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Metaphysical Explanation by Constraint

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Abstract It is often thought that metaphysical grounding underwrites a distinctive sort of metaphysical explanation. However, it would be a mistake to think that all metaphysical explanations are underwritten by metaphysical grounding. In service of this claim, I offer a novel kind of metaphysical explanation called metaphysical explanation by constraint, examples of which have been neglected in the literature. I argue that metaphysical explanations by constraint are not well understood as grounding explanations.

1 Introduction

As the sixth richest person in the world, Mark Zuckerberg is incredibly wealthy (Dolan and Kroll 2016). Yet, without doubting this, we might wonder why Zuckerberg is wealthy. Answering this question involves explaining Zuckerberg's wealth and there are a several kinds of explanation available to us.

One familiar kind is causal. These get their power by providing information about the causal histories of their targets, particularly the causal processes that produced them and events that bear on their occurrence. A causal explanation for Zuckerberg's wealth might include the fact that he founded Facebook and retains a controlling interest.

However, another kind of explanation has attracted recent attention. It is identical to or, alternatively, is underwritten by metaphysical grounding. The identity view understands metaphysical grounding to be identical to a distinctively metaphysical sort of non-causal explanation. The underwriting view understands metaphysical

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grounding to be the primitive relation of ontological determination that underwrites these explanations.[1] On the underwriting view, which I will assume here, grounding explanations work by providing information about the grounds of their targets. They say what it is in virtue of which those targets exist and have the features they do. A grounding explanation for Zuckerberg's wealth identifies those bits of the world that ground it. It attempts to say what makes it the case that Zuckerberg counts as being wealthy in the first place, irrespective of what caused him to be wealthy. Perhaps Zuckerberg is wealthy in virtue of constituting a small percentage of Earth's total population while possessing a substantial percentage of its total wealth.[2]

Grounding explanations have an important role to play in metaphysics and have received a great deal of attention as a result. But because they have received so much attention, it might be tempting to conclude that all metaphysical explanations are underwritten by grounding and resemble those canonical examples that are the focus of the literature. My aim, in what follows, is to show that this is not the case.[3]

In service of this aim, I introduce instances of correct metaphysical explanation that I claim are not underwritten by metaphysical grounding and do not resemble canonical grounding explanations. Instead, these explanations are better understood to belong to a novel sort of metaphysical explanation called metaphysical explanation by constraint.[4] I offer an account on which metaphysical explanations by constraint explain their targets by showing them to result from constitutive parts of some suitably chosen nature.

Metaphysical explanations by constraint belong to a new category of metaphysical explanation and work from the top-down rather than the bottom up. Because they work from the top-down, they have the capacity to extend the explanatory reach of metaphysics. They are also related to top-down scientific explanations and so illuminate interesting connections between science and metaphysics.

I'll begin by identifying the explanatory role played by metaphysical explanations by constraint. In order to do this, I identify a structural parallel between metaphysical and scientific explanations. Though I suspect more interesting connections, I assume here that "metaphysical explanation" refers to those explanations regularly aimed at in the course of doing metaphysics. In Sect. 3 I offer several examples of correct metaphysical explanations and, in Sect. 4, argue that they are not plausibly grounding explanations. My examples are better understood as top-down metaphysical explanations by constraint and I offer an account of them

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[1] See Kovacs (2017) for discussion. Fine (2001, 2012), Dasgupta (2014, 2016) endorse the identity or unionist view. Schaffer (2012), Audi (2012), Raven (2012), Skiles (2015), Schaffer (2016), and Wilson (2017) endorse the underwriting or separatist view. Relations of ontological determination are a category of relations members of which connect more fundamental facts to the less fundamental ones they give rise to (c.f. Audi 2012). Grounding is a particular member of the category, which may also include additional relations.

[2] For other examples, see Fine (2012), Audi (2012), Dasgupta (2016) and for critical discussion see Kovacs (2017).

[3] The identity view is similarly tempted to understand all metaphysical explanations on the model of canonical grounding explanations. However, not all metaphysical explanations resemble these canonical grounding explanations.

[4] The term "explanation by constraint" originated with Marc Lange, though my use of it is importantly different from his. See Lange (2009, 2011, 2013a, 2014, 2016).

in Sect. 5. In what follows, I will assume that both grounding and explanation are relations exclusively among worldly facts (c.f. Rosen 2010, Audi 2012, Glazier 2017).

2 Top-Down and Bottom-Up Explanation

To exhibit the role played by metaphysical explanations by constraint, begin by considering the distinction between top-down and bottom-up explanations. In this section, I argue that the distinction, familiar from the philosophy of science, ought to be extended to metaphysics as well.

Intuitively, a scientific explanation counts as bottom up if it gets its explanatory power by providing information about the particular processes by which its target was produced or set of events that made a difference with respect to its occurrence. Bottom-up explanations are essentially particular so that explanations for individual occurrences are fundamental and illuminating generalizations are explained in terms of them.[5]

Paradigmatic examples of bottom-up explanation are often causal/mechanical: they get their power by identifying the particular underlying mechanisms by which their targets were produced.[6] Salt dissolves in water, for example, because charged parts of water molecules pull Chlorine atoms off salt crystals and into solution, causing the salt to dissolve. Difference-making causal explanations are bottom up as well. These get their power by providing information about those causal antecedents that made a difference with respect to the occurrence of their targets.[7] The reason the car crashed, to borrow an example from David Lewis, was because the road was icy, the tires were bald, the driver was drunk, and was coming around a blind corner (Lewis 1986, 214).

In contrast with bottom-up explanations, top-down explanations get their power by subsuming their targets under extremely general principles, thereby showing how particular occurrences fit into the universal scheme of things. For example, some particular sample of Neon is chemically inert because Neon has a full outermost electron shell (Kitcher 1985, 637). Rather than providing a description of causal processes in various samples of Neon, this explanation works by subsuming the behavior of our sample under a unified account on which the chemical behavior of all elements is explained in terms of their valence electrons. Top-down explanations

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[5] The bottom-up/top-down distinction originates with Kitcher (1985) but is used in two ways in the literature, often without being adequately distinguished. On one use, it marks a distinction among explanations based on their sources of explanatory power. This is the sense that I have in mind here. On the other use, it marks a distinction among methods by which theories of explanation are developed. See Ruben (1992) for discussion.

[6] By extension, I consider Jackson and Pettit (1990)'s program explanations to be bottom up. These do not directly concern causally efficacious properties. However, they get their explanatory power by identifying properties that are causally relevant in virtue of some causally efficacious mechanism that realizes them.

[7] Committing to a particular account of difference making is not necessary for my purposes. For a template generally instantiated by such accounts, see Strevens (2008, 55).

don't work by revealing causal mechanisms or difference-makers and they need not cite causes at all.

Many familiar top-down scientific explanations involve unification.[8] However, I set these aside in order to focus on scientific explanations by constraint. Scientific explanations by constraint explain their targets by showing that they must be the case. They follow from the "great general principles all laws seem to follow" and so are necessary in a stronger sense than are the ordinary dynamical laws (Lange 2016, 51). As top-down explanations, scientific explanations by constraint get their power by subsuming their targets under scientific constraints: facts that are more necessary than, and so more general than, their targets.

For an example, consider that both gravitational and electrical interactions conserve energy. Why are they similar in this respect despite being different in many others? Because the law of energy conservation requires them to be similar. The law of energy conservation is more necessary than the force laws roughly in the sense that it is stable under a wider range of counterfactual situations. It constrains the way any possible force law can be by requiring every nomologically possible interaction to conserve energy.[9] The conservation law is explanatorily prior to the conservation behavior exhibited by the actual force laws. So, it is no coincidence that each force law conserves energy.

Another example, this time a distinctively mathematical scientific explanation, asks why it is that mother fails every time she tries to distribute her twenty-three strawberries evenly among her three children without cutting any. Mother fails every time she tries because twenty-three cannot be divided evenly into three (Lange 2013a, 496; Lange 2016, 16). This mathematical fact is more necessary than the causal details of mother's particular failure and constrains the way in which any possible attempt to divide objects might be. It is no coincidence that mother failed since her success was mathematically impossible.

Some facts can be explained both from the top down and from the bottom up. Consider Salmon's famous case of the friendly physicist (2006, 183). In it, Salmon's physicist asks passengers on a plane what will happen to a helium balloon in its cabin as the plane accelerates for takeoff. While we might expect the balloon to move toward the back of the plane, it moves toward the front of the plane instead. Why is this so? One explanation we might give works from the bottom up. In giving it, we provide causal information about the air molecules in the cabin. As the plane accelerates, the back of the cabin collides with some of those molecules creating a pressure gradient that exerts an unbalanced force on the balloon, pushing it toward the front of the plane. However we might also give a top-down explanation for this

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[8] See Friedman (1974), Kitcher (1989) and more recently Ruben (1992) and Strevens (2004, 2008).

[9] See Lange (2011, 2013a, b, 2014, 2016). Scientific constraints like energy conservation are physically necessary. However, energy conservation is explanatorily prior to the conservation behavior of particular force laws. Its greater necessity is witnessed by the truth of counterlegal conditionals like "had there been additional forces, they would have conserved energy" (c.f. Lange 2011, 347). This idea is further fleshed out by Lange's (2007) sub-nomic stability account of laws and section 2.5 of Lange (2016). Lange's view of conservation laws faces competition from Humean views according to which they are coincidental generalizations rather than constraints. We need not endorse Lange's view of conservation laws in order to see how scientific explanations by constraint are meant to function on the supposition that it is correct (though see Lange 2011).

same fact. Giving it requires an appeal to Einstein's principle of equivalence, which states that acceleration is physically equivalent to, and so observationally indistinguishable from, a gravitational field.[10] Because helium balloons tend to rise in Earth's gravitational field, the balloon will move toward the front of the plane, acting as if a gravitational field were placed behind the cabin's rear wall. This is to explain the behavior of the balloon by showing it to result from an extremely general physical principle and not by appeal to the detailed causal mechanisms responsible for its particular occurrence.

2.1 The Distinction Extended to Metaphysics

The distinction between top-down and bottom-up explanation is an important one in the philosophy of science. However, it is not uniquely applicable to scientific explanation. It ought to be extended to metaphysical explanation as well. Doing so draws focus to a region of neglected space in the taxonomy of possible metaphysical explanations. Though this space is not occupied by grounding explanations, I argue that it is fruitfully occupied by metaphysical explanations by constraint.

Little needs to be done to extend the category of bottom-up explanation. Bottom-up metaphysical explanations are, in fact, already widely appreciated in the form of grounding explanations. Recall that bottom-up scientific explanations work by identifying the particular processes by which their targets were produced or occurrences that serve as difference-makers. In an analogous way, grounding explanations work by laying bare particular metaphysical processes, the grounds in virtue of which their targets exist and have the features they do. Grounding explanations explain why something exists or has the features it does by identifying the metaphysical mechanisms that give rise to it: the more fundamental bits of the world in which it is grounded. Above, we explained why Zuckerberg is wealthy by citing the grounds for his being wealthy. Similarly, {Socrates} exists in virtue of the fact that Socrates exists, the ball is red in virtue of being maroon, and the vase is beautiful in virtue of its color.

The analogy between causal and grounding explanations is an apt one in virtue of the deep similarities shared by the relations that underwrite them. The grounding relation is often glossed as the metaphysical analogue of causation and is sometimes even identified with a species of causation.[11] In addition, grounding and causing are formally similar so that the same formalism can be used to describe each of them. And grounding and causing are each relations of production or dependence. Causes give rise to effects so that these effects depend on their causes. In an analogous way, grounds give rise to their groundees so that these facts depend on their grounds. It is because grounding and causing are similar in this way that grounding explanations

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[10] Physically equivalent systems are indistinguishable with respect to their physical processes so that the laws of nature with respect to one system entirely agree with the laws with respect to the other (Friedman 1983, 318).

[11] Schaffer gives this relationship extensive discussion and adapts causal modeling to describe grounding (Schaffer 2012, 2016). Alastair Wilson (2017) offers an interesting recent defense. See also Bennett (2011, 2017). In contrast, Koslicki (2016) and Bernstein (2016) argue that there are important differences between grounding and causing.

and causal explanations are similar too. Both work by describing the way in which their explananda were generated and so by revealing the underlying bits of the world on which they depend. Grounding explanations and causal explanations are plausibly backed by different relations and so belong to different explanatory kinds. However, there is a deep similarity between them that is well captured by their common membership in the category of bottom-up explanation.

This deep similarity is suggestive. Causal explanations have a metaphysical analogue in the form of grounding explanations. Do scientific explanations by constraint have metaphysical analogues as well? Top-down metaphysical explanations have been neglected in the literature. However in what follows, I argue that there are top-down metaphysical explanations in the form of metaphysical explanations by constraint.

3 Some Examples of Metaphysical Explanation by Constraint

The best way to demonstrate the existence of these metaphysical explanations by constraint is to offer some examples of them.

However, before doing so a caveat is required. No example of metaphysical explanation is entirely uncontroversial and it is not my aim here to endorse the claims that appear in my examples. Instead, I propose to set aside questions about the truth of these claims. I assume them for the sake of argument in order to understand how the explanations that feature them work. In doing this, I am extending a common practice from philosophy of science. We can sensibly ask, for example, whether the Ptolemaic model of the solar system explains the motion of the planets even while knowing that it is false. This way of thinking about metaphysical explanation, though not wholly unknown, remains relatively unfamiliar in the metaphysical explanation literature.[12] Defending it falls outside the scope of this paper. However, I invite the hesitant reader to understand the practice as a kind of pretense or fiction useful for evaluating explanatory connections in difficult epistemic circumstances.

This caveat in place, consider the following:

Dishes: Imagine five dishes in a sink, one stacked on top of the other, and suppose that exactly these dishes taken together sum to form an object. Call the resulting object a stack. The fact that composition is unique explains the fact that there are not two distinct stacks composed of exactly our five dishes.

Composition is unique if it is the case that for any composite objects x and y that have exactly the same proper parts, x is identical with y.[13] This means that if exactly

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[12] A similar conception of non-factive metaphysical explanation is discussed by Fine (2012). A non-factive conception is also often supposed in debates concerning grounding in non-actual hypothetical scenarios like gunky worlds or mereological loops. I take this to be of a kind with what I have in mind here, though I take no stand with respect to whether there are mereological loops, non-factive grounding claims, or gunky worlds. I owe this point to a helpful referee.

[13] See Simons (1987) and Lewis (1991).

our five dishes were to compose stacks with exactly the same proper parts, then these stacks would have been identical.

There are two ways that we might understand the claim that composition is unique, only one of which supports the explanation in *Dishes*. We might understand uniqueness as a generalization over all the actual or possible instances of composition, including those involving the dishes. Understood in this way, each instance of composition is unique, but not for any one reason. Instead, the uniqueness of composition is true in virtue of each particular instance of composition taken together. Alternatively, we might understand uniqueness as a constraint on instances of composition so that each instance is unique for the same reason: because the uniqueness constraint limits the ways in which composition might be.[14] Only this second understanding of uniqueness secures the explanation in *Dishes*. If uniqueness were a generalization and not a constraint then *Dishes* would feature what is uncomfortably close to a tight explanatory circle: that the dishes compose uniquely is a partial explanation for the fact that all instances of composition are unique, while this same generalization is presented as the full explanation for the fact that the dishes fail to compose more than one distinct stack.

My complaint here is closely related to a more general tension between the claim that universal generalizations explain their instances—a fixture of many accounts of scientific explanation—and the claim that their instances explain universal generalizations—a widespread commitment in the debate on grounding (Maudlin 2007, 172; Lange 2011; Fine 2012). As long as the same notion of explanation is at issue in both claims and partial explanation is asymmetric, a contradiction can be derived from these commitments (Roski 2017).

Despite this similarity, solutions deployed in response to the more general tension seem not to generalize to the cases I offer here. For example, the most popular of these responses attempts to avoid contradiction by denying that each claim features the same type of explanation: universal generalizations scientifically explain their instances but are metaphysically explained by them (Loewer 2012; Miller 2015; Hicks and van Elswyk 2015; Roski 2017). However, this maneuver is not appealing in *Dishes* since it seems to feature a metaphysical explanation at both points. The explanation in *Dishes* certainly doesn't work by identifying causal antecedents, as many scientific explanations do, since it appeals to uniqueness alone. And uniqueness is intuitively quite different from prototypic laws of nature so that this seems not to be a case of explanation solely in terms of natural laws.

Here's another example:

> *Flagpole*: Imagine a vertical flagpole standing on level ground and the shadow that it casts. It is widely held that the height of the flagpole scientifically explains the length of the shadow and not the other way around. Why not give both explanations at once? The fact that explanation is asymmetric explains the fact that it is not both the case that the height of the flagpole explains the length of its shadow and vice versa.

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[14] For a similar claim about scientific explanations by constraint, see Lange (2011, 2016, 49–58).

It is widely claimed that the height of the flagpole can't be explained by the length of the shadow because scientific explanations ought to track causal relations: the flagpole causes the shadow and not the other way around (see e.g. Salmon 2006, 47). However, the explanandum in *Flagpole* is different. It is the fact that the pair of (alleged) explanations are not both the case together.

In order to explain in *Flagpole*, asymmetry cannot be a mere generalization on pain of vicious circularity. The fact that the flagpole-and-shadow symmetric pair are not both the case would partially explain why explanations are asymmetric. This fact then explains why the flagpole-and-shadow symmetric pair are not both the case. If it is to do its explanatory work, asymmetry must instead be a constraint.

It might be tempting to explain why the flagpole-and-shadow symmetric pair are not both the case by appealing to the badness of the shadow's explanation of the flagpole's height. This is consistent with the logic of ground, since a negated conjunct fully grounds the negation of a conjunction (Fine 2012, 63).[15] This is no threat to my example given that I have claimed to offer a correct metaphysical explanation of the phenomenon rather than the only correct explanation. Nonetheless as its full ground, the badness of the shadow's explanation ought to fully explain why the flagpole-and-shadow symmetric pair are not both the case. But the badness of the shadow's explanation makes no difference to whether the explanandum obtains. Plausibly, the explanans of a complete explanation ought to make a difference to its explanandum. But even if both explanations were otherwise good ones, they couldn't both be given together since explanations are asymmetric and can't run in tight circles. Rather than depending on the particularities of the flagpole and shadow, the fact that the flagpole-and-shadow symmetric pair are not both the case is the result of the asymmetry constraint: a great general principle that all explanations follow.

Finally,

> *Statue*: Consider a statue on the East Coast and a lump of clay on the West Coast. Statue and clay fail to overlap in the sense that they share no proper parts. The fact that constitution requires mereological overlap explains the fact that the statue is not constituted by the clay.

Constituted objects have, as proper parts, the proper parts of their material bases. In this way, constitution has explicit mereological conditions.[16]

Each of these examples feature explanations that work from the top-down: they get their explanatory power by showing how particular occurrences fit into the universal scheme of things. Exactly our five dishes fail to compose more than one distinct stack not because of the particularities of their arrangement but because this is required by uniqueness: one of the grand principles that all instances of composition follow. Analogous claims can be made for *Flagpole* and *Statue*. The length-to-height and height-to-length explanations can't be given at once because of

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[15] Thanks to a helpful referee for pressing this objection.

[16] I assume in this example that constitution is not in some way collapsable to composition. I further assume that the mereological condition I am offering is not part of the definition of "material constitution" or the concept to which the technical term refers. This involves assuming that material constitution is worldly rather than conceptual.

a grand principle governing every instance of explanation: explanation is asymmetric. Similarly the statue doesn't constitute the clay because of a grand principle governing all instances of constitution: constituted objects must partially mereologically overlap their bases.

Dishes, *Flagpole*, and *Statue* feature plausibly correct instances of metaphysical explanation. Yet, I have argued that these explanations are intelligible only if the claims in their explanantia are understood as constraints that are explanatorily prior to their instances.

4 Metaphysical Explanations by Constraint Can't Be Replaced by Grounding Explanations

Though I've argued that they are correct metaphysical explanations, examples like *Dishes*, *Flagpole*, and *Statue* are not well understood as grounding explanations and do not resemble prototypic instances of them. I'll first argue that it is doubtful that the explanantia and explananda featured in these examples are connected by grounding relations. Yet, this is required if they are to count as grounding explanations. Second, I'll argue that any grounding explanation that might be produced will be inconsistent with the top-down character of the examples. Since top-down explanations make distinctive explanatory contributions that are not duplicated by bottom-up explanations of the same phenomena, any resulting grounding explanation will be a complement to rather than a replacement for its companion metaphysical explanation by constraint.

In order to count as grounding explanations, the explanations featured in cases like *Dishes* must be underwritten by grounding. Yet, it is unclear what is doing the grounding in these cases and whether any such grounds are available. Consider again the explanation featured in *Dishes*.

> *Dishes*: The fact that composition is unique explains the fact that there are not two distinct stacks composed of exactly our five dishes.

Since the explanandum is a negative fact, any such grounding explanation of it must slay what Jonathan Schaffer calls the Dragon of Negatives by accounting for the grounds of negative facts. How best to do this is extremely controversial. Negatives might be grounded in the total collection of positive facts or in the cosmos as a whole (Martin 1996; Armstrong 1997, 2004; Cameron 2008; Schaffer 2010). Or it may be that negative facts do not have grounds at all. Similar claims are made by opponents of truthmaker maximalism (e.g. Mellor 2003; Melia 2005). Since it is not clear whether negative facts are grounded, and being underwritten by grounding is required of grounding explanations, it is not clear whether the explanandum in *Dishes* is apt to be grounding explained. Supposing that this explanandum can be grounded, it remains unclear in what. Yet, no such unclarity afflicts the explanation actually given in *Dishes*. There are not two distinct stacks composed of exactly our five dishes because composition is unique. This explanation seems not to be hostage to the debate about grounding negative facts and this is evidence that the explanation in *Dishes* is not a grounding explanation.

It might be claimed that uniqueness is among the grounds for the fact that there are not two distinct stacks composed of exactly our five dishes. However, I claim that the relationship between constraints and their objects is intuitively unlike the one between grounds and their groundees. Grounding is a primitive relation often introduced by paradigmatic examples: for instance the existence of parts ground the existence of wholes, the existence of sets are grounded in the existence of their members, normative facts in non-normative ones, and complex facts are grounded in simpler ones. By considering examples like these, we gain some ability to identify other instances of the same genius and so, one hopes, to reliably recognize when grounding obtains. However, it seems that the relationship between constraints and their objects does not hang together with these prototypic instances of grounding. This is a bare intuition of difference but one that is similar in strength and kind to the intuition of sameness uniting prototypic instances.

In addition to its prototypic instances, our grasp of grounding is buttressed by a guiding analogy to causation. As claimed in Sect. 2, grounding (on the assumed underwriting view) is intimately related to causation and sometimes identified with a species of it. Consistent with this, it is apt in each of the prototypic cases above to talk of grounds in causative terms; as making up, bringing about, generating, or producing groundees (c.f. Sider 2011, 145; Bennett 2011; Audi 2012; Schaffer 2016; Wilson 2017). However, it seems inapt to speak in these causative terms about the relationship between constraints and their objects. The fact that if x and y have exactly the same proper parts then x is identical to y does not seem to bring about, generate, or produces the fact that there are not two distinct stacks composed of exactly our five dishes.[17] We are acquainted with the concept of metaphysical grounding largely via our grasp of the similarity shared by prototypic examples and the systematic analogy between grounding and causation. However, I claim that the relationship between constraints and their objects does not intuitively resemble paradigmatic instances of grounding and, since it is not aptly described in causative terms, does not support an analogical relationship to causation. In light of this, it seems implausible that constraints ground their objects. Since the requisite grounding relations are not plausibly available to underwrite them, it is not plausible that constraints grounding explain their objects.

I have so far claimed that the examples discussed in Sect. 3 are not plausibly grounding explanations because the relationship between their explanantia and explananda is not plausibly one of grounding. Suppose for the sake of argument, however, that my examples can be well understood as grounding explanations. I

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[17] It is not inapt to say that constraints determine their objects. However, this is not to describe constraints in causative terms. It is to claim that constraining belongs to the same generic kind as i.e. causing, grounding, supervening, and necessitating. Nonetheless, constraints don't determine their objects in the same way that grounds do. Following Audi (2012), I say that "determination" is meant in at least two ways. In one sense, one thing determines another by bringing it about or being responsible for it. In the other, the first thing determines the second by fixing its unique value. Grounds determine their groundees in the first sense. Indeed, Fine claims that grounds constitutively determine their groundees: the fact that the groundee obtains consists in nothing more than that the grounds obtain (Fine 2012, 39). I soon claim that a fact results from a constraint (and so is determined by it) roughly in the sense that its falsity is inconsistent with the constraint. This more closely resembles the second sense of "determine" than the first.

further argue that any such grounding explanation will work from the bottom up and not from the top down. Such explanations fail to capture the distinctive top down character of these examples. Yet, it is generally the case that top-down explanations make different explanatory contributions than bottom-up explanations do.

Grounding explanations explain why something exists or has the features it does by identifying those metaphysical mechanisms that give rise to it: the more fundamental stuff in which the explanatory target is grounded. For example, Koko the Gorilla exists in virtue of the existence and arrangement of fundamentalia, <Socrates> exists because Socrates does, the fact that the ball is red and round obtains in virtue of the fact that it is red and the fact that it is round, and the existence of Al Wilson's head partially explains the existence of Al Wilson (Schaffer 2016; Correia 2005; Fine 2012; Wilson 2017, 10).

However, I've argued that explanations like the one at issue in *Dishes* work from the top down and are not well understood from the bottom up. In particular, if the fact that composition is unique is to explain why the dishes failed to compose more than one distinct stack, then I have claimed that it must be understood as a constraint and not as a generalization conveniently summarizing disparate particular facts about instances of composition. In order to explain in this way, uniqueness must be a constraint on the composition relation so that every instance of composition is unique for the same reason: because it lies in the nature of composition to be unique. This explanation subsumes a wide range of particular failures of the same parts to compose more than one distinct whole under an extremely general principle: the uniqueness of composition.

If, as I have assumed, explanations are to be distinguished by their source of explanatory power, then those explanations featured in my examples are not plausibly grounding explanations. These explanations have different sources of explanatory power, one explaining from the bottom up and the other from the top down. Therefore, any grounding explanation that might also be available will be a distinct explanation of the same explanandum. Were it to exist, such a grounding explanation would be a complement to rather than a replacement for its companion metaphysical explanation by constraint.

Whether in science or metaphysics, top-down explanations are valuable even when bottom-up explanations are available for the same phenomenon. This point is familiar in the philosophy of science and is illustrated by the Friendly Physicist case from Sect. 2. Each kind of explanation in that case makes a distinctive contribution to our understanding of the movement of the balloon. Bottom-up explanations reveal the particular features of the world that generate or make a difference with respect to the phenomenon. Top-down explanations illuminates the way in which these particular occurrences fit into the universal scheme of things by subsuming them under general principles.

It is in virtue of their different contributions that Salmon claims that bottom-up and top-down explanations complement rather than compete with one another (Salmon 2006, 180–185). Precisely the same thing is true of top-down and bottom-up metaphysical explanations. A grounding explanation would reveal the particular features that give rise to or makes a difference with respect to the explanandum. A metaphysical explanation by constraint shows how that same explanandum can be

subsumed under a metaphysical constraint and so fits into the universal scheme of things. It follows that a bottom-up grounding explanation for *Dishes* would be compatible with the top-down metaphysical explanation by constraint. Each offers a different kind of understanding of the same phenomenon, thereby highlighting a different aspect of metaphysical explanation.[18]

5 An Account of Metaphysical Explanation by Constraint

Having argued that metaphysical constraints are not grounding explanations, it is time to present my own account. Like other kinds of explanation, metaphysical explanations by constraint are characterized by their distinctive source of explanatory power. They, unlike other explanations, work by showing their explananda to result from metaphysical constraints.

The notion of metaphysical constraint stands at the core of my account. For some (worldly) fact F and entity x, F counts as a metaphysical constraint on x if and only if that F is the case is part of what it is to be x.[19] This entails that if some fact is part of the nature of x, then it is the case in every possible world in which x exists. Though worlds might differ in many ways with respect to x, they cannot possibly differ with respect to the metaphysical constraints on x. In addition to constituting the core of what x is, parts of its nature play a constraining role by restricting the way that x might be across the possible worlds in which it (or its counterparts) obtain.

Though every metaphysical constraint on x is the case in every x-world, not every metaphysically necessary truth involving x counts as a metaphysical constraint on x. For example, it is metaphysically necessary that x is worldmates with the fact that $1 + 1 = 2$. However, this is not a metaphysical constraint on x: it has nothing at all to do with the nature of x and everything to do with the fact that '$1 + 1 = 2$' obtains in every possible world and so obtains in every world in which x exists. It is for this reason that metaphysical explanations by constraint are not special cases of modal explanation, in which 'Necessarily, P' explains 'P'. The explananda of metaphysical explanations by constraint are not merely necessary given some constraint. They are instead guaranteed by the natures of the entities involved.

Metaphysical explanations by constraint work by showing that their explananda result from a metaphysical constraint: a constitutive part of a nature. Intuitively, this is the case when a metaphysical constraint guarantees that the explanandum must be the case. More precisely, some fact F results from a metaphysical constraint C if in the nearest complete world in which F fails to obtain, a fact F* obtains such that F*

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[18] Salmon (2006, 183–184) inspires this claim.

[19] For the purposes of this paper I will refrain from appealing to any particular account of essence or nature. The reader is free to fill in their favorite account here provided that essence is not understood to be reducible in some way to metaphysical modality (see e.g. Fine 1994). By discovering the nature of x, we're discovering what it is to be x.

is logically or metaphysically inconsistent with C and there is some set of facts obtaining in W, Δ, such that F* is logically or metaphysically consistent with Δ.[20]

My account of metaphysical explanation by constraint in some ways resembles Martin Glazier's recent account of essentialist explanations (Glazier 2017). Essentialist explanations "explain the fact that A in terms of the fact that a certain thing is by its very nature such that A" (Glazier 2017, 2871). For example, water contains hydrogen because by its nature water contains hydrogen. Both sorts of explanation are tightly related to the notion of natures or essences. However, metaphysical explanations by constraint are distinct from essentialist explanations such that my examples are not readily accommodated by Glazier's schema.

The explanantia of essentialist explanations make explicit appeals to the natures of things. However, the examples I have presented do not do this. The explanans in *Dishes*, for example, is not the fact that uniqueness is part of the nature of composition or is a constraint on it. The dishes' failure to compose more than one distinct stack is explained by the fact that composition is unique. In addition, the explananda of essentialist explanations must be parts of some relevant thing's nature, where Glazier claims to have in mind "something very close to Fine's notion of immediate constitutive essence" (Glazier 2017, 2873).[21] This commitment helps account for the ultimacy of essentialist explanations, an important intuitive datum, and protects the view against counterexamples. Yet, the explananda in my examples are not plausibly immediate constitutive essences. The composition behavior of the dishes, for example is not itself part of the immediate constitutive essence of composition. Intuitively, no fact about the dishes is part of the immediate core of what it is to be the composition relation.

To see how the account I have offered does justice to the examples from Sect. 3, consider again the explanation offered in *Dishes*. Exactly our five dishes fail to compose more than one distinct stack, on this explanation, because their failure results from the uniqueness of composition. Uniqueness is a metaphysical constraint on the composition relation. So, had the dishes composed more than one distinct stack, a state of affairs that is logically inconsistent with uniqueness, but not with some arbitrarily chosen set of facts, would have occurred. If composition exists at all in the worlds in which this is the case, then it (impossibly) has a different nature than it actually does. As predicted, this metaphysical explanation by constraint works from the top down. It explains why our five dishes actually fail by showing that their particular failure results from a much more general constraint on composition. By subsuming the particular failure under the more general constraint, this metaphysical explanation by constraint unifies its explanandum with a range of other possible and actual failures of collections of parts to compose more than one

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[20] There are a range of weaker notions of inconsistency built on weaker modal notions that are also available. However, these are too weak to do justice to the explanatory power of metaphysical explanation by constraint. My account requires that we judge whether impossible states of affairs are inconsistent with constraints. To be useful, it requires impossible worlds with a non-trivial closeness ordering and completeness property. Though controversial, I will continue to assume that such impossible worlds are available. See e.g. Nolan (1997) for an account of them and A. Wilson (2016, 9) for discussion of their connection with grounding.

[21] See also Fine (1994).

distinct whole. All of these failures can be subsumed under the same constraint on composition.

In much the same way, the explanation in *Flagpole* is well understood in terms of the account I've offered. We can't both explain the height of the flagpole with the length of its shadow and vice versa because doing so would violate asymmetry. Asymmetry is a constraint on explanation. So, had this pair of explanations been available, a state of affairs that is inconsistent with the asymmetry constraint would have obtained. Again, this explanation works from the top down. It explains why this particular symmetric pair of explanations is not both the case by showing that it follows from a much more general constraint on the explanatory tie. In doing so, it unifies this explanandum with a range of other possible and actual symmetric explanations none of which are available as a result of the same very general constraint.

Finally, *Statue* explains that the East Coast lump fails to constitute the West Coast statue because doing so would violate the overlap constraint: a constitutive part of what it is for an object to be constituted by a material base. Like *Dishes* and *Flagpole*, this explanation works from the top down by subsuming its particular explanandum under a much more general metaphysical constraint. In doing so, it shows that a wide range of particular facts result from the very same bit of nature.

6 Conclusion

Metaphysical explanations of the kind at issue in *Dishes*, *Flagpole*, and *Statue*, are metaphysical explanations by constraint: explanations that get their explanatory power by showing their targets to result from a metaphysical constraint. Though metaphysical explanations by constraint are likely to be abundant in metaphysics, they have not received an adequate treatment in the literature.

Furthermore, metaphysical explanations by constraint cannot be fully understood in terms of grounding. Because they have different sources of explanatory power, metaphysical explanations by constraint are distinct from grounding explanations. Because they work from the top down, metaphysical explanations by constraint have the capacity to unify their targets under a common explanation while grounding explanations do not. As a result, metaphysical explanations by constraint should not be forsaken in favor of a grounding based account. Not all metaphysical explanations are grounding explanations. Rather, insofar as metaphysical explanations by constraint are both indispensable and distinct from grounding explanations, our best accounts of metaphysical explanation ought to countenance both grounding explanation and metaphysical explanation by constraint.

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