truth is sensitive to patterns of recurrence of its constituent entities, properties, and relations. But now: passing from a grounding to a grounded fact can change what the constituents of the fact are, and hence change the patterns of recurrence. In the fact (T), the constituent property on the "left-hand side" of the biconditional is the property of being a table, whereas the property on the right-hand side is the disjunction of the realizers of being a table. Since these properties are distinct there is no recurrence, and the fact is not a logical truth. But when we pass from (T) to its ground (T′), the property of being a table is replaced by the disjunction of its realizers; that property now recurs in (T′); (T′) is a logical truth.

Perhaps the appearance of oddness persists: (T′) is knowable apriori, whereas for all we know apriori, (T) could be false. But it's not an apriori matter what a given fact's grounds are; it's not apriori that (T)'s ground is (T′). So it is unsurprising that the apriori (T′) could ground the aposteriori (T).

Logical form (1) might also be partly grounded in facts about its "logical form", facts such as (8):

(8) The grounder of $Ta \rightarrow (Ta \vee Ca)$ is a disjunct of its groundee

(By "the grounder" and "the groundee" of a grounding statement I mean its left- and right-hand sides, respectively.)

Continuing to drill down: what grounds (8)? And how, generally, are facts about the logical forms of facts or propositions grounded? Assuming a structured conception of facts (perhaps presupposed by talk of facts as having logical forms), the question reduces to that of how facts about the constituency-structure of complexes are grounded. On one view, the existence and features of an entity with parts (in a broad sense of 'part') are grounded solely in the existence of those parts. Thus (8) would be grounded in the mere existence of its parts: the entity a and the properties T and C (plus the "syntactic" relations of grounder, constituency, and disjunct, plus some logical concepts). On another view, facts about the holding of fundamental constituency relations or operations would also be required.

Either way, to drill further down we need a ground of the existence of the properties T and C—of being a table and being a chair. How this proceeds depends on the ontology of properties.

On a "deflationary" approach, the existence of the former property, for example, might be said to be grounded in the fact that there exist tables.[23] And from the existence of tables, subsequent drilling down in line with Purity is unproblematic. Another approach is nondeflationary but reductive. For example, David Lewis (1986, section 1.5) identifies properties with sets. Subsequent drilling down will then depend on what one thinks the grounds of facts about sets are (recall what was said a moment ago about the grounds of the existence of things with parts).

Yet another approach is nonreductive. Now, a nonreductivist conception of properties might seem to conflict with Purity, since it might seem committed to there being no ground for the fact that there exists a property of being a table. But the situation here is parallel to that of (6) for a modal antireductionist. The nonreductivist about properties could claim that the existence of the property

[23] I have in mind Schiffer's (2003) approach.

of being a table is grounded in the ungrounded existence of the property of *being a* T_1 *or a* T_2 *or a* T_3 *or …*, which is compatible with Purity.

Mereology, etc. The appeal to logical form is a special case of a more general idea: that the grounds of a grounding fact $A \twoheadrightarrow B$ might include internal relationships between the facts A and B. Relations of logical form are one sort of internal relationship; another is relations of parthood or constituency. For example, those who think that Socrates's existence grounds the existence of his singleton set might hold that this grounding fact is partly or fully grounded in the fact that Socrates is a member of his singleton set.

Exactly which internal relationships? We needn't say. I continue to insist on the appropriateness of specifying the kinds of facts that can ground grounding facts without supplying a formula that is applicable in all cases.[24]

Metalinguistic facts Logical form was available to help ground (1) because (1) is a case of "logical grounding", and holds at least in part by virtue of its logical form: all disjunctions are grounded by their true disjuncts. Other cases, for instance those connecting levels, have nothing to do with logical form. For instance, in the grounding fact $T_1 a \twoheadrightarrow Ta$ (a is a table in virtue of possessing the realizing property T_1), there is no logical connection between $T_1 a$ and Ta. Similarly for $Q \twoheadrightarrow N$.

Extensional and modal facts (as well as, perhaps, nonlogical internal relations between groundee and grounder, though this seems less likely), are of course still available to help ground levels-connecting grounding facts. But there is another sort of fact that may well also be relevant. Perhaps part of what ties T_1 to T, part of what makes T_1 a sufficient condition for T, are metalinguistic facts about how the word 'table' is used, about the environment surrounding our usage of 'table', about the history of our usage of that term, and so on. Various philosophers have put forward various ideas about the sources of meaning, the facts that attach our words to bits of the world, and any of these facts might be regarded as partly grounding levels-connecting facts about ground.[25] [26]

[24]Kovacs (2016) defends a "lightweight" conception of ontological dependence (a close cousin of ground) in which mereological relations play a central role. Also meshing with the spirit of the present paper is Kovacs's insistence that a lightweight account need not give necessary and sufficient conditions for ontological dependence. (His defense of the propriety of this stance is different from mine.)

[25]See Fodor (1987); Lewis (1984); Millikan (1989), and myriad other works.

[26]This idea could take different forms. Metalinguistic facts might be said to directly ground

It's straightforward to continue drilling down from metalinguistic facts to pure grounds; such facts don't present any particular conflict with Purity.

Some will reject the idea that any fact having anything to do with words could help ground $T_1 a \twoheadrightarrow Ta$. Facts about the grounding of tablehood, they will say, concern only the nonlinguistic part of the world, and could have held if different or even no languages had existed.

Now, I don't think this objection is clearly right. Given the tight connection between ground and explanation—a connection that might even be identity—it would be unsurprising if facts about ground turned out to involve language, human beings, and their connection with their environment in certain ways. Also, metalinguistic partial grounds of facts about the grounding of table-facts wouldn't imply the existence of metalinguistic partial grounds of the table-facts themselves.

In any case, it doesn't matter much whether the objection is right. For suppose it is. Then we must clearly separate the operation of meaning-determining facts from the operation of ground: the meaning-determining facts play only the role of content-selection, associating contents with words; ground is a relation on the contents thus selected, a relation that is blind to the manner of selection, concerning only non-metalinguistic features of the contents. Fine; but then, some of the work we might have thought was to be accomplished by ground must instead be accomplished by metalinguistic facts.

For instance, suppose the metalinguistic facts associate the disjunctive fact $T_1 a \vee T_2 a \vee \ldots$ with the sentence 'Ta'. The grounding fact $T_1 a \twoheadrightarrow Ta$ would then be a case of logical grounding after all: the fact Ta would just *be* the disjunctive fact $T_1 a \vee T_2 a \vee \ldots$, which is grounded in its disjunct $T_1 a$.[27] The non-metalinguistic nature of the grounding fact $T_1 a \twoheadrightarrow Ta$ has thus been secured. But there still remains a question of the connection between the disjunction $T_1 a \vee T_2 a \vee \ldots$ and Ta. That question can no longer be understood as a question about facts since as facts these are identical. But the question obviously still remains, however we conceptualize it—perhaps as a question

$T_1 a \twoheadrightarrow Ta$, the idea being that there is a direct realization relation between T_1 and T that is partly metalinguistic in nature. Alternatively, it might be said that T_1 realizes, in an entirely nonmetalinguistic sense, a certain functional property F, so that $T_1 a \twoheadrightarrow Fa$ is grounded by facts having nothing to do with language; but nevertheless, metalinguistic facts help ground $Fa \twoheadrightarrow Ta$, the idea being that they attach F to 'table' and hence to tablehood. $T_1 a \twoheadrightarrow Fa$ and $Fa \twoheadrightarrow Ta$ would then ground $T_1 a \twoheadrightarrow Ta$ (the latter would be a case of mediate ground in Fine's (2012) sense).

[27] Here I assume that ground is a relation between facts.

about sentences or about concepts. Moreover, the remaining question is clearly akin to other questions that we answer with ground. Even though we can no longer say that a's being a table is grounded in a's either being a T_1 or a T_2 or ..., it's still entirely natural to say that a is a table *because* a is either a T_1 or a T_2 or .... And the answer to the question will appeal to metalinguistic facts. We don't properly understand the way the levels are connected, given the above setup, unless we bring in the fact that 'Ta' expresses the disjunctive fact $T_1a \vee T_2a \vee \ldots$.

Pure grounding facts The friend of ground might even claim that the pure grounds of (1) include certain grounding facts. This would be consistent with Purity if those grounding facts involved only fundamental concepts. It might be held, for instance, that (1) is partially grounded in:

(9) $(T_1a \vee T_2a \cdots) \rightarrow ((T_1a \vee T_2a \cdots) \vee (C_1a \vee C_2a \cdots))$

This would require, however, claiming that ground itself is a fundamental concept. It would involve regarding grounding as a sort of super-added force, if only a force restricted to "pure" facts involving only fundamental concepts.

Although some grounding theorists may favor this position, I don't. The most convincing argument for the indispensibility of ground is that ground is needed as a levels-connector. It is this function of ground, for instance, that lets us give suitable statements of sweeping metaphysical theses like moral naturalism.[28] This aspect of ground's role does not call, however, for a metaphysically fundamental concept of ground.[29] Second, given Purity, the vast majority of grounding facts require grounds, even if grounding is claimed to be a fundamental concept. So the position doesn't buy us much extra "oomph". The added oomph is only for "logical" and "mathematical" grounding (of disjunctions by disjuncts, of the existence of $\{a\}$ by the existence of a, and so forth). My own tastes call for reducing this trickle of oomph to patterns, in some Humean fashion. But to each her own.

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[28] See Rosen (2010, section 2), for example.

[29] See my Sider (2017, chapter 1) for further discussion, including a defense of this aspect of ground against Wilson's (2014) assault.

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