

# EXPLANATORY ASYMMETRIES, GROUND, AND ONTOLOGICAL DEPENDENCE

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ABSTRACT. The notions of ground and ontological dependence have made a prominent resurgence in much of contemporary metaphysics. However, objections have been raised. On the one hand, objections have been raised to the need for distinctively *metaphysical* notions of ground and ontological dependence. On the other, objections have been raised to the usefulness of adding ground and ontological dependence to the existing store of other metaphysical notions. Even the logical properties of ground and ontological dependence are under debate. In this article, I focus on how to account for the judgements of non-symmetry in several of the cases that motivate the introduction of notions like ground and ontological dependence. By focusing on the notion of explanation relative to a theory, I conclude that we do not need to postulate a distinctively *asymmetric* metaphysical notion in order to account for these judgements.

## 1. TWO QUESTIONS ABOUT GROUND AND ONTOLOGICAL DEPENDENCE

The notions of ground and ontological dependence have made a prominent resurgence in much of contemporary metaphysics. However, objections have been raised: first, to the need for distinctively *metaphysical* notions of ground and ontological dependence, and second, to the usefulness of having these metaphysical notions in addition to other metaphysical notions.<sup>1</sup> I will focus on two questions within this debate.

The first is captured by Schaffer's [2009, 364–365] characterisation of the role of ground.

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<sup>1</sup>See for example Daly [2012], Hofweber [2009], Koslicki [2015], Sider [2011, chapter 8], and Wilson [2014]. The concern that the notion of ground is problematic is tackled by Audi [2012] and Raven [2012].

Grounding is an unanalyzable but needed notion—it is *the primitive structuring conception of metaphysics*. It is the notion the physicalist needs to explicate such plausible claims as “the fundamental properties and facts are physical and everything else obtains *in virtue of* them” (Loewer 2001: 39). It is the notion the truthmaker theorist needs to explicate such plausible claims as: “Must there not be something about the world that makes it to be the case, that serves as an ontological ground, for this truth?” (Armstrong 1997: 115; c.f. Schaffer forthcoming–b).<sup>2</sup>

**First question:** Is ground/ontological dependence required, or at least useful, in order to explicate “coarse-grained” doctrines such as physicalism?

The answer that is suggested by Schaffer’s [2009] discussion is that ground is required in order to clearly formulate and understand broad views such as physicalism.<sup>3</sup> The view that I will defend here allows that the notion of ground can be useful in articulating such views. However, I will also end up in agreement with Wilson’s [2014] and Koslicki’s [2015] assessment that the usefulness of ground/ontological dependence for this role does not guarantee a unified *metaphysical* posit that provides a suitable basis for explication of coarse-grained doctrines such as physicalism. Rather, claims of ground/ontological dependence are a useful way of articulating broad metaphysical commitments “. . . prior to rolling up one’s sleeves and getting down to the real work of illuminating dependence enabled by the more specific ‘small-g’ grounding relations” [Wilson, 2014, 557].<sup>4</sup>

This leads me to what I suspect that many take as the leading reason for stipulating primitive metaphysical notions like ground (or ontological dependence). Such notions are needed to account for the directionality of our other metaphysical notions.<sup>5</sup> Schaffer’s [2009] discussion above already points to the idea that ground is supposed to express ideas about structure—a direction of priority—within a given ontology. Reductive attempts—such as analyses based on supervenience or in modal existential terms—have failed to capture the directionality that seems to be present in many of our intuitive judgements about priority. For example, Schaffer rejects supervenience analyses of grounding since “. . . supervenience is reflexive, and non-asymmetric, while grounding is irreflexive,

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<sup>2</sup>The references in the quote are to Loewer [2001], Armstrong [1997], and Schaffer [2010] respectively.

<sup>3</sup>A similar view is attributed by Wilson [2014] to a personal communication with Theodore Sider and to a talk by Daniel Nolan. Note that I am not trying to tackle the broader question of whether ground/ontological dependence are generally fruitful notions.

<sup>4</sup>I will differ from both Wilson and Koslicki in how I articulate what the real work is, but the general point stands.

<sup>5</sup>Wilson [2014, 564, footnote 74] notes this type of worry in connection with her primitivism about fundamentality and attributes it to Kit Fine, Alex Jackson, and Jonathan Schaffer.

and asymmetric” [Schaffer, 2009, 364]. There is a substantive assumption here: an asymmetric notion is required to do justice to the directionality of our intuitive judgements.

**Second question:** Is a primitive asymmetric metaphysical notion needed in order to do justice to our judgements of directionality in the cases that motivate the introduction of the notions of ground and ontological dependence?

A negative answer to this question will be the focus for most of the rest of this article. Along the way, I will be able to say something about the first question. Before I can do any of that, I need to say more about ground, ontological dependence, and explanation.

## 2. THE CONSENSUS AND BEYOND

I take the precise notions of ground and ontological dependence in the literature to be technical ones. This means that we cannot hope to settle the question of how to understand them by direct appeal to a pre-theoretic understanding of the terms. However, one feature has reached near consensus.<sup>6</sup> Ground and dependence (including ontological dependence) have close ties to explanation. When these technical notions are introduced, they are typically motivated by a range of cases where we intuitively judge there to be a failure of *explanatory* symmetry of some kind. Consider, for example, the following passage by Dasgupta [2014, 3].

Imagine you are at a conference, and imagine asking why a conference is occurring. A causal explanation might describe events during the preceding year that led up to the conference: someone thought that a meeting of minds would be valuable, sent invitations, etc. But a different explanation would say what goes on make the event count as a conference in the first place. Someone in search of this second explanation recognizes that conferences are not *sui generis*, so that there must be some underlying facts about event *in virtue of which* it counts as being a conference, rather than (say) a football match. Presumably it has something to do with how the participants are acting, for example that some are giving papers, others are commenting, and so on. An answer of this second kind is a statement of what *grounds* the fact that a conference is occurring.

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<sup>6</sup>Wilson [2014, 555-556] is an example of a dissenter.

This passage nicely illustrates Jenkins’s [2013] claim that when we are discussing notions of dependence and ground we tend to do so in explanatory terms such as “because” and “in virtue of”. This suggests that there is a very close relationship between the explanatory judgements that we make in these cases and the judgements that the introduction of the technical terms is trying to elucidate.<sup>7</sup>

In answering the second question of section 1, I will focus on one aspect of explanation, on the one hand, and ground and ontological dependence, on the other: their directedness. For most of this article I will address a common argumentative strategy that uses the failure of explanatory symmetry in certain cases—such as that of the existence of Socrates and the existence of the singleton set containing Socrates—to support the asymmetry of the metaphysical notions of ground/ontological dependence. In this section, I will first address a more general strategy that aims to recover the asymmetry of ground/ontological dependence from the asymmetry of explanation in general. Raven [2015, 327] gives an example of the argumentative strategy that I have in mind.<sup>8</sup>

Ground’s *explanatory* aspect seems to impose on it a distinctive logic, including  
... *asymmetry*: just as cyclical explanations are prohibited, so too are cycles of  
ground ...

There are several reasons to be worried about this line of argument. First, while I take there to be consensus in the literature on explanation, more broadly conceived, that explanation is *not symmetrical*, it is not at all clear that explanation is *asymmetrical* (or antisymmetrical). Just as, for example, Jenkins [2011], Wilson [2014], and Rodriguez-Pereyra [footnote 9: 2005, 2015] raise questions about whether dependence and ground are asymmetric, we also find such questions raised by others, for example Woodward [1984], when it comes to scientific explanation. Indeed, many causal accounts of explanation that also allow for the possibility of causal loops (such as time travel

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<sup>7</sup>I take this to have near consensus in the literature. However, many of the specifics about how ground, dependence, and explanation are related are in contention. For example, ground can be taken to be a metaphysical relation that underwrites explanation (like causation may be taken to be in the case of scientific explanation), or it can be understood directly as an explanatory notion. I take Rodriguez-Pereyra [2005], Schaffer [2016], and Wilson, (manuscript) as examples of the former position and Fine [2012] as supporting the latter. Similarly, some hold that ontological dependence is a relation that underwrites certain kinds of explanations while others take it to be an explanatory notion. Here I take Koslicki [2012] to hold the former position and Schnieder [2006] to defend the latter view. Further, ground is sometimes thought of as very closely related to ontological dependence and sometimes treated as strictly separate from it. See for example Schaffer [2009] versus Fine [1995, 2012]. Finally, there is no consensus as to whether ground and dependence are relations or sentential connectives, etc. However, all sides can speak of a relation of ground and dependence (in a deflationary sense). I am indebted to Bliss and Trogon [2014] for delineating several of these issues.

<sup>8</sup>Raven does not present the view as his own, so I am not sure if he endorses this argument. However, Raven [2013] defends the view that ground is asymmetric.

cases) will be likely to accept the possibility of cyclical explanations (at least when it comes to the ontic aspect of explanation). Here an independent debate could be had, but there is no consensus to lean on by shifting the question to the nature of explanation in general.

This may seem to allow for identifying the directionality of ground and dependence with that of explanation if we are willing to allow that ground and dependence are only clearly *non-symmetric*. This strategy, however, raises its own problems when it comes to understanding the directionality of ground and dependence. Even for the *particular cases* where there is consensus in acknowledging an intuitive judgement of explanatory asymmetry there is not a near consensus that this asymmetry is traceable to ontic aspects of explanation.<sup>9</sup> The metaphysical literature is typically interested in ontic explanation (or the ontic aspect of explanation).<sup>10</sup> There is significant debate over whether, for example, scientific explanations should be taken to be underwritten by any agent independent asymmetric relations in light of, for example, the time-symmetry of the laws of nature or the seeming context sensitivity of the directionality of explanation.<sup>11</sup>

Finally, even setting these larger worries about ontic explanation aside, if we merely hold that ground and dependence are *non-symmetric*, then this does not tell us why a particular case is not symmetric (just that there are some such cases). We could still ask for an account of why some particular case—let us say that of Socrates and the singleton set containing Socrates—is one where ground and dependence seem to run in one direction and not the other.

So far, I hope to have convinced you that merely accepting the near consensus, that ground and dependence (including ontological dependence) are closely related to explanation, does not answer the second question in section 1. To start to address this question, I will need to say something beyond the consensus. First, I will present what I will take for granted about explanation. Second, I will discuss how I take ground (and ontological dependence) to relate to explanation.

### 3. EXPLANATION AND NON-INFERENTIAL CONSEQUENCE

To get things started, I need to say a little about what I take explanation to be. In order to remain as neutral as I can on this issue, I will build on Jenkins's [2008, 75] bare bones functional account of explanation.<sup>12</sup>

<sup>9</sup>I am using, roughly, the terminology of Salmon [1989].

<sup>10</sup>See for example Jenkins [2013] and Correia and Schnieder [2012].

<sup>11</sup>See for example Price and Weslake [2009] and van Fraassen [1980].

<sup>12</sup>Jenkins [2013] develops an account of dependence using this notion of explanation as it stands. I will instead give a partial reduction of this notion of explanation relative to a theory.

Why-explanations of  $p$  are things that show of what  $p$  is a non-inferential consequence, or things of which  $p$  is a non-inferential consequence.

This characterisation of the role of why-explanations is sufficiently broad that it could accommodate all of scientific, metaphysical, and logical explanations. Moreover, it does not make any commitments as to whether explanation could be symmetric. Jenkins [2008, 74] characterises the notion of non-inferential consequence by contrasting it with inferential consequence. Inferential consequence is cashed out as “. . . the relation of premiss(es) to conclusion in an inference (which inference may be good or bad)”.

In order to make the notion of non-inferential consequence clearer, I will make a modification to Jenkins’s [2008] account. Instead of trying to specify what an explanation is *simpliciter*, I will focus on what it takes to have an explanation relative to a theory.

**3.1. Explanation relative to a theory.** The difficulty of spelling out what a non-inferential consequence is finds an analogy in the literature on scientific explanation. In the case of accounts of scientific explanation, the notion that is left unanalysed is not that of non-inferential consequence in general. It is typically what Jenkins [2008] would view as two specific examples of non-inferential consequence: causal consequence and nomological consequence. The distinction between laws and accidents, or the distinction between causal relations and mere correlations, is treated as a given in the analysis.<sup>13</sup> We can gain traction on the question of what a scientific explanation is without an analysis of these notions. We do, as a matter of fact, take some generalisations to be laws and some relations to be causal. We can make sense of explanatory judgements and make progress on understanding debates about explanatory status by appealing to what we have to take to be a law or a causal relation in order to, by our own lights, justify our explanatory judgements. Our causal judgements and judgements about the lawlike or accidental status of generalisations is part of our broader theory of the world. When we appeal to the fact that we *take* some generalisations to be laws and some relations to be causal, we are appealing to the fact that we take them to be laws or causes *according to some theory* of the phenomena of interest. We are directly analysing only what it takes to have an explanation relative to some such theory. I will spell out the same methodological move applied, first, to ontological dependence and, later, to ground.

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<sup>13</sup>This is the strategy in Woodward [2003] and Strevens [2008] as well as the mechanistic literature such as Machamer et al. [2000].

By modifying the quote from Jenkins [2008, 75] to take the above discussion into account, we get the following (with additions in italics).

Why-explanations of  $p$  *relative to a theory  $T$*  are things that show of what  $p$  is a non-inferential consequence *relative to  $T$* , or things of which  $p$  is a non-inferential consequence *relative to  $T$* .

I will focus on the first part of Jenkins's [2008] definition; in order to have an explanation of  $p$  relative to a theory  $T$  we need to display a relation of non-inferential consequence (relative to  $T$ ) that shows of what  $p$  is such a consequence. The difficulty with Jenkins's [2008] original formulation was the problem of getting a grip on the notion of non-inferential consequence. Rather than trying to spell out what a non-inferential consequence is *simpliciter*, we can now tackle the easier task of getting a handle on the notion of a non-inferential consequence relative to a theory.

To have a full account of explanation we could hope to have necessary and sufficient conditions for displaying a non-inferential consequence relative to a theory. Unsurprisingly, this is a big project in its own right.<sup>14</sup> Luckily, for the purposes of this article, I can get by with a merely necessary condition. My suggestion is this: to display a relation where  $x$  is a non-inferential consequence of  $y$ , relative to a theory  $T$ ,  $x$  has to be a consequence of  $y$  according to an inference that makes essential appeal to at least one theory specific principle of inference of  $T$ .

An example will make the contrast with mere inferential consequence clearer. In physical theories we expect the theory specific principles of inference to often be laws. For example, a commitment to it being a law that  $\vec{F}_{net} = m\vec{a}$  carries with it a commitment to judge certain inferences to be good that would otherwise not be thought to be so.<sup>15</sup> Now, relative to Newtonian mechanics, the magnitude of  $ma$  being  $10N$  is a consequence of the magnitude of the net force,  $F_{net}$ , being  $10N$ . This inference makes use of a principle of inference specific to Newtonian mechanics. Namely, that  $\vec{F}_{net} = m\vec{a}$ . That  $|ma|$  is  $10N$  is a potential non-inferential consequence of  $|F_{net}|$  being  $10N$  relative to Newtonian mechanics.

As a contrast,  $|ma| = 10N$  is also a consequence of  $|ma| = (5 \times 2)N$ . However, this inference does not make use of any principles of inference specific to Newtonian mechanics. Rather, it makes use of a principle of inference that belongs to elementary arithmetic. It is not a principle characteristic

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<sup>14</sup>I have worked on saying more about this for law based explanations in Jansson [forthcoming].

<sup>15</sup>Thinking of laws of nature as "inference tickets" goes back at least to Ryle [1949/2009, 105]. I should note that I am not here attempting an analysis of lawhood in these terms.

of Newtonian mechanics that  $2 \times 5 = 10$ .  $|ma| = 10N$  is not a potential non-inferential consequence of  $|ma| = (5 \times 2)N$  relative to Newtonian mechanics.

Similarly,  $|ma| = 10N$  is also a consequence of  $(|ma| = 10N \vee |ma| = 5N) \wedge \neg|ma| = 5N$ . However, yet again, this does not make use of a principle of inference characteristic of Newtonian mechanics. So  $|ma| = 10N$  is not a potential non-inferential consequence of  $(|ma| = 10N \vee |ma| = 5N) \wedge \neg|ma| = 5N$  relative to Newtonian mechanics. However,  $|ma| = 10N$  is a potential non-inferential consequence of  $(|ma| = 10N \vee |ma| = 5N) \wedge \neg|ma| = 5N$  relative to classical logic.

The example above made use of a theory from physics. It is a major assumption of this article that our metaphysical and conceptual theories also contain theory specific rules of inference.<sup>16</sup> The assumption is at least plausible. We can often articulate what we take to be the metaphysical or conceptual principles of some theory. For example, when talking about some theory of sets we will often outline such principles by claiming that sets are defined by their members, so that any two sets with the same members are the same set, etc. Like the corresponding case of the distinction between accidents and laws, I will simply rely on the fact that we *make* this distinction. What, if anything, makes the distinction legitimate is a further question. In this respect, accounts of ordinary, scientific, and metaphysical explanation are on a par with one another. Further, there are cases where it is difficult to adjudicate whether an inference principle belongs to, for example, a mathematical theory or a physical theory.<sup>17</sup> I expect that this can happen when we are dealing with metaphysical principles versus physical principles too. After all, the disciplinary domains are not sharp or without interaction. However, the cases used to motivate the introduction of, and the specific features of, the notions of ground and ontological dependence do not fall into the class of cases where it is hard to identify which theory a principle of inference belongs to.

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<sup>16</sup>I am leaving open the question of whether the relevant principles are metaphysical or conceptual. Both views are represented in the literature. See, for example, Jenkins [2013] for the former view and Schnieder [2006] for the latter.

<sup>17</sup>We see this reflected in the debate over whether there are any genuinely mathematical explanations of physical phenomena.

Setting aside the hard to place cases, here is the analogy so far.

Scientific	Metaphysical/Conceptual
explanations, relative to some theory, aim to display relations of non-inferential consequence, relative to the theory. <sup>18</sup>	
A necessary condition for displaying a relation of non-inferential consequence relative to a theory is that the inference (or presentation, if the display is non-inferential) makes essential appeal to a principle of inference identified within the theory as	
a law of nature or a causal principle.	a metaphysical or conceptual principle.
Laws of nature and causal principles	Metaphysical and conceptual principles
may give rise to symmetric, asymmetric, antisymmetric or non-symmetric relations.	

I have emphasised that I am not assuming that laws or metaphysical principles give us anti-symmetric or asymmetric relations between their relata. This is crucial. I am trying to clarify the source of the directionality without assuming asymmetry of explanation at the outset.

**3.2. Two assumptions about explanation.** In section 4 and 5, I will need two more assumptions about explanation. Both of the assumptions are substantive, but they are not tied to any specific account of explanation.

The first assumption rules out the use of known falsehoods as potential explainers. If  $E$  is necessarily false—by the lights of the explanatory background theory  $T$ —then  $E$  cannot feature in a potential explanation relative to  $T$ .<sup>19</sup>

**First assumption about explanation:** If  $E$  is a part of a potential explanation of  $M$  relative to theory  $T$ , then  $\sim E$  cannot be a theorem of  $T$ .

The second assumption captures a restriction on explanatory relevance. Let us assume that we have a full explanation in terms of  $A$  and  $B$  of some  $C$  that—by the lights of the explanatory background theory  $T$ —is not a necessary truth. While we cannot demand that  $A$  failing to hold is on its own a potential *full* explanation (relative to  $T$ ) of  $C$  failing to hold, we expect that  $A$  failing to hold is at least potentially explanatorily relevant (relative to  $T$ ) to  $C$  failing to hold. That is,

<sup>18</sup>I am setting aside the second disjunct in Jenkins’s [2008, 75] definition.

<sup>19</sup>Once we are dealing with idealisations and distortions, we need to modify this. However, idealisations and distortions are not taken to be relevant in the cases of interest.

we expect there to be some potential full explanation (relative to  $T$ ) of  $C$  failing to hold of which  $A$  failing to hold is at least a part.<sup>20</sup>

**Second assumption about explanation:** If  $A$  and  $B$  are a joint full explanation of  $C$  relative to  $T$ , and  $C$  is not a theorem of  $T$ , then  $\sim A$  should be explanatorily relevant to  $\sim C$  relative to  $T$  (and mutatis mutandis for  $B$ ).<sup>21</sup> That is,  $\sim A$  should be *part of* a potential full explanation of  $\sim C$  relative to  $T$ .

**3.3. Ground and ontological dependence *simpliciter* versus relative to a theory.** The discussion of ground and ontological dependence in the literature has been focused on elucidating the notions of ground/ontological dependence without making claims about ground/ontological dependence relative to a theory. In this article, I have stressed that the target is the *judgements* that we make about particular cases. In the existing literature there are certain stock examples that are doing double duty. First, these examples motivate the need for notions like ground/ontological dependence by showing how we make judgements about these cases that other accounts—such as the modal/existential one—fail to capture. Second, these examples inform the logical features of the notions of ground/ontological dependence. For example, they are often used to motivate hyperintensionality and—the focus of this paper—asymmetry.

Since I am questioning whether a metaphysical asymmetric notion is required in order to account for our judgements about particular cases in common circulation, it is appropriate to take a step back and ask what components we need in order to make the required intuitive judgement in these examples. The claim that we need to have some background theory in place is very plausible. After all, these judgements are not made through pure intuition alone. Rather, they are made against the background of some—more or less articulated—theory. Notice that this does not force us to accept that, for example, whether an object ontologically depends on another is theory dependent. The claim is that what we *take* to ontologically depend on what is theory dependent. I am, for now, silent on what, if anything, makes these judgements correct. In section 6, I will discuss how this changes the debate over whether a distinctively metaphysical notion of ground or ontological dependence is required.

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<sup>20</sup>I am using the term “explanatorily relevant” roughly in the sense of Schnieder [2011, 450].

<sup>21</sup>I am ruling out cases where  $C$  is a theorem of  $T$  since the question over whether some theorems of a theory  $T$  can explain other theorems of  $T$ , relative to  $T$ , will take me too far afield from the issue in this article. None of the cases discussed will have this form.

#### 4. ONTOLOGICAL DEPENDENCE REVISITED

I will start by focusing on the notion of ontological dependence. The terminology is not standardised, so let me be explicit about the rough and pre-theoretic notion that I have in mind. The type of ontological dependence that I will be concerned with aims to capture the relationship between two objects when the existence of one of them, so to speak, hinges on the existence of another.<sup>22</sup> In a by now standard example, it seems as if the existence of {Socrates} hinges on the existence of Socrates in a way in which the existence of Socrates does not hinge on the existence of {Socrates}. Examples such as this one are often used both to motivate the need for a notion like ontological dependence that is distinct from that of the modal/existential account and to motivate the claim that ontological dependence should be asymmetric (or, at least, antisymmetric).<sup>23</sup> To see why, let me briefly summarise the difficulty for the modal/existential account.

When we try to make the idea in the example above precise, it is tempting to formalise it as the claim that {Socrates} could not exist without Socrates existing, but not vice versa. However, as Fine [1994, 1995] notes, the most straightforward way of trying to capture this idea—the modal/existential account of ontological dependence—seems unable to reflect the non-symmetry of our pre-theoretic gloss.

On (a prominent version of) the modal/existential account,  $x$  ontologically depends on  $y =_{def}$  it is necessary that  $y$  exists whenever  $x$  exists.<sup>24</sup> We can formalise the modal/existential account as below.

$$x \text{ ontologically depends on } y: \Box(\exists z z = x \rightarrow \exists z z = y)$$

The problem for the modal/existential account is that  $\Box(\exists x x = Socrates \leftrightarrow \exists y y = \{Socrates\})$  seems to be true. We then have both

$$\star \Box(\exists y y = \{Socrates\} \rightarrow \exists x x = Socrates)$$

and

$$\star \Box(\exists x x = Socrates \rightarrow \exists y y = \{Socrates\}).$$

So that here, contrary to what we wanted to capture, Socrates ontologically depends on {Socrates} just as much as {Socrates} ontologically depends on Socrates. Let me now rephrase this in terms of the *judgements* that will be my primary focus in this article. The modal/existential account

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<sup>22</sup>For Lowe and Tahko [2015] this would be only one potential member in the larger family of ontological dependence.

<sup>23</sup>See for example Lowe and Tahko's [2015] discussion of existential dependence.

<sup>24</sup>See Fine [1995, 270–271] for a discussion of the historical roots and formulations of the modal/existential view.

delivers the result that we should judge Socrates to ontologically depend on  $\{Socrates\}$  if we take  $\Box(\exists x x = Socrates \leftrightarrow \exists y y = \{Socrates\})$  to be true. Yet, even though we do (plausibly) take the necessary biconditional to be true, the goal was to have a notion that could recover the failure of symmetry in my earlier pre-theoretic gloss. For the notion of ontological dependence to achieve this, it has to deliver that we do not take Socrates to ontologically depend on  $\{Socrates\}$ .

For ontological dependence to capture the intuitions of the pre-theoretic gloss, it is, in light of the previous section, not enough to ask whether we take it to be true that (using the contrapositive formulation of the modal/existential account)

$$(1) \quad \Box(\sim \exists z z = y \rightarrow \sim \exists z z = x).$$

My suggestion, as a first rough approximation, is that we need to ask whether or not the relevant theory (in this case our theory about sets and their relations to their members) delivers a metaphysical or conceptual explanation of the non-existence of  $x$  from the non-existence of  $y$ .<sup>25</sup> So far I have stayed close to the consensus. Whether or not we judge there to be a relation of ontological dependence is tied up with whether or not we judge there to be an explanation of a particular kind.

In the previous section, I identified a necessary condition for having a metaphysical or conceptual explanation relative to some theory. Namely, that the theory identifies as metaphysical or conceptual certain theory specific principles that are essential to the explanatory inference (or display). This now allows me to state a necessary condition for ontological dependence relative to a theory.<sup>26</sup> It is impossible for there to be an explanation of the non-existence of  $x$  from the non-existence of  $y$ , on the theory in question, if the non-existence of  $x$  is not even a consequence of the non-existence of  $y$  according to the metaphysical/conceptual principles singled out by the theory.

Let  $T_w$  be some theory that is relevant to  $x$  and  $y$ .

**Necessary condition for  $x$  to ontologically depend on  $y$  according to  $T_w$ :** There is some collection of principles that, according to  $T_w$ , conceptually/metaphysically connect object

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<sup>25</sup>Notice that this is not obviously equivalent to saying that there is a metaphysical or conceptual explanation of the existence of  $y$  from the existence of  $x$  based on the theory in question. This is the reason for focusing on the contrapositive version of the modal/existential definition. It will be clearer in section 5 why I am focusing on this formulation.

<sup>26</sup>I will not consider the view that there can be ontological dependence without explanation. The existence of such cases is more plausible when we deal with the notion of ontological dependence *simpliciter* and not with our judgements of ontological dependence relative to a theory.

$x$  and object  $y$  such that these principles are essential in ensuring that  $x$  not existing is a consequence of  $y$  not existing.

I still need to say something about what it means for principles to be *essential* in an inference. While I think that this notion is reasonably intuitively clear and captures the idea that the principles are doing inferential work, it is not trivial to make this notion precise. However, many examples used to introduce the need for a notion of ontological dependence beyond what the modal/existential account captures come from cases where we have relatively clearly formalised theories.<sup>27</sup> Here, we can state more precisely what it takes for one of the metaphysical or conceptual principles to play an *essential* role in an inference. We can think of the theory as a system of proof where the proof rules represent the principles of inference licensed within the theory. Many of these inference rules are not going to reflect logical rules of inference, but rather the theory specific rules of inference (call them  $R_i$ s).<sup>28</sup> For example, when our theory is a metaphysical or conceptual one, then these theory specific rules of inference identify our metaphysical or conceptual principles (relative to that theory). In other cases our theory specific principles may be a mixture of, for example, metaphysical and conceptual ones.

**Essential role:** Conceptual/metaphysical principles of theory  $T_w$  play an essential role in ensuring that the non-existence of  $x$  is a consequence of the non-existence of  $y$  relative to  $T_w$  only if

- the ordinary modal/existential conditional 1 can be proved as a theorem within the system representing  $T_w$
- and
- any such proof makes use of at least one of the theory specific rules of inference, the  $R_i$ s.

This is a natural way of thinking of the requirement that the  $R_i$ s play an essential role since it forbids us from importing any other knowledge that we might have—we are proving 1 as a theorem—and the  $R_i$ s are doing crucial work. Let us see how this account tackles a prominent counterexample to the modal/existential account.

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<sup>27</sup>I will not try to tackle cases that do not come from logic or mathematics in this paper. It is harder to do so. Theories here are often less clearly articulated, and it is harder to specify what the theory specific principles of inference are. Here I cannot do more than note that I think that a similar solution will work in these cases too.

<sup>28</sup>Of course, if our theory is a theory about logic, then the theory specific rules of inference might just be the logical ones. In general, however, they will not be.

4.1.  $\square$  (**Socrates exists**  $\leftrightarrow$  **{Socrates} exists**). On the account above, it is far from obvious that we have a solution to examples where the particular ontological dependence is non-symmetrical. This is an important point to stress. We still need an account of how the principles involved can allow us to claim that Socrates does not ontologically depend on {Socrates}, given that we accept  $\square$  (Socrates exists  $\leftrightarrow$  {Socrates} exists).

First, we should add a reference to a specific theory of sets  $T$ . As Zalta [2006] points out, there is no such thing as a single notion of a set but, rather, several different set-theoretic systems. The question is really how it can be that  $\{\text{Socrates}\}_T$  ontologically depends on Socrates, for some appropriate theory  $T$ , but not vice versa. Let me specify some terminology for the rest of this paper.

- ★ From now on I will use  $T$  to refer to a specific set-theoretic system.
- ★ Let us take  $a$  to refer to Socrates and  $b_T$  to refer to  $\{\text{Socrates}\}_T$ . I will allow that constants can be empty.
- ★ Let us take  $M(x, y, z)$  to stand for the claim that  $x$  is a member of  $y$  according to a theory of sets  $z$ . So,  $M(a, b_T, T)$  is true since we stipulate that according to our theory in question,  $T$ , Socrates is a member of  $\{\text{Socrates}\}_T$ .<sup>29</sup>
- ★  $b_T$  is a singleton set, so  $\forall x(M(x, b_T, T) \rightarrow x = a)$  is true.
- ★ Let  $C(x)$  stand for the claim that set-theory  $x$  satisfies some constraint on acceptable theories. Minimally we might want our theories to be consistent or paradox-free. More substantively, we might want  $x$  to correspond to the true platonic theory of sets. I will leave it open how strong the requirement is, but I will assume that there is some minimal requirement imposed on acceptable set-theoretic systems.

Now we can get clearer on why we think that  $\square(\exists x x = a \leftrightarrow \exists y y = b_T)$ . Drawing on Fine [1981], I will go through the relevant basic conceptual/metaphysical principles about set-theories that would allow us to get the necessary biconditional. Note that these principles are not simply principles of some set-theory. As Fine [1994, 4] makes clear, we need *modal* set-theoretic principles.

For arbitrary  $c$  and  $d$  the following are rules that I will take to apply for some arbitrary theory of sets  $e$  (of the right kind to get the problematic biconditional off the ground).<sup>30</sup> We take it that

<sup>29</sup>Here, I am assuming a positive free logic.

<sup>30</sup>I am formulating the rules in a natural deduction system. However, as is clear from the definitions earlier, I am assuming a positive free logic and an extension such as that of Fitch [1966] to deal with modal notions ( $M$ ) in a natural deduction system.

the identity of a set is defined by its members. By extending this to apply across worlds we get that, first, if a certain set has certain members in some possible world, then those are members of that set in all possible worlds.<sup>31</sup>

$$(R1) \quad \left| \begin{array}{l} \cdot \\ M(c, d, e) \\ \cdot \\ \Box M(c, d, e) \end{array} \right.$$

Here we can see why a modal set-theory is needed.

Although this axiom gives an identity condition for sets, it should be distinguished from the Extensionality axiom, which is also said to state an identity condition. The latter is an axiom of *internal* identity; it states when two sets of a given possible world are identical. The present axiom is one of *external* identity; it states a necessary condition for a set of one possible world to be identical with a set of another possible world. [Fine, 1981, 179]

Second, if a certain entity is not a member of a certain set, then that entity is not a member of that set in any world. In order to simplify the discussion I will make the rule specific to a singleton set, so that if  $c$  is the only member of a set (in the actual world), then that is the only member of the set in all possible worlds.

$$(R2) \quad \left| \begin{array}{l} \cdot \\ \forall x(M(x, d, e) \rightarrow x = c) \\ \cdot \\ \Box \forall x(M(x, d, e) \rightarrow x = c) \end{array} \right.$$

Moreover, sets are also only differentiated from each other, at a world, on the basis of their members.<sup>32</sup> So that two sets that do not differ in their members according to theory  $e$  must be

<sup>31</sup>This is roughly what Fine [1981, 179] calls *Rigidity of Membership*.

<sup>32</sup>This is roughly what Fine [1981, 179] discusses as the extensionality axiom as an internal condition of identity.

taken to be the very same set.<sup>33</sup>

$$(R3) \quad \left| \begin{array}{l} \cdot \\ \forall x(M(x, c, e) \leftrightarrow M(x, d, e)) \\ \cdot \\ c = d \end{array} \right.$$

We also take it to be the case that if some entity does not exist, then no set has that entity as a member.<sup>34</sup>

$$(R4) \quad \left| \begin{array}{l} \cdot \\ \sim \exists x x = c \\ \cdot \\ \sim \exists y M(c, y, e) \end{array} \right.$$

We might be tempted to assume that the converse also holds, so that if according to the theory in question there is no set that has some given entity as member, then that entity does not exist.<sup>35</sup> However, this would be too quick. We have to be careful since there is a double theory relativisation that has remained largely hidden until now. The notion of set and membership is relative to some specific set-theory. However, we also have our general theory,  $T_w$ , about what conceptual/metaphysical principles there are that connect sets that belong to  $T$  and the existence of entities. As I stressed above, the principles R1–R4 are not principles of some set-theory  $T$  but principles *about* sets on  $T$  extending to modal situations. The case of Socrates and  $\{\text{Socrates}\}_T$  relies on reasoning that takes us from the existence of the set in some possible world to the existence of the member and vice versa. This reasoning takes us outside the set-theory  $T$  itself. That we are not merely relying on the rules of  $T$  was clear already from the inclusion of modal notions (as Fine [1981, 1994] points out).

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<sup>33</sup>To make this completely accurate I should demand that  $c$  and  $d$  are sets (according to  $e$ ). Since it will not be important for the rest of the paper I have simplified the rule by leaving it out.

<sup>34</sup>This is one direction of what Fine [1981, 180] calls *Set Existence*.

<sup>35</sup>This is how Fine [1981, 180] treats *Set Existence*. However, Fine is thinking of how to get from an already acceptable set theory to a modal version of that theory. It will be clear below why I think that this way of thinking of the inferences involved misses an important factor.

This is not to say that we cannot make the converse inference to the one in R4. We can, but we need to be careful about how we do so. The failure of there to be a singleton set with a certain member is not enough on its own to conclude that the member fails to exist. We typically also require that the set-theory in question ( $T$ ) fulfils certain conditions (such as being paradox free or consistent, etc.). This is a sensible condition to impose. After all, we might take it to be the case that nothing exists that is a naïve set since the notion of a naïve set is not formulated clearly enough to avoid paradoxes (Russell’s paradox in particular). So we might take it to be the case that there is no naïve set-theoretic set containing Socrates. Yet we do not thereby commit ourselves to thinking that Socrates does not exist. In order to get Fine’s case off the ground, we have to assume that the theory,  $T$ , is not like the naïve theory of sets. I have represented the required constraints on  $T$  as just  $C(T)$  and have purposefully left it open exactly what they are. For what I will say here, it does not matter if we wish to strengthen or weaken the constraints as long as we accept that there *are* some such constraints.

To make this idea somewhat more specific, I will make use of just the idea that if some entity exists and the set-theory in question fulfils the constraints, then there is a singleton set containing that entity as its sole member. This gives us the basis for saying that if, under such a theory, there is no singleton that has the entity as its sole member, then that entity does not exist.

$$(R5) \quad \left| \begin{array}{l} \cdot \\ C(e) \\ \exists x x = c \\ \cdot \\ \exists y (M(c, y, e) \wedge \forall x (M(x, y, e) \rightarrow x = c)) \end{array} \right.$$

With this in place, we quickly get the troubling strict biconditional. As long as  $C(T)$  holds, we will get one direction of the biconditional (for ease of presentation in the next section, when I reintroduce explanatory notions, I present them in the contrapositive form).

$$(2) \quad \Box(\sim \exists x x = b_T \rightarrow \sim \exists x x = a)$$

Whether  $C(T)$  holds or not we will get the other direction of the biconditional.

$$(3) \quad \Box(\sim \exists x x = a \rightarrow \sim \exists x x = b_T)$$

This way of establishing the strict biconditional is somewhat pedantic. The pedantry will pay off in the next section by allowing us to see how it is possible for ontological dependence to fail to be symmetric in this case.

4.1.1. *Socrates does not ontologically depend on {Socrates}*. In the coming sections I will take it as given that (R1), (R2), (R3), (R4), and (R5) are good candidates for being conceptual/metaphysical principles on our general theory  $T_w$ . As we would suspect from similar problems about explanatory non-symmetry and subsumption under laws, this has not yet solved the problem of accounting for the failure of symmetry in our pre-theoretic judgement about Socrates and  $\{Socrates\}$ . After all, above I argued that these principles entail that, when  $T$  is successful in its stipulation of the existence of sets, then necessarily there will be a singleton set containing Socrates if and only if Socrates exists.

However, when we look a little closer at the derivations, we see that they are not strictly parallel. To get 2 we first had to assume that  $T$  fulfilled the conditions imposed for the successful postulation of sets (such as being paradox free, etc.). We do not have an explanation of the failure of the member to exist simply from the failure of the singleton set to exist.  $x$  failing to exist is not a consequence of  $y$  failing to exist relative to  $T_w$ . So, a fortiori,  $x$  failing to exist is not a non-inferential consequence of  $y$  failing to exist relative to  $T_w$ . Here my partially reductive analysis of explanation delivers the result that  $x$  failing to exist is not metaphysically/conceptually explained by  $y$  failing to exist relative to  $T_w$ . Since I took ontological dependence to demand such an explanation,  $x$  does not ontologically depend on  $y$  (relative to  $T_w$ ). Against what we plausibly take to be the relevant theoretical background principles—determined by those needed to get the case off the ground and drawing on Fine [1981]—Socrates does not ontologically depend on  $\{Socrates\}_T$ .

4.1.2. *{Socrates} can ontologically depend on Socrates*. It is still the case that, against what we plausibly take to be the relevant theoretical background principles,  $\{Socrates\}_T$  can ontologically depend on Socrates.<sup>36</sup> We did not need to invoke  $C(T)$  to get 3. As soon as we find out that

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<sup>36</sup>I have to settle for the cautious claim since I have only given a necessary condition without explicitly relying on explanatory notions. However, plausibly, the failure of Socrates to exist explains the failure of the set to do so.

Socrates does not exist, we know that the singleton set containing him fails to do so too. It simply does not matter whether the set theory in question is paradox-free, etc., or not.

4.1.3. *The moral of Socrates and {Socrates}*. We can ensure that, necessarily, Socrates exists if and only if  $\{\text{Socrates}\}_T$  does. However, to ensure this, we require the assumption that  $T$  fulfils certain criteria. Yet, even when  $T$  fulfils all of the criteria stipulated, we still do not have the result that Socrates ontologically depends on the singleton set containing Socrates. The idea is that ontological dependence is a matter of having a *negative* explanation. That is, an explanation where the failure of  $x$  to exist would be explained by the failure of  $y$  to do so. To determine whether a theory  $T_w$  supports such an explanation, we first identify what the relevant metaphysical/conceptual principles singled out by  $T_w$  as such are. When we spell out these principles, we find that they ensure that when some object does not exist, then there is no set containing that object as a member. However, they do not guarantee that if some set does not exist, then the members of that set also do not exist.

Spelling out what the principles are forces us to consider what happens when one of our theories of sets does not fulfil the minimal criterion, but this does not force us to consider any counter-possible world. We need to consider what happens when a theory does or does not fulfil the constraints, but we do not need to consider *for any given theory* (which presumably either fulfils or does not fulfil the constraints in all possible worlds) what would be the case had *it* fulfilled or failed to fulfil the minimal requirements.

There is nothing in this solution that bans the *possibility* of Socrates depending on  $\{\text{Socrates}\}_T$  according to some theory. This is as it should be. I have only tried to account for what it takes for  $x$  to ontologically depend on  $y$  *relative to a theory*. I have not given an account of when a theory is correct to employ something as a metaphysical/conceptual principle. I have argued above that what we plausibly take to be the modal principles relating sets and their members—assuming that we are trying to get the example off the ground to start with—do not support ontological dependence in both directions. This is enough to account for our judgements about the case. Yet I relied on no primitive asymmetric notions to do so.

It might be objected that the reasoning above is too involved to capture what is driving our judgement of explanatory non-symmetry.<sup>37</sup> However, I do not think that this is so. I suspect that

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<sup>37</sup>Thank you to an anonymous referee for raising this objection.

the relative immediacy—that is, without being able to articulate worries about paradoxes, etc.—of the intuition that the direction of dependence runs from the singleton set to Socrates, but not vice versa, is driven largely by the fact that we take sets to be abstract entities, whereas we do not take Socrates to be so. Abstract and theoretically defined entities generally rely on the success of the theory of which they are a part for their claim to legitimacy. Non-abstract entities do not. This is enough to lead us to suspect that there are conditions of acceptability in play in order for the abstract entity to exist, while there are no such conditions in play for the concrete entity. As a rough rule of thumb, it is sensible to expect the existence of concrete entities to not hinge on the existence of theoretically defined abstract ones, while the reverse may not hold.<sup>38</sup>

Finally, this account is general enough to handle cases beyond Socrates and  $\{\text{Socrates}\}_T$ . If we had taken the non-symmetry to be traceable *directly* to the theoretical and abstract nature of sets—instead of taking it to merely give us reason to think that some such non-symmetry was likely to be found—then we would end up with new difficulties. The account I have presented relies only on the principles spelling out the relationships between the theory of sets, sets on that theory, and their members. Once we accept these, we find that, no matter what the member is, the set can ontologically depend on the member but not vice versa. Nothing crucial hinged on  $a$  referring to Socrates and  $b_T$  to  $\{\text{Socrates}\}_T$  rather than  $\{\text{Socrates}\}_T$  and  $\{\{\text{Socrates}\}\}_T$  respectively.<sup>39</sup>

## 5. DEPENDENCE VERSUS GROUND (AN EXTENSION AND ELABORATION)

In the previous section, I showed how we can locate the failure of symmetry in the case of Socrates and the singleton set containing Socrates to the different role that assumptions about the theory of sets plays in the two cases. I think that this case is of particular importance since it is one of the main cases used to motivate a departure from the modal/existential account. However, we may worry that this case is particularly well suited as one where we are relying on more specific background commitments. Other cases may seem like they cannot be accounted for by using the same strategy. Wilson [2014, 549] attributes a worry of this sort to an anonymous referee.

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<sup>38</sup>Thank you to Donnchadh O’Conaill for suggesting this reformulation. At the 2015 Explananza: A Conference on Explanation in Science and Metaphysics, Kristie Miller presented a more extensive account than I have attempted here of how to handle the seeming ease of the intuition.

<sup>39</sup>For an account that runs up against the challenge of not being generalisable in this way see Zalta [2006]. However, it is a problem that any two-tier account—with one notion of dependence for concrete objects and one for abstract objects—will face.

Can we not assess, as plainly true, claims to the effect that disjunctions metaphysically depend on disjuncts, and that conjunctions metaphysically depend on conjuncts?

Wilson [2014, 550] responds that in this case we are already specifying the specific metaphysical relation since we are talking about *disjunction* and *disjuncts*, etc. In the end, I think that Wilson is correct about this, but I do not think that it is at all trivial to see how we would recover non-symmetry in these cases.

There is also a second motivation to tackle such examples. So far I have stayed close to the modal/existential view that ontological dependence is a matter of the existence of some object “hinging” on the existence of some other object. This notion is, however, limited in several ways. In particular, it only applies to objects. Often a slightly modified version of the same case is presented when discussing the notion of ground; where this is understood to claim, roughly, that some fact (etc.) holds in virtue of some other fact.<sup>40</sup> A first natural step to take would be to generalise the notion of ontological dependence to not be restricted to objects. I think that we can generalise the notion of ontological dependence in this way, and I will use the term metaphysical/conceptual dependence (dependence for short) for it. However, it is still useful to distinguish this generalised notion of dependence from the notion of ground.<sup>41</sup>

If we generalise the central idea of section 4, it will follow that  $P \vee Q$  does not depend on  $P$  (relative to a standard classical theory of propositional logic).  $P \vee Q$  not holding is not a consequence of  $P$  not holding (relative to such a theory). There is an important distinction that this notion of dependence captures. Unlike the case of  $P \wedge Q$ ,  $P \vee Q$  does not hinge on  $P$  holding. Yet there is also something left out. We want to capture the idea that  $P \vee Q$  can hold in virtue of  $P$  holding. I take us to be interested in  $P$  holding *explaining* why  $P \vee Q$  does (relative to a classical theory of logic). In grounding terminology,  $P$  can ground  $P \vee Q$ .

Now I can spell out the relationship between ground and dependence a little more fully. I have taken dependence to demand *negative* explanation. That is, the *failure* of that which is being depended upon to hold would explain the *failure* of the dependent to hold. I will take ground

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<sup>40</sup>There are many candidates for the proper relata. See for example Bliss and Trogdon [2014] for a summary. I am not here trying to take a stand on how this should be construed. I will only be careful to stick to the locution of facts if there is a risk of confusion with ontological dependence.

<sup>41</sup>Since these are technical notions, there is leeway in how we fix them. Here I am following Fine [2012] in taking the central notion of ground to involve full explanation. What I am calling the generalised notion of dependence (dependence for short) will turn out to guarantee partial ground in Fine’s [2012, 50] terminology.

to demand *positive* explanation. That is, the holding of the ground explains the holding of the grounded. Since these notions are all technical, there is an element of stipulation in this. However, it captures well the appeal of the modal/existential account of ontological dependence and the use of *in virtue of* locutions in the grounding literature.

We can state the corresponding necessary conditions by again making use of the partial reduction of explanation from section 3.1.

**First necessary condition for  $x$  to depend on  $y$  relative to a theory  $T_w$ :** The theory specific principles singled out by  $T_w$  are essentially involved in making  $x$  not obtaining a consequence of  $y$  not obtaining.

**First necessary condition for  $y$  to ground  $x$  relative to a theory  $T_w$ :** The theory specific principles singled out by  $T_w$  are essentially involved in making  $x$  obtaining a consequence of  $y$  obtaining.

I have singled out these necessary conditions since they make no mention of explanation. However, once we return to the explanatory motivation for these necessary conditions, we find a second difference between ground and dependence. I have taken dependence to demand *full* negative explanation. The explanation in question is full since  $y$  not obtaining is on its own enough to explain  $x$  not obtaining (relative to the background theory). Given the negative explanation, we can say something about the positive explanation of  $x$  too. We cannot claim that  $y$  obtaining must be a potential *full* explanation of  $x$  obtaining (relative to the background theory). However, we know that  $y$  obtaining must be *explanatorily relevant* to  $x$  obtaining (by the second assumption in 3.2). That is,  $y$  obtaining must at least be *part of* a potential full explanation of why  $x$  obtains (relative to the background theory). This tells us that dependence demands full negative explanation and partial positive explanation. Mutatis mutandis, the same reasoning applies to ground. Ground demands full positive explanation and partial negative explanation. We can again apply the partial reduction of explanation in order to state the corresponding necessary conditions (since the reduction is partial, the necessary conditions will not be jointly sufficient).

**Second necessary condition for  $x$  to depend on  $y$  according to  $T_w$ :** The theory specific principles singled out by  $T_w$  are essentially involved in making  $x$  obtaining a consequence of some condition of which  $y$  obtaining is a part.

**Second necessary condition for  $y$  to ground  $x$  according to  $T_w$ :** The theory specific principles singled out by  $T_w$  are essentially involved in making  $x$  not obtaining a consequence of some condition of which  $y$  not obtaining is a part.

By demanding full negative explanation for  $x$  to depend on  $y$ , we commit ourselves to  $y$  being a partial ground of  $x$ .<sup>42</sup> Similarly, by demanding full positive explanation for  $y$  to ground  $x$ , we commit ourselves to  $x$  partially depending on  $y$ . This gives rise to an iterative process—where at each stage we can formulate a new necessary condition for dependence/ground—that only terminates once we reach a case of full ground or full dependence.

To illustrate this, let me continue the example at hand. The goal is to allow that, although  $P \vee Q$  does not depend on  $P$ ,  $P$  can ground  $P \vee Q$ . First, on standard logical systems the principles distinctive of the system will make  $P \vee Q$  a consequence of  $P$ .

$$\left| \begin{array}{l} P \\ \hline P \vee Q \end{array} \right.$$

The first necessary condition for ground is fulfilled. Further, it is at least plausible that  $P$  holding does provide a full explanation of  $P \vee Q$  holding. Second,  $P$  not holding is also plausibly explanatorily relevant to  $P \vee Q$  not holding.  $P$  not holding together with  $Q$  not holding plausibly provides such an explanation, and  $P$  not holding is part of this explanation. The second necessary condition for ground is clearly fulfilled.

$$\left| \begin{array}{l} \sim P \\ \sim Q \\ \hline \sim (P \vee Q) \end{array} \right.$$

Both  $P$  not holding and  $Q$  not holding are part of this putative negative explanation. So we expect both  $P$  and  $Q$  to be explanatorily relevant to the corresponding positive explanation. That is, we expect there to be explanations of  $P \vee Q$  in which  $P$  plays a part, and explanations of  $P \vee Q$  in which  $Q$  plays a part. We have already seen this for  $P$ . The case left to address is whether  $Q$  is explanatory relevant to  $P \vee Q$ . Plausibly  $Q$  is. At the very least we know that  $P \vee Q$  is a consequence of  $Q$ . Finally, notice that we now have a situation where we say that there are

<sup>42</sup>In the sense of Fine [2012, 50].

two independent possible explanations for  $P \vee Q$ . Whenever we reach the stage where we are postulating more than one explanation for the same explanandum, we need to make sure that the possible explanations postulated make sense *collectively*. The minimal requirement for having a case of potential explanatory overdetermination is that the explanantia are jointly consistent. If they are not, then they cannot both be true (and from the first assumption in 3.2, they cannot both be explanations). The case of  $P$  grounding  $P \vee Q$  has no difficulties with this condition.  $P$  and  $Q$  are classically consistent, and we have a potential case of explanatory overdetermination. The iterative process has now terminated since there are two independent possible explanations of  $P \vee Q$ .

With this distinction between ground and dependence in place, let me tackle a second case where we intuitively judge there to be a failure of symmetry. We take  $P$  to be part of the explanation for why  $P \wedge Q$ , but we do not take  $P \wedge Q$  to be part of an explanation of  $P$ . Yet  $P$  is a logical consequence of  $P \wedge Q$ . On accounts of ground, this would be captured by saying that  $P \wedge Q$  does not ground  $P$ . However,  $P, Q$  may ground  $P \wedge Q$ . Let us start with the judgement that, in classical logic,  $P \wedge Q$  can hold in virtue of  $P, Q$  holding.

Jointly,  $P, Q$  fulfil the first condition of ground.  $P \wedge Q$  is a logical consequence of them jointly holding.



So we expect  $P$  not obtaining to be explanatorily relevant to  $P \wedge Q$  not obtaining. For this to be the case,  $P \wedge Q$  not obtaining has to be a consequence of  $P$  not obtaining (or of some condition of which  $P$  not obtaining is a part). This is clearly the case. The same reasoning holds for  $Q$ . We have a potential case of overdetermination when it comes to explaining why  $P \wedge Q$  does not obtain. Moreover,  $Q$  not obtaining and  $P$  not obtaining are logically consistent.

Why does  $P \wedge Q$  obtaining not explain  $P$  obtaining relative to a system of classical logic? First,  $P$  is a consequence of  $P \wedge Q$  (relative to classical logic).

$$\left| \begin{array}{l} P \wedge Q \\ \hline P \end{array} \right.$$

If this had been an explanation, then by the same reasoning as before we would expect  $P \wedge Q$  not holding to be explanatorily relevant to  $P$  not holding. This motivated the second necessary condition for ground. Now we need  $P \wedge Q$  not holding to be part of an explanation for  $P$  not holding. The suggestion below

$$\left| \begin{array}{l} \sim (P \wedge Q) \\ Q \\ \hline \sim P \end{array} \right.$$

would allow us to meet the second necessary condition for ground. However, we now need to find a way to make  $Q$  not holding explanatorily relevant to  $P$  holding. We can, of course, construct an appropriate inference of which  $Q$  not holding is a part.<sup>43</sup> However, since we are now assuming that we have two possible explanations for  $P$ , we need to check that they make sense collectively. We could have a potential case of explanatory overdetermination as above. However, relative to classical logic, this is not possible. The difficulty is that both  $Q$  (in  $P \wedge Q$ ) and  $\sim Q$  have to be explanatorily relevant to  $P$ .  $P \wedge Q$  and  $\sim Q$  are not classically consistent.  $\sim (\sim Q \wedge Q)$  is a theorem of classical logic, so, by the first assumption in 3.2,  $\sim Q \wedge Q$  is not explanatorily relevant to any explanandum relative to classical logic.<sup>44</sup>

<sup>43</sup>There are also trivial cases where  $Q$  not holding can simply be dropped while preserving the entailment of  $P$ . I am not counting these as inferences of which  $Q$  not holding is a part.

<sup>44</sup>In general we have a second option to consider: whether we have a case of back-up explanations. In back-up explanations we are only committing to one or the other of the two potential explanations holding, but to both being potential explanations nonetheless. However, relative to classical logic, we do not have the structure to make this work. This is not surprising since back-up scenarios rely on counterfactual conditionals and not merely on material conditionals. To see that we will be looped back to the question of whether or not  $P \wedge Q$  explains  $P$  relative to classical logic, let us stipulate that we add some proposition  $A$  to  $\sim Q$  to ensure the entailment of  $P$ . If we try to construe this as a case of back-up explanation, we expect that  $(P \wedge Q) \vee (A \wedge \sim Q)$  will be a potential explanation of  $P$ . When we take into account the fact that  $A \wedge \sim Q$  has to entail  $P$ , then this is equivalent to asking whether  $(P \wedge Q) \vee (P \wedge A)$  is a potential explanation of  $P$ . If this is an example of an explanatory back-up situation, then we expect  $P \wedge A$  to explain  $P$ . However, there was nothing special about  $Q$  in our original question of whether  $P \wedge Q$  explains  $P$  (relative to classical logic). We find ourselves back with the same question. The iterative process cannot terminate.

This allows us to make sense of the judgement that while  $P$  can be part of explaining why  $P \wedge Q$ ,  $P \wedge Q$  is not part of explaining why  $P$  in classical logics. Crucially, for this to go through I have not relied on any assumption that explanation is asymmetrical or underwritten by an asymmetric relation. I have recovered the failure of symmetry by showing how the theory specific principles (in this case the inference rules of classical logic) cannot be used to explain  $P$  from  $P \wedge Q$ . Yet it is possible that they can be used to explain  $P \wedge Q$  from  $P$  together with  $Q$ .

As in the case of Socrates and the singleton set containing Socrates, we can show how the failure of symmetry comes about by pointing to the principles that we take to govern the behaviour of  $\vee$  and  $\wedge$  in classical logic. Even though we have a less obvious theory in play here since we often take the principles of classical logic for granted, the principles in play allow us to see that (relative to a theory of classical logic)  $P, Q$  may jointly explain  $P \wedge Q$ , but  $P \wedge Q$  cannot explain  $P$ . Similarly, relative to classical logic,  $P$  may explain  $P \vee Q$ , and a similar argument to the one given above can be given for why  $P \vee Q$  cannot be part of an explanation of  $P$ . Here too we can show how the failure of symmetry comes about without appealing to any specific primitive asymmetric relation.

Finally, since I have delineated several closely related and technical notions, let me summarise the terminology of this section briefly.<sup>45</sup>

$x$ ontologically depends on $y$	$x$ depends on $y$	$y$ grounds $x$
relative to $T_w$ iff		
$x$ and $y$ are objects	$x$ and $y$ are facts, states, etc.	
and, first,		
$y$ obtaining/existing is explanatorily relevant to $x$ obtaining/existing		$y$ obtaining explains $x$ obtaining
relative to $T_w$ .		
And second,		
$y$ not obtaining/existing explains $x$ not obtaining/existing		$y$ not obtaining is explanatorily relevant to $x$ not obtaining
relative to $T_w$ .		

This way of distinguishing ground and dependence is not commonly used in the literature. However, I hope to have shown that, although the two notions are closely related, there is a useful distinction to be made between them. Moreover, although dependence turns out to guarantee

<sup>45</sup>The table is read from the top following the column to the bottom.

partial ground in Fine’s [2012, 50] terminology, just using the notion of partial ground obscures the strong parallels between the two notions as I have used them here.

**5.1. Socrates and {Socrates} revisited.** In section 4.1 I showed how it is possible to make sense of our judgements of non-symmetry in the case of ontological dependence without postulating any primitive asymmetric relation. I did so by drawing on a partially reductive account of explanation. The same solution will apply to ground. The fact that Socrates exists *alone* does not ground the fact that the singleton set exists. The fact that  $\{\text{Socrates}\}_T$  exists is not a consequence of merely the fact that Socrates exists (relative to  $T_w$ ). Rather, the fact that Socrates exists *together with* the fact that  $C(T)$  can ground the fact that  $\{\text{Socrates}\}_T$  exists.

$$\left| \begin{array}{l} C(T) \\ \hline \exists x x = a \\ \hline \exists x x = b_T \end{array} \right.$$

This fulfils the first necessary condition for ground, and the failure of either of the facts in the explanans to hold is plausibly explanatorily relevant to it being the case that the set fails to exist. If it is the case that Socrates does not exist, then, according to principles laid out in section 4.1, the singleton set will not exist either. If the set-theory does not fulfil the minimal requirements for the successful postulation of sets, then the failure of the singleton set to exist will be a consequence of the reasoning in section 4.1.<sup>46</sup> The second necessary condition is fulfilled, and we have reached a stopping point. We have found out that the failure of the set to exist is potentially overdetermined. Moreover, the explanantia of the two potential explanations are consistent.

Although the fact that Socrates exists *together with* the fact that  $T$  is an acceptable set-theory can ground the fact that  $\{\text{Socrates}\}_T$  exists—relative to what we plausibly take to be the relevant theoretical principles—the fact that  $T$  is an acceptable set-theory *together with* the the fact that  $\{\text{Socrates}\}_T$  exists cannot ground the fact that Socrates exists. While this conjunction too fulfils the first necessary condition for ground,  $T$  failing to fulfil the minimal criteria does not, on its own, potentially explain it failing to be a fact that Socrates exists. The reasoning laid out in 4.1 does not allow us to conclude anything about the existence or non-existence of Socrates from the failure

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<sup>46</sup>Although not given its own principle since we did not need it to derive the necessary biconditional, I assumed it in the discussion.

of set-theory  $T$  to be consistent or paradox free. Thus, the situation is not analogous to the case in the previous paragraph. We can, of course, make the fact that Socrates is non-existent (when that is a fact) a logical consequence of a (non-contradictory) condition of which the failure of  $C(T)$  to hold is a part, but we cannot make the iterative process terminate and make essential use of the theory specific principles.

We can vindicate the judgement that—relative to the kind of theory about the relationship between sets and their members that we need in order to get Fine’s original case off the ground—the features of the set-theory in question together with the fact that Socrates exists can explain the fact that the singleton set containing Socrates exists. Yet, the fact that the singleton set exists does not play a part in explaining the fact that Socrates does.

## 6. CONCLUSION

I have relied on a partially reductive account of explanation relative to a theory. The postulation of a notion of metaphysical/conceptual principles relative to a theory is by no means trivial. However, we can lean on the observation that we require analogous notions when we sort the potentially explanatory relations from the non-explanatory ones in other cases too. For example, when we discuss causal explanations relative to a theory. The failure of symmetry does not automatically follow from the postulation of theory distinctive principles together with the notion of non-inferential consequence relative to a theory. However, we can account for some of the major cases that motivated the departure from the modal/existential account by paying attention to what is guaranteed by these principles relative to the relevant background theory. In particular, this partially reductive account is enough to shed light on why we take there to be an explanatory non-symmetry in some of the cases—such as that of the existence of Socrates and the singleton set containing him—that motivate the introduction of notions like ground. We can do so without postulating that explanation is in general an asymmetrical notion or that explanation has to be underwritten by a primitive asymmetric relation.

For most of this article, I have been concerned with defending a negative answer to the second question in the introduction. We do not need a primitive asymmetric metaphysical notion in order to capture our judgements of a failure of symmetry in cases such as that of the existence of Socrates and the singleton set. Let me now go back to revisit the broader discussion about ground and ontological dependence that this paper started with. The first question raised was whether

notions such as ground, etc., are required in order to articulate, or, the stronger claim, explicate broad views such as physicalism. I think that the notion of ground can play the role of articulating views such as physicalism. It is informative to learn that someone is committed to the view that, say, the physical grounds the mental. I have built the tie to explanation into my notion of ground relative to a theory, so in this usage, the claim above can be understood as a commitment to there being a theory of the relationship between the physical and the mental on which the physical metaphysically explains the mental.<sup>47</sup> However, the notion of ground that I have articulated in this paper does not support us actually *having explicated* a physicalist account of the mental once we claim that the physical facts ground the mental facts. Here is where I agree with Wilson’s [2014] view that the work of making good on that claim comes by specifying the theory specific “small-g” relations. Or better, the theory specific metaphysical/conceptual principles.

The first question in the introduction arises as a particular way of defending the usefulness of notions such as grounding. I have allowed that, for example, ground can play a useful role in articulating views like physicalism. Yet the notion of ground relative to a theory that I make use of in this article is clearly not the primitive metaphysical structuring relation that Schaffer [2009, 2016] has in mind. How much is what I have said here friendly to such a notion of ground? Although I have relied on the assumption that we postulate theory distinctive metaphysical principles, I have remained silent on what it takes for our postulation of certain principles to be legitimate. Throughout the article, I have been concerned with recovering the judgements of non-symmetry. For these purposes I could lean on the fact that we make the judgements in light of our theoretical views. For much of the discussion in the metaphysics literature, this will not yet have delivered the desired realist metaphysical notions of ground and ontological dependence. On the positive side, what I have said is compatible with such views.<sup>48</sup> Whether objective and worldly metaphysical relations are needed will come down to what we want to say about what makes the postulation of certain principles within metaphysical theorising correct.

On the negative side, I have argued that at least some of the prominent examples that are often given to *support* the need for distinctively metaphysical notions of ontological dependence and ground do not obviously require special and realist metaphysical notions in order to make sense of

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<sup>47</sup>Note that it does not require *having* such a theory at hand.

<sup>48</sup>I take Wilsch [2015] to broadly develop such a view. However, here the asymmetry is written in by hand by only allowing modus ponens, but not modus tollens, as a principle of inference.

our judgements. Whether the desired metaphysical structuring relations are, in the end, needed depends on whether we require them in order to make sense of what it is that makes a metaphysical principle legitimate. This opens up for an option that is not often discussed in the metaphysics literature on ground/ontological dependence. The question of whether a worldly metaphysical structuring relation is needed may only be possible to address in a piecemeal way. It is not obvious that we should expect there to be a general answer to give to the question of what makes the postulation of theoretical principles legitimate. For example, it is not clear that what makes the postulation of our familiar principle of disjunction introduction in classical logic legitimate should be expected to have much in common with what it is that would make an assumption that sets have the same members across possible worlds legitimate. I have given some conceptual unity to the notion of ground in this article by making use of the notion of explanation relative to a theory. However, it does not follow from this that we can expect there to be a unified answer to whether the notion of ground/ontological dependence as developed in this article is objective, underwritten by (non-deflationary) metaphysical relations, etc.

This puts the proponent of ground in a position that is familiar from the literature on scientific realism. Proponents of scientific realism have to contend with the possibility that the question of what attitude we should take towards, say, the posits of our best scientific theories is unanswerable at the level of generality at which the question is posed. The answer may end up differing for different theories or different parts of theories.

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