

## *An Introduction to Grounding*

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### **1. Introduction**

Consider the fact that there was a global economic recession in 2008. A causal explanation of this fact specifies facts that were causally responsible for the economic meltdown or facts on which the meltdown counterfactually depends such as the occurrence of predatory lending, deregulation of financial institutions, weak underwriting practices, and so on. It seems that a metaphysical explanation of this fact, on the other hand, shows us why the global economic situation in 2008 counted as a recession in the first place. In this case, an *explanans* is the fact that 2008 was marked by severe declines in consumption, investment, government spending, and export activity.

Suppose that you currently have a brain state that is an experience as of motion, and someone asks, ‘Why are you having that experience rather than one of a different type?’ On the causal/counterfactual reading of the question, an appropriate response might be ‘A raven just flew by.’ On the metaphysical reading, the questioner wants to know what it is in virtue of which you’re having an experience as of motion, and it would seem that the raven fact isn’t a candidate *explanans* in this case. According to non-reductive physicalism, in the actual world the mental properties are ultimately instantiated in virtue of certain physical properties (cf. Levine (2001: Ch. 1) and Loewer (2001)). For the non-reductive physicalist a candidate (partial) *explanans* is, for example, the fact that there is recurrent activity of a certain sort between your V1 and MT/V5 neural structures.

One diagnosis of the contrast in the two cases above is this: in causal explanations the *explanans* and *explanandum* are connected through a causal mechanism, while in metaphysical explanations they’re connected through a constitutive form of determination, that of *grounding* (cf. Fine (forthcoming)). There is a burgeoning literature on grounding. The primary goal of this chapter is to set out and clarify some of the central issues and disputes concerning this notion. In the course of the chapter I’ll weigh in on certain positions, treat others as working assumptions, and remain neutral on others. In some cases philosophers either explicitly endorse or reject the positions I discuss, while in other cases the positions have yet to be discussed in any detail.

The plan for the chapter is as follows. I begin by distinguishing two general approaches to grounding – on one our talk of grounding in philosophy is univocal, and on the other it isn't – and consider different ways in which each view might be further developed (§2). Then I consider the logical form of grounding statements as well as the structural principles that govern grounding (§3–4). Next, I take up the matter of how the notions of grounding, modality, and reduction interact (§5–6). I close with a brief discussion of the grounds for what grounds what (§7).

## 2. Is grounding talk univocal?

Many philosophical theses in addition to non-reductive physicalism are naturally cast in terms of grounding vocabulary: maximalism about truthmaking (for any true proposition, something *metaphysically explains* why that proposition is true), priority pluralism (the existence and nature of wholes are *posterior* to the existence and nature of their constituent mereological atoms), non-reductive naturalism about moral properties (in the actual world moral properties are ultimately instantiated *in virtue of* natural properties), and so on. A natural starting point in thinking about grounding is this: is there a single dependence notion corresponding to the various grounding expressions in theses like those listed above?

One view is that grounding is *univocal* in that there is but a single dependence notion in play here. This is the view recommended by the diagnosis of the contrast I began the chapter with. The contrasting claim is that grounding is *equivocal* in that these theses traffic in multiple dependence notions marking different phenomena. In this section I consider different ways of developing each of these views along the following dimensions of difference: (i) the possibility of analysis, (ii) the relation to ordinary, everyday thinking, (iii) the relation to notions we already accept in discussions of dependence in philosophy, and, (iv), assuming that grounding is equivocal in the sense specified above, how our various grounding notions are related to one another. Let a notion be *primitive* just in case it can't be analysed in terms of other notions, *quotidian* just in case it figures in ordinary, everyday thinking, and *orthodox* just in case it already has currency in discussions of dependence in philosophy.

We begin with the view that grounding is univocal. Both Witmer et al (2005) and Rosen (2010) claim that grounding is both univocal and primitive. Given their discussion of grounding claims from both philosophical and ordinary discourse, Witmer et al think that grounding is quotidian, while Rosen is naturally read as claiming that it's non-quotidian instead. Schaffer (2009) also agrees that grounding is both univocal and primitive and can be interpreted as claiming that grounding is orthodox as well. In his view grounding has played an important role in the history of philosophy and it traces all the way back to Plato and Aristotle. Raven

(forthcoming) agrees that grounding has a venerable historical pedigree and suggests that grounding, like causation, is such that we have some ordinary understanding of it. So on Raven's view grounding is orthodox and (somewhat) quotidian.

Bricker (2006), Leuenberger (manuscript), and Skiles (manuscript) claim that grounding is univocal and non-primitive. Bricker recommends an analysis of grounding in terms of supervenience and absolute fundamentality or perfect naturalness, Leuenberger in terms of his notion *ceteris absentibus* sufficiency, and Skiles in terms of metaphysical analysis. Absolute fundamentality, *ceteris absentibus* sufficiency, and metaphysical analysis are non-quotidian and relatively non-orthodox notions.

Now we turn to the view that grounding is equivocal, the thesis that there are multiple dependence notions marking different phenomena corresponding to the various grounding expressions in the sorts of theses mentioned above. Fine (forthcoming) is sympathetic with this view. He claims that there are various heterogeneous grounding notions, for grounding considered as a generic relation is akin to a disjunction of special relations. Fine apparently thinks that none of the various grounding notions are amenable to analysis, and all are non-quotidian and non-orthodox. Hofweber (2009) also claims that there are various heterogeneous grounding notions, but he is naturally read as claiming that each can be analysed. Hofweber's view is something like this: the notion of grounding<sub>1</sub> is analysable partly in terms of conceptual priority, grounding<sub>2</sub> in terms of modal entailment, and so on. He claims that, while several heterogeneous grounding notions figure in everyday thinking, there is no 'special metaphysical sense' of 'ground' (2009: 271). Hence, Hofweber is naturally read as claiming that the various grounding notions are all quotidian and orthodox. I read Daly (forthcoming) and Wilson (manuscript) as endorsing similar packages of views.

One might claim that, while there are various grounding notions, they are all unified in an important sense. Consider the primitivist view of colour according to which our colour concepts can't be analysed. Though the primitivist takes the concepts of red and blue, for example, as primitive, these notions are importantly related, for it's a priori that any red thing is coloured, and any blue thing is coloured. More specifically, the semantic values of these concepts are determinates of the determinable property of being coloured. Perhaps the advocate of the claim that grounding is equivocal and the various grounding notions are primitive but unified would make a corresponding claim. And perhaps the advocate of the claim that grounding is equivocal who thinks that the various grounding concepts are unified and analysable would claim that there is a primitive, general concept of grounding, and the notions of grounding<sub>1</sub>, grounding<sub>2</sub>, and so on are species of it. In this case, grounding<sub>1</sub> is analysable as 'grounding + differentia<sub>1</sub>', grounding<sub>2</sub> as 'grounding +

differentia<sub>2</sub>', and so on. Some of those relations Bennett (2011a) calls *building* relations (e.g. singleton set formation, constitution, and realisation) are natural candidates for the semantic values of the various grounding concepts in this case. If, for example, the notion of grounding<sub>1</sub> expresses the relation of constitution, then perhaps differentia<sub>1</sub> concerns spatial coincidence; and, if grounding<sub>2</sub> expresses the realisation relation, then presumably differentia<sub>2</sub> concerns role-properties and their corresponding role-fillers. If our various grounding concepts express building relations, presumably these notions are orthodox and relatively non-quotidian.

Which package of views is the most plausible? The issues here are obviously complex. To give you a taste of how one small part of the discussion might go, consider the view according to which grounding is equivocal, and our various grounding notions are analysable in terms of the following "safe" notions: composition, conceptual priority, supervenience, and modal entailment. I think it's fairly clear that this view is false, for there are various coherent (if not true) philosophical accounts and theses formulated in terms of grounding vocabulary, and we would end up with *importantly different theses* were we to formulate them instead in terms of the *analysans* listed above.

Let's return to non-reductive physicalism according to which in the actual world mental properties are ultimately instantiated in virtue of physical properties. In this case, what is the non-reductive physicalist saying about how the mental and physical are related? It's widely agreed that non-reductive physicalism isn't a thesis about what composes what, and many claim that it doesn't require an a priori connection between the mental and physical. Hence, it would seem that grounding in this context isn't to be understood in terms of composition or conceptual priority.

What about supervenience and modal entailment? Most non-reductive physicalists take the existence of the explanatory gap between the mental and the physical (roughly speaking, our impression that the phenomenal facts in particular just aren't to be explained in terms of the relevant physical facts, whatever they might turn out to be) as a prima facie reason to reject the thesis (cf. Chalmers (2010: Ch. 1) and Levine (2001: Ch. 3)). This suggests that there is a close connection between grounding and explanation, an idea that I take up in detail later. As was noted years ago, however, there isn't a corresponding connection between explanation and either supervenience or modal entailment (cf. Lepore and Loewer (1989) and Horgan (1993)). Hence, if we formulate non-reductive physicalism in terms of either of these notions, we end up with an importantly different thesis, one that isn't essentially explanatory in nature.

Corresponding arguments against the equivocation view under discussion can be made with respect to characterisations of intrinsicity (cf. Rosen (2010) and Witmer

et al (2005)), the formulation of truthmaking principles (cf. Schaffer (2010a)), and how to cast three/four-dimensionalism concerning the nature of material objects (cf. Fine (forthcoming) and Raven (forthcoming)).

So how should we proceed with respect to the univocal/equivocal dispute? Later I consider a version of the equivocation view that distinguishes grounding proper and metaphysical explanation. But apart from this possibility, for the purposes of this chapter I assume that talk of grounding in philosophical discourse is otherwise univocal, and by ‘grounding’ I mean full grounding rather than partial grounding unless otherwise noted. (The distinction between mere partial and full grounding doesn’t count as a substantive sense in which our grounding talk is equivocal.) Though I won’t defend the univocality assumption here, I think it’s a reasonable starting point. For, just as our default position with respect to our talk of synchronic identity, causation, parthood, and the like is one of univocality, the same is true of grounding. As for whether grounding is primitive, quotidian, and orthodox, I leave these matters open.

### **3. What is the logical form of grounding statements?**

In this section I discuss different takes on how best to regiment the notion of grounding. Consider the following three examples of grounding vocabulary: ‘ground’, ‘because’, and ‘in virtue of’. On the syntactical surface level, the verb ‘ground’ is a relational predicate, ‘because’ is a sentential connective, and ‘in virtue of’ is a sentence-forming operator that requires a sentence as its first argument and a singular term as its second. Hence, on the surface level grounding vocabulary comes in different syntactic guises. The debate concerning the logical form of grounding statements concerns which of these guises (or still some different one) is the most fundamental. In other words, the debate is about which guise is involved in the ultimate representation of grounding talk in the best semantic theory.

Some argue that our best semantic theory will treat grounding expressions as predicates introducing a certain relation(s). If the relation view is correct, it makes sense to ask what kinds of things grounds are. Others argue that grounding expressions ultimately behave like non-truth-functional sentential connectives. On this view it’s ultimately misguided to ask what kinds of things grounds are assuming that there is no relation expressed by grounding expressions to relate any such relata. It’s important to realise that the latter view isn’t the view that the relata of grounding are sentences; this would be to treat grounding expressions instead ultimately as predicates introducing a relation that holds between sentences. Such a view is a version of the view that the best regimentation of grounding is one according to which the term introduces a relation. (It’s open for the proponent of the connective view to add that, non-ultimately speaking, we may well talk about a relation of

grounding, for we can define a relational predicate in terms of the sentential connective.)

Consider, for example, the sentence ‘{Socrates} is grounded in Socrates’. Advocates of the relation and connective views (we will assume) agree that this sentence is true, but they differ on whether it ultimately involves a relation holding between certain entities (e.g. {Socrates} and Socrates, or the fact that {Socrates} exists and the fact that Socrates exists), or whether it is best expressed without any relational terms (e.g. ‘{Socrates} exists because Socrates does’, or some other sentence with a sentential connective).

We find a corresponding debate in the literature on truthmaking. Truthmaking enthusiasts tend to agree that propositions are the bearers of truth. And they also tend to agree, for example, that (i) the truth of the proposition that the rose is red is explained by the redness of the rose, and (ii) the proposition that the rose is red is true because the rose is red. Rodriguez-Pereyra (2005) and others argue that (i) with its nominalisations of the adjectives ‘true’ and ‘red’ more closely approximates the logical form of truthmaking statements, and this suggests that talk of truthmaking introduces a relation. As a relation, truthmaking relates entities – truthmakers (whatever these might be) and propositions. By contrast, Hornsby (2005) and others argue that (ii) more closely approximates the logical form of truthmaking statements, so truthmaking expressions ultimately behave like non-truth-functional sentential connectives. If this is right, there is no reason to believe that truthmaking requires truthmakers. With this disagreement in mind, a gloss of the difference between the relation and connective views with respect to grounding is this: on the former the ultimate representation of grounding talk requires both grounding entities and grounded entities, while on the latter it requires neither.

Defenders of the connective view include Correia (2010) and Fine (forthcoming), and they prefer it on the basis of its ontological neutrality. Defenders of the relation view, on the other hand, include Rodriguez-Pereyra (2005) and Schaffer (2009). Rodriguez-Pereyra (2005) offers several arguments for the relation view. One turns on the nature of explanation. According to Kim (1994), Ruben (1990: Ch. 7), and others, successful explanations track or are backed by dependence relations, both causal and non-causal. Rodriguez-Pereyra argues that, since this tracking conception of explanation is correct, successful metaphysical explanations track some relation(s). Grounding is the obvious candidate for the relation such explanations track.

In this chapter I’ll work with the relation view, in part because I’m sympathetic with the tracking conception of explanation described above. Assuming the relation view, what are the relata of grounding? Those who endorse the relation view tend to think that facts stand in the grounding relation, so the question is really whether entities

from other ontological categories stand in the relation as well. (The identity relation is categorically neutral in this sense, provided that there is an identity relation.)

Should we endorse the fact view or neutral view? Those who claim that the relata of the grounding relation are restricted to facts (e.g. Audi (forthcoming) and Rosen (2010)) might say that their opponents who claim that the relation is categorically neutral (e.g. Cameron (2008) and Schaffer (2009) and (2010a)) aren't properly distinguishing between grounding proper on the one hand and ontological dependence in something like Fine's (1995) sense on the other. The idea is that the fact view reasonably targets grounding proper, while the neutral view reasonably targets ontological dependence. This is a special case of a general strategy worth further thought: we appeal to various dependence notions in philosophical discourse and we can plausibly recast certain disagreements concerning grounding as involving reasonable stances that target the semantic values of different dependence notions. This would allow us to ecumenically resolve various disputes.

What more can we say about this dispute? Let's return to the idea that successful metaphysical explanations track grounding relations. Expanding on this idea, Rodriguez-Pereyra writes, 'Explanation is not and does not account for grounding – on the contrary, grounding is what makes possible and “grounds” explanation' (2005: 28). Here the claim seems to be that the facts about what grounds what themselves ground the facts about what metaphysically explains what. On this view, grounding proper and metaphysical explanation are distinct relations. Recall the view that grounding is equivocal in the sense that there is more than one dependence notion marking different phenomena corresponding to the various grounding expressions in the sorts of grounding claims described earlier in the chapter. If the notions of grounding proper and metaphysical explanation express different relations, it seems that grounding is equivocal in just this sense. An alternative view – one compatible with our grounding talk being univocal – is that the grounding facts and the metaphysical explanation facts are the same facts. In this case, grounding proper just is metaphysical explanation. Notice that the identity view fits well with the view according to which the relata of grounding are restricted to facts. For, if for one fact to be grounded in another just is for the latter to metaphysically explain the former, then, assuming that explanation is a relation between facts, the same is true of grounding. If the grounding relation and the relation of metaphysical explanation are distinct, however, then a restriction to facts in the case of metaphysical explanation seems well motivated, while matters aren't so clear in the case of grounding.

One might argue against the claim that grounding is categorically neutral as follows. Whether or not grounding and metaphysical explanation are the same, we can all agree that there are contexts in which citing a ground for a fact (assuming that there are such things as facts) suffices to metaphysically explain why that fact obtains.

Suppose that grounding is categorically neutral, and in particular that objects can ground facts. Let's suppose in particular that the fact that thus-and-so is grounded in a substance named 'Kelly'. The problem is that there is no context in which citing Kelly suffices to metaphysically explain any fact. The reason is that Kelly just doesn't have the right kind of structure to be an *explanans* of anything. Sider (2012: Ch. 8) makes a similar point when he claims that it's hard to see how from merely listing substances we could answer questions such as 'Are there helium molecules?', 'Are there cities?', and so on. And Dasgupta (manuscript-a) is on to the same point in claiming that it makes no grammatical sense for a table, for example, to explain anything. He claims that the fact that the table exists or the fact that it has various properties might explain something, but not the table itself.

Two disputes concerning how to regiment grounding that I don't have the space to discuss in any detail concern its adicity and whether its relata or arguments are singular or plural in nature. For the purposes of this paper I will assume, following Audi (forthcoming), Rosen (2010), and others, that the logical form of grounding statements is  $[p]$  is grounded in  $\Delta$ , where  $[p]$  is the fact that  $p$ , and  $\Delta$  a plurality of facts. A plurality can have a single member, so it's fine to speak of one fact being grounded in another fact. Here is a sampling of other views. Schaffer (2009) claims that grounding is a binary relation whose relata are singular, while Schaffer (forthcoming) and Jenkins (2011) reject the binary view and argue that grounding is instead a quaternary relation. Dasgupta (manuscript-b) argues that grounding talk is best understood as introducing an operator that takes pluralities of sentences as arguments. In this case, the logical form of grounding statements is  $\Pi$  because  $\Delta$ , where  $\Pi$  and  $\Delta$  are pluralities of sentences. Still another view is that grounding is variably polyadic, as Fine (forthcoming) claims.

#### **4. What structural principles govern grounding?**

In this section I aim to communicate and clarify some major points of discussion with respect to the structural principles that govern grounding. To begin, a common assumption is that grounding, like proper parthood, is irreflexive, asymmetric, and transitive, and as such imposes a strict partial ordering on the entities in its domain (see, e.g., Audi (forthcoming), Cameron (2008), Raven (forthcoming), Rosen (2010), and Schaffer (2010b)).

As we've noted, if one fact is grounded in another, there are conditions in which citing the latter suffices to explain the former. The fact that grounding is systematically connected with explanation in this way suggests that grounding, like explanation generally speaking, is asymmetric. There are, however, putative counterexamples to the asymmetry of grounding discussed in the literature. Here is one I adapt from Rodriguez-Pereyra (2005): [this fact obtains] is grounded in [[this

fact obtains] obtains] and vice versa. Putting the case in terms of propositions rather than facts, such a case, in his view, is one ‘in which the truth of a proposition depends on its subject matter and vice versa’ (2005: 22). For what it’s worth, my intuition is that this case functions better as an illustration of the *asymmetric* nature of grounding. While the latter fact is grounded in the former, the former isn’t grounded in the latter.

The fact that grounding is systematically connected with explanation in the manner discussed above also suggests that grounding is irreflexive on the assumption that nothing explains itself. Four challenges to irreflexivity, however, are as follows. First, Lowe (1998: 145) suggests that ‘self-explanatory states of affairs’ are epistemically possible, so a characterisation of grounding shouldn’t rule this out. This is just to deny the intuitive claim that explanation is irreflexive. Second, Fine (2010) discusses the following case. It’s a trivial matter that everything exists. Any particular fact is a partial ground for this fact. The fact that everything exists is a particular fact, so the fact that everything exists is a partial ground for itself. Third, Paseau (2010) points out that, on the assumption that the existence of any set is grounded in the existence of its members, any self-membered set (e.g.  $g = \{g\}$ ) is such that the fact that it exists grounds itself. One option here is to say that the notion of grounding applies only to the iterative notion of the set. On this conception a non-empty set is *constructed out of* or *founded on* its members. Fourth, Jenkins (2011) notes that if, as is standard to assume, irreflexivity is a feature of binary relations but grounding is a quaternary relation as she suggests, it’s inappropriate to describe grounding as irreflexive. In his defence of a quaternary conception of grounding, however, Schaffer (forthcoming) understands irreflexivity as a binary principle holding between pairs of entities.

Now we turn to transitivity. Schaffer (forthcoming) proposes various putative counterexamples to the transitivity of grounding understood as a binary relation. One of his examples is this. Consider the following three facts: (i) [the ball is dented in a particular way], (ii) [the ball has a certain determinate shape], and (iii) [the ball is more-or-less spherical]. Intuitively, (iii) is grounded in (ii), (ii) is grounded in (i), yet (iii) isn’t grounded in (i). Three responses to this putative counterexample to transitivity are as follows. First, you might claim that this example equivocates on full and mere partial grounding. Returning to our case, the idea is that, while (iii) is (fully) grounded in (ii), and (ii) is merely partially grounded in (i). There is an easy fix, however: let the third fact instead be [the ball is spherical or Hong Kong is a city]. In this case, (iii) is merely partially grounded in (ii). Second, let’s return to the idea that grounding proper and metaphysical explanation are distinct relations. You might argue that the fact that metaphysical explanation is non-transitive shouldn’t be surprising, given the epistemic and pragmatic components involved in producing and evaluating explanations. So it’s natural to interpret Schaffer’s case as targeting metaphysical explanation. This is compatible, however, with grounding proper being

transitive. Third, Litland (manuscript) argues that (iii) in its original form is indeed partially grounded in (i). Part of his proposal appeals to the distinction between explaining *why* and explaining *how*. He claims that, while (i) doesn't help metaphysically explain why (iii) obtains, it does help metaphysically explain how (iii) obtains, how that fact exists. As such, (iii) is partially grounded in (i).

What other structural principles might apply to grounding? Some claim that grounding is *well founded*. In standard use, a relation  $R$  on a set  $X$  is well founded just in case every non-empty subset of  $X$  has a *minimal element*. A minimal element of an ordered set  $X$  is an element of  $X$  that is less than or equal to every element of  $X$ . When philosophers claim that it's necessary that grounding chains terminate, they mean that grounding is well founded in this sense. By contrast, a *lower bound* for a subset  $Y$  of an ordered set  $X$  is an element of  $X$  which is less than or equal to every element of  $Y$ . Notice that a lower bound of a set with respect to an ordered superset may not be a member of the first set. It seems that some philosophers understand the claim that grounding is well founded instead as the claim that it's necessary that grounding chains have lower bounds (cf. Cameron (2008)). If grounding is well founded in this sense, infinite grounding chains are allowed, each of whose elements is grounded by facts not in the chain.

Why think that grounding is well founded in either sense? Lowe finds 'the vertiginous implications of [the thesis that grounding isn't well founded] barely comprehensible' (1998: 158). Schaffer's rationale for the claim that grounding is well founded is that there must be, as it were, a ground for being, for 'if one thing exists only *in virtue of* another, then there must be something from which the reality of the derivative entities ultimately derives' (2010b: 37). In the case of endless grounding, 'being would be infinitely deferred, never achieved' (2010b: 62). Others, however, aren't so sure. Rosen finds nothing obviously wrong with the idea that grounding isn't well founded. He claims that, for all we know, 'the facts about atoms are grounded in facts about quarks and electrons, which are in turn grounded in facts about "hyperquarks" and "hyperclectrons", and so on ad infinitum' (2010: 116). (Notice, however, that Rosen's remarks here are compatible with the idea that grounding chains must have lower bounds.) Bliss (manuscript) argues that one potential motivation for the claim that grounding is well founded – appeals to variations of the principle of sufficient reason – is misguided. Bohn (manuscript), Morganti (2009), and Orilia (2009) each reject the claim that grounding is well founded; and Cameron (2008) suggests that we're only warranted in thinking that grounding chains have lower bounds in the actual world.

Putting the controversy concerning whether grounding is well founded to the side, many agree that grounding is *non-monotonic* (see, e.g., Audi (forthcoming), Rosen (2010), and Raven (forthcoming)). On the view that the relata of grounding are

restricted to facts, the claim is that, if one fact is grounded in another, it doesn't follow that, for any third fact compatible with the first two, the first is also grounded in the plurality consisting of the second and third. For example, if [ $\{Socrates\}$  exists] is grounded in [Socrates exists], it doesn't follow that [ $\{Socrates\}$  exists] is also grounded in the plurality consisting of [Socrates exists] and, say, [Hong Kong is a city]. The idea is that the explanatory nature of grounding secures its status as a non-monotonic relation. As Dasgupta (manuscript-b) puts the point, given that all parts of an explanation must be explanatorily relevant, adding irrelevant information defeats the initial explanation. This route to securing non-monotonicity makes the most sense on the view we discussed above that the facts about what grounds what and the facts about what metaphysically explains what are the same facts. Matters are less clear, however, on the view that the facts about what grounds what themselves ground the facts about what metaphysically explains what. This view on the face of it is compatible with metaphysical explanation being non-monotonic and grounding monotonic.

Many also agree that the grounding locution is *hyperintensional* (see, e.g., Jenkins (2011) and Schaffer (2009)). It is easiest to make sense of this claim on the connective view of the logical form of grounding statements. Consider the sentences 'Socrates exists' and ' $\{Socrates\}$  exists'. Even though they are intensionally equivalent, substituting one for the other turns the true grounding statement ' $\{Socrates\}$  exists because Socrates exists' into 'Socrates exists because Socrates exists', which is false. This hyperintensionality lends strong support to the claim that the grounding locution is not analysable purely in terms of supervenience, modal entailment, and the like, for the latter are intensional in nature. The thesis that grounding is non-monotonic has similar implications.

## 5. What are the modal consequences of grounding?

Now we turn to the matter of how grounding and modality interact. *Necessitarianism* very roughly is the thesis that grounding carries modal entailment; according to *contingentism*, necessitarianism is false. Leuenberger (manuscript), an advocate of contingentism, stresses that the fact that grounding is a determination relation doesn't by itself give us reason to think that necessitarianism is correct, for it's widely agreed that causation is a contingent determination relation. And Schaffer (2010a) claims that, since grounding is categorically neutral, grounding and modal entailment can come completely apart; hence, necessitarianism is false. This, however, may be too quick. One way to formulate necessitarianism appeals to the idea that each entity (regardless of its ontological category) corresponds to a unique fact: if one entity is grounded in another, then any metaphysically possible world in which the fact corresponding to latter obtains is a world in which the fact corresponding to former obtains. This view has content only if we specify the relevant sense of

correspondence. Here are some suggestions: for any sentence  $s$ , the fact corresponding to  $s$  is  $[s]$ ; for any event  $e$ , the fact corresponding to  $e$  is  $[e \text{ occurs}]$ ; for any fact  $f$ , the fact corresponding to  $f$  is  $f$  itself; and so on. If we can specify the correspondence relation for entities of each ontological category, necessitarianism is compatible with the neutral view of grounding. We're assuming, however, the fact view, so for our purposes necessitarianism is the thesis that, if one fact is grounded in another, then every metaphysically possible world in which the latter obtains is a world in which the former obtains as well.

Why think that necessitarianism so understood is true? deRosset (2010) endorses necessitarianism because in his view grounds metaphysically explain what they ground, and the *explanans* in a successful metaphysical explanation modally entails its *explanandum*. For others (e.g. Audi (forthcoming), Cameron (2010), Correia (2011), Rosen (2010), Witmer et al (2005)), necessitarianism is simply regarded as a plausible assumption supported by reflection on paradigm examples of grounding. My sense is that such theorists tend to think that to separate grounding and modal entailment completely would be to render the former theoretically unconstrained in a way that's best to avoid. In Trogdon (forthcoming) I argue that certain epistemic considerations support the idea that  $[p]$  is grounded in  $\Delta$  only if there are certain essential truths (in Fine's (1994) sense) characteristic of  $[p]$ ,  $\Delta$ , the plurality consisting of  $[p]$  and  $\Delta$ , or the entities they involve according to which, if the members of  $\Delta$  obtain,  $[p]$  obtains as well. Assuming that essential truths are metaphysically necessary, necessitarianism follows.

There are, however, potential counterexamples to necessitarianism. I'll consider three. The first is due to Dancy (2004: Ch. 3). Suppose you reason as follows: (i) I promised to  $\phi$ , (ii) my promise wasn't given under duress, (iii) I'm able to  $\phi$ ; therefore, (iv) I ought to  $\phi$ . Suppose further that each of the premises and the conclusion are true. Dancy suggests that (i) gives you a reason to commit the action, while (ii) and (iii), though not providing reasons themselves, jointly enable (i) to do so. A natural way of translating this into talk of grounding (what Dancy calls 'resultance') is to say that, while  $[you \text{ promised to } \phi]$  grounds  $[you \text{ ought to } \phi]$ ,  $[your \text{ promise wasn't given under duress}]$ ,  $[you're \text{ able to } \phi]$ , and additional relevant facts jointly enable the promise-fact to ground the obligation-fact. Since the former doesn't modally entail the latter, we have a putative counterexample to necessitarianism. This proposal requires that we take the distinction between grounding and enabling conditions as a genuine metaphysical distinction rather than a purely pragmatic one. Chudnoff (manuscript) defends the distinction as a metaphysical one, though the fact that the corresponding distinction in the case of causation is almost certainly pragmatic seems to count against this idea.

The second potential counterexample to necessitarianism I adapt from Schaffer (2010a). Let's grant for the sake of argument a substance/mode (trope) ontology. Consider, for example, the connection between a rose qua substance and its particular redness qua mode. Modes are dependent modifications of substances, and a natural way to translate this into grounding talk is to say that [the particular redness exists] is grounded in [the rose exists]. If this is right, however, then necessitarianism is false, given that it's not the case that the latter modally entails the former. The necessitarian might respond that [the particular redness exists] is merely partially grounded in [the rose exists], and necessitarianism applies to full grounds. Here the idea is that [the particular redness exists] is fully grounded in two facts: [the rose exists] and [the rose is a particular shade of red]. I think a better response, however, is this: (i) [the rose exists] is explanatorily irrelevant to [the particular redness exists], (ii) if one fact is partially grounded in another, the latter is explanatorily relevant to the former; hence, (iii) [the particular redness exists] isn't even partially grounded in [the rose exists]. This is Schneider's (2006a) view; he argues that, while the existence of the rose is a necessary condition for the existence of the particular redness, [the particular redness exists] is fully grounded in [the rose is a particular shade of red].

The third potential counterexample I adapt from Schneider (2006b): [Xanthippe became a widow] is grounded in [Socrates died], yet the latter doesn't modally entail the former given that there are possible worlds in which they were never married. The initial response we considered to the second potential counterexample is worth considering here. The proposal in this case would be that [Xanthippe became a widow] is merely partially grounded in [Socrates died]; the former is fully grounded in two facts: [Socrates died] and [Socrates and Xanthippe were married].

## **6. What is the connection between grounding and reduction?**

Having taken up the matter of how grounding and modality interact, in this penultimate section we turn to the same question with respect to grounding and reduction. Is there a substantive sense in which the grounded reduce to what grounds them? Audi (forthcoming) doesn't think so. He states that '...grounded facts and ungrounded facts are equally real, and grounded facts are an "addition of being" over and above the facts in which they are grounded', adding that the grounded are no more or less "ontologically innocent" than what grounds them (forthcoming: 1).

What more can we say about this matter? I'll consider three ways of explicating reduction that have different consequences for the connection between grounding and reduction. First, we might characterise reduction in terms of identity. Put in terms of facts, the idea is that [*p*] reduces to [*q*] just in case [*p*] is the same fact as [*q*] (cf. deRosset (2010) and Sider (2003)). On the identity conception, reduction, of

course, has the structural features of identity: reflexivity, symmetry, and transitivity. Were grounds to reduce to what grounds them in this sense, facts would ground themselves. If grounding is irreflexive, however, then no fact grounds itself. Hence, if grounding is irreflexive then on the identity conception of reduction the grounded fail to reduce to their grounds.

Second, we might characterise reduction in terms of fundamentality. Consider the notion of ontological economy or parsimony, which is analogous to that of conceptual economy. It would seem that the number of theoretical terms a theory countenances is not in general a good guide to its conceptual economy. What is more important is the number of its primitive notions in terms of which the others are characterised; generally speaking, the less primitive notions a theory countenances, the more conceptual economy it has. In the same way, the number of entities a world contains in general is not a good guide to its ontological economy, or so the idea goes. What is more important is the number of *fundamental* entities it contains. Generally speaking, the less fundamental entities a world contains, the more ontologically parsimonious it is (cf. Schaffer (manuscript)). (There are, however, important differences between conceptual and ontological economy. For example, given an analysis of one term in terms of another, the former is dispensable from the statement of the theory in which it occurs without sacrificing expressive or descriptive power. But the grounding of one fact in another doesn't underwrite this sort of dispensability; a theory that mentions the former will generally be descriptively more powerful than an otherwise similar one that doesn't mention this fact.)

Let's assume that an entity is fundamental just in case it isn't grounded in anything. A world's fundamental entities make an *ontological impact* in the sense of being directly relevant to how ontologically parsimonious that world is. With this conception of ontological impact – what I call *direct* ontological impact – we can introduce a related notion – *indirect* ontological impact. Suppose we claim that a derivative (i.e. non-fundamental) entity *d* exists (obtains, occurs, etc.). In making this claim we take on certain *fundamentality commitments* in the sense that what we're saying, if true, puts constraints on the way the world is, fundamentally speaking (cf. Schaffer (2008)). The claim that *d* exists, in other words, requires there are fundamental entities of some sort that ultimately ground the fact that *d* exists. It's best in this context to stay neutral on just which sorts of entities are fundamental, so it's also best to view such commitments as being disjunctive in nature. The truth of our claim might require, for example, that there is a plurality of microphysical particles instantiating certain fundamental properties (as a particular version of *priority pluralism* would have it), or that the world as a whole instantiates certain fundamental properties (as a particular version of *priority monism* would have it) (cf. Schaffer (2010b) and Trogon (2009)).

Derivative entities, therefore, make an indirect ontological impact in the sense that claims to the effect that they exist incur fundamentality commitments. Notice that we can also speak of the indirect ontological impact made by fundamental entities. When we claim that some entity  $f$  exists, then, if  $f$  is fundamental according to our theory, we take on the fundamentality commitment to  $f$ . Henceforth, by ontological impact I mean indirect ontological impact in particular.

In contrast to the identity conception, the fundamentality conception of reduction cast in terms of facts is this:  $[p]$  reduces to  $[q]$  just in case both  $[p]$  and  $[q]$  obtain and they make the same ontological impact. In other words,  $[p]$  reduces to  $[q]$  just in case  $[p]$  and  $[q]$  obtain and  $[p]$  incurs a fundamentality commitment  $C$  just in case  $[q]$  incurs  $C$ . It would seem that a grounded fact makes the same ontological impact as the plurality consisting of all its actual grounds. On the fundamentality conception, reduction again is reflexive, symmetric, and transitive. A consequence of symmetry is that, not only does a fact reduce to the plurality of its actual grounds (which themselves are pluralities), but the plurality of grounds reduces to the grounded fact as well.

Given the fundamentality conception of reduction, why not claim that, if one fact is grounded in another, the former reduces to the latter? The reason is that there are cases in which, though one fact is grounded in another, the ontological impact of the former is greater than that of the latter. Consider, for example, [something is  $H$ ]. Suppose that this existential fact is grounded in [ $a$  is  $H$ ] and it's also grounded in [ $b$  is  $H$ ]. It may be that the latter ground incurs fundamentality commitments that the former doesn't and vice versa. Supposing that this is so, it would be a mistake to say that the fundamentality commitments of [something is  $H$ ] are the same as those of the first ground, for in this case [something is  $H$ ] incurs all those fundamentality commitments incurred by each ground.

Third, we might characterise reduction in terms of essence. This is the option Rosen (2010) pursues. First, (putting to the side certain complications) Rosen argues that  $\langle p \rangle$  (the proposition that  $p$ ) reduces to  $\langle q \rangle$  just in case  $\langle q \rangle$  is the proposition we get from providing the 'real definition' of the entities  $\langle p \rangle$  involves in roughly Fine's (1994) sense. For example, we can express the real definition of the property of being a square thus: what it is to be a square is to be an equilateral rectangle. Hence, on this view  $\langle \text{something is a square} \rangle$  reduces to  $\langle \text{something is an equilateral rectangle} \rangle$ . So for Rosen reduction is a relation between propositions, and it's a form of *analysis*, in particular a form of *metaphysical analysis*. Second, Rosen claims that if  $\langle p \rangle$  is true and  $\langle q \rangle$  is the real definition of  $\langle p \rangle$ , then  $[p]$  is grounded in  $[q]$ . Putting all of this together, we arrive at the following view: if  $\langle p \rangle$  is true and  $\langle p \rangle$  reduces to  $\langle q \rangle$ , then  $[p]$  is grounded in  $[q]$ .

So while our discussion of the fundamentality conception of reduction resulted in a putative sufficient condition for reduction that appeals to grounding facts, Rosen proposes a necessary condition for reduction that appeals to grounding facts. Another important difference between the two conceptions of reduction is that reduction on Rosen's conception is irreflexive and asymmetric, given that metaphysical analysis has these features.

## 7. What grounds the grounding facts?

In this final section I consider the matter of what if anything grounds the facts about what grounds what. This issue is interesting in part because, as deRosset (forthcoming), Sider (2012), and others have argued, we face a potential problem here. I put the problem in the form of a dilemma, and it departs in various ways from the discussions of the aforementioned authors.

Suppose that [you're having an experience as of motion] is partially grounded in [there is recurrent activity above a such-and-such threshold between your V1 and MT/V5 neural structures]. Is this fact itself grounded? Taking the first horn, suppose this fact isn't grounded. Assuming that a fact is fundamental just in case it isn't grounded, it follows that the fact that the mental fact is partially grounded in the physical fact is fundamental. And it seems that, if a fact is fundamental, then its constituents are fundamental as well. If this is right, it follows that the mental and physical facts are both fundamental. So here we're committed to the idea that in describing how the world is fundamentally speaking – in writing the *Book of the World* to use Sider's (2012) phrase – we must mention the experience as of motion as well as activity between certain neural structures. The problem here is obvious: to describe the way the world is fundamentally speaking, we needn't speak of these things. This isn't to say that it's clear what would go into such a description; what's clear is just that these items won't be among them. (The property dualist who claims that there are fundamental laws connecting mental and physical properties (cf. Chalmers (1996)) might disagree, but we could just as well have used a different example. [Hong Kong is a city], for example, is grounded in facts concerning the activities of various people, yet presumably the dualist would agree that the *Book of World* mentions neither Hong Kong nor the property of being a city. Moreover, the dualist claims that it's special features of mental properties that secure dualism, not general considerations concerning the grounds for what grounds what.)

Taking the second horn, suppose instead that the fact that the mental fact is partially grounded in the physical fact is grounded. In this case it's unclear, however, just what a plausible candidate ground for this fact might be. What sort of fact could play this role? Moreover, whatever fact we might settle on, we face the question of whether it too is grounded, and, if so, how.

As Dasgupta (manuscript-a) notes, however, there is a class of grounding facts whose members intuitively are grounded in certain facts. Suppose (i)  $[p]$  is grounded in  $[q]$ , (ii)  $[q]$  is grounded in  $[r]$ , and (iii)  $[p]$  is grounded in  $[r]$ . You might claim that, no matter what  $[p]$ ,  $[q]$ , and  $[r]$  come to, (iii) is grounded in the plurality consisting of (i) and (ii). Suppose this claim is correct. In this case,  $[r]$  is a ‘mediate ground’ for  $[p]$  in the sense that the latter is grounded in the former only because  $[p]$  is grounded in  $[q]$  and  $[q]$  is grounded in  $[r]$  (cf. Fine (forthcoming)). Assuming that (i) and (ii) aren’t grounded in a similar fashion – assuming, in other words, that  $[q]$  is an immediate ground for  $[p]$  and  $[r]$  is an immediate ground for  $[q]$  – the dilemma set out above targets such facts. The dilemma, in other words, concerns the facts about what immediately grounds what.

What are our options here? I’ll consider two. The first proposal is one that Bennett (2011b) and deRosset (forthcoming) have independently come upon. Suppose that  $[p]$  is (immediately) grounded in  $[q]$ . Both claim in this case it follows that  $[[p]$  is grounded in  $[q]]$  is grounded in  $[q]$ ,  $[[[p]$  is grounded in  $[q]]$  is grounded in  $[q]]$  is grounded in  $[q]$ , and so on. So suppose that  $[pvq]$  is grounded in  $[p]$ . On this view,  $[[pvq]$  is grounded in  $[p]]$  is grounded in  $[p]$ ,  $[[[[pvq]$  is grounded in  $[p]]$  is grounded in  $[p]]$  is grounded in  $[p]$ , and so on.

As deRosset notes, in explaining why  $[pvq]$  is grounded in  $[p]$ , it seems that we should say something about disjunction in addition to  $[p]$ . Yet on his view  $[[pvq]$  is grounded in  $[p]]$  is grounded in  $[p]$ , not  $[p]$  plus some fact about disjunction. In response to this concern, deRosset distinguishes between facts that ground a given fact, and facts that would render a metaphysical explanation intelligible to an audience in certain contexts. With respect to  $[[pvq]$  is grounded in  $[p]]$ , he claims that facts about disjunction play the latter rather than former role.

Dasgupta (manuscript-a) objects as follows. He agrees that, when we metaphysically explain  $[pvq]$  in terms of  $[p]$ , talk of disjunction is merely an aid to make the explanation intelligible to an audience. But it doesn’t follow from this that when we metaphysically explain  $[[pvq]$  is grounded in  $[p]]$  in terms of  $[p]$  the same is true. In support of this claim, he points to a corresponding asymmetry. When we prove  $pvq$  from  $p$  no reference to disjunction need be made in our premises, while when we prove in the metalanguage that  $p$  implies  $pvq$  our premises will include that disjunction introduction is a valid inference rule.

The second proposal we will consider comes from Dasgupta (manuscript-a). He argues that facts about what (immediately) grounds what are grounded in certain groundless facts concerning the essences of entities. One version of the proposal he considers is as follows. Recall from §5 the claim that, if one fact is grounded in

another, certain essential truths (in Fine's (1994) sense) characterise these facts or the entities they involve according to which the latter fact suffices for the former. Dasgupta agrees and claims that these facts concerning essence are groundless. He then claims that these groundless facts concerning essence together with certain associated facts ground facts about what grounds what. Example: suppose that the fact that Oswald's killing of President Kennedy was wrong is grounded in the fact that his action failed to maximise utility. For Dasgupta, this fact is grounded in (i) the fact that part of what it is to be a wrong action is that if an action fails to maximise utility then that action is wrong, and (ii) Oswald's action failed to maximise utility. Dasgupta argues that this proposal iterates, so we have, for example, grounds for the fact that certain groundless facts concerning the essences of entities partially ground grounding facts.

Returning to the dilemma I opened this section with, recall the idea that a fact is fundamental just in case it isn't grounded, and, if a fact is fundamental, its constituents are fundamental as well. If this package of views is correct, then Dasgupta is committed to the view that the entities characterised by the relevant essential truths are all fundamental, which is a disastrous result. For Dasgupta, the relevant essential truths are 'autonomous': the facts corresponding to these truths are groundless not because it just so happens that nothing grounds them; instead, they aren't apt for metaphysical explanation in the first place. I take it that Dasgupta's view, then, is this: a fact is fundamental just in case it's ungrounded and not autonomous. For Dasgupta claims that the relevant groundless facts about essence aren't brute facts occupying the lowest level of the hierarchical structure of the world but part of "the scaffolding around which the hierarchy is built" (manuscript-a: 2).

deRosset (forthcoming) criticises this conception of fundamentality as follows. The autonomous facts – whatever they are – are, well, facts. Hence, a specification of fundamental reality that leaves out the autonomous facts is one that leaves out some of the facts. This gives us a reason to think that such a specification is incomplete. Assuming that a specification of fundamental reality doesn't leave anything out, something has gone wrong here.

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