



# Derivative Indeterminacy

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## Abstract

Indeterminacy is metaphysical (or worldly) if it has its source in the way the world is (rather than how it is represented or known). There are two questions we could ask about indeterminacy. First: does it exist? Second: is indeterminacy derivative? I focus on the second question. Specifically, I argue that (at least some) metaphysical indeterminacy can be derivative, where this roughly means that facts about indeterminacy are metaphysically grounded in facts about what is determinate.

## 1 Introduction

Indeterminacy is *metaphysical* (or worldly) if it has its source in the way the world is (rather than how it is represented or known). There are an increasing number of proponents of metaphysical indeterminacy.<sup>1</sup> (Going forward, I will use “indeterminacy” to refer to metaphysical indeterminacy.) There are two questions we could ask about indeterminacy. First: does it exist? Second: is indeterminacy derivative? I will focus on the second question.<sup>2</sup>

Can indeterminacy be derived from—metaphysically explained in terms of, reduced to, defined in terms of, grounded in—determinacy? Yes. In this paper, I give the following account of what it is for indeterminacy to be derivative.

### DERIVATIVE

Indeterminacy is derivative just in case the determinate facts are more fundamental than the facts about what is indeterminate, where relative fundamentality is understood in terms of metaphysical grounding.

<sup>1</sup> For defenses of metaphysical indeterminacy, see: Parsons (2000), Hawley (2002), Morreau (2002), Akiba (2004), Rosen and Smith (2004), Williams (2008c), Barnes and Williams (2011), Wilson (2013), Wilson (2016).

<sup>2</sup> For others who address this question, see Barnes (2014), Eva (2018), and Mariani (2022).

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To clarify the content of this thesis, I develop a modal account of indeterminacy, one that uses centered worlds as opposed to standard possible worlds.

If my account is correct, the existence of metaphysical indeterminacy is less metaphysically and logically committal than philosophers have traditionally assumed. It is less metaphysically committal because it does not require the existence of fundamental indeterminacy. It is less logically committal because it does not require the fundamental logic to be non-classical. If there are objections to metaphysical indeterminacy, then, they cannot be based on the idea that indeterminacy requires a drastic change in our fundamental metaphysics and logic.

Here is my plan. I start by proposing that we take the derivative to mean: metaphysically grounded (Sect. 2). Then I respond to Barnes (2014)'s argument against the possibility of derivative indeterminacy (Sect. 3). After this objection is set aside, I present the centered-worlds account of indeterminacy and explain how my account constitutes a real definition of indeterminacy (Sects. 4–6). I end by outlining the logical implications—or lack thereof—of derivative indeterminacy (Sect. 7).

## 2 Derivative as Grounded

I propose we understand being derivative in terms of *being metaphysically grounded*. I start by introducing the ground-theoretic framework for derivative indeterminacy. Afterward, I justify the focus on metaphysical grounding (as opposed to some other notion of metaphysical dependence).

To understand grounding, we should consider examples.

- (1) Gwen is virtuous because she acts virtuously.
- (2) The proposition  $\langle P \text{ or } Q \rangle$  is true because  $\langle P \rangle$  is true.
- (3) The book is colored in virtue of being yellow.

*Metaphysical grounding* is the explanatory relation common to metaphysical explanations like (1)-(3). It corresponds to the “because” or “in virtue of” in such explanations; it is the makes-the-case relation. Much has been said to motivate, explicate, and defend the notion of grounding<sup>3</sup>. Since grounding is now a mainstay of contemporary metaphysics, I will assume that grounding claims like (1)-(3) are intelligible and sometimes true.

I will make four assumptions about grounding: (i) grounding is a relation between facts (or states of affairs); (ii) grounding covaries with metaphysical explanation—*viz.*,  $P$  metaphysically explains  $Q$  just in case  $P$  metaphysically grounds  $Q$ ; (iii) grounding is asymmetric; (iv) grounding is necessary in the sense that: if  $P$  grounds  $Q$ , then necessarily,  $P$  only if  $Q$ .

Let  $[Q] \leftarrow [P]$  mean: the fact that  $Q$  is fully grounded in the fact that  $P$ . When we translate (1)-(3) into this idiom, we get:

- (4)  $[Gwen \text{ is virtuous}] \leftarrow [Gwen \text{ acts virtuously}]$

<sup>3</sup> For surveys of the literature, see Trogon (2013), Raven (2015), and Bliss and Trogon (2014).

(5) [ $\langle P \text{ or } Q \rangle$  is true]  $\leftarrow$  [ $\langle P \rangle$  is true]

(6) [ $b$  is colored]  $\leftarrow$  [ $b$  is yellow]

With the grounding framework in hand, we can give a first pass account of derivative indeterminacy. Let a *determinate full ground* be a full ground such that: every fact within that full ground determinately obtains. Then our first pass is:

#### FIRST PASS

Indeterminacy is derivative just in case facts about what is indeterminate always have a determinate full ground.

You may notice that FIRST PASS does not make reference to the fundamental. A more obvious proposal would be: indeterminacy is derivative just in case facts about what is indeterminate are grounded in facts about what is fundamental. My proposal only assumes the existence of relatively fundamental facts. But why?

I have avoided the obvious proposal because I do not want to make strong assumptions about absolute fundamentality. There are a couple of reasons for this. First, there may not be such a thing as absolute fundamentality.<sup>4</sup> Second, absolute fundamentality may exist, but there may be fundamental facts that are nonetheless grounded.<sup>5</sup> Third, the notion of absolute fundamentality tends to be associated with the thesis of *well-foundedness*, but there are various interpretations of the latter property.<sup>6</sup>

In general, absolute fundamentality is more complicated than sometimes thought, but the thesis of derivative indeterminacy need not rely on assumptions about absolute fundamentality. Going forward, whenever I speak of the fundamental, I only assume the existence of the relatively fundamental—that is, facts that ground other facts.

We can see, broadly speaking, how a grounding theorist would frame the thesis of derivative indeterminacy. But why use the grounding framework, as opposed to others? Instead of understanding derivative indeterminacy in terms of grounding, one could talk about derivative indeterminacy in terms of composition, reduction, building, emergence, metaphysical naturalness, etc. Furthermore, even if derivative indeterminacy is cashed out in terms of grounding, there is a non-trivial possibility that there are multiple grounding relations.<sup>7</sup> If grounding pluralism is true, there is an additional question: why use some specific concept of grounding, as opposed to others? Not only must I justify my choice of grounding, I have to justify whatever specific assumptions I make about grounding.

I focus on one metaphysical dependence relation because we need an account of derivative indeterminacy that is detailed, and such detail can only be had by considering a specific relation. I focus on metaphysical grounding because it has been seen as a promising form of metaphysical dependence by many metaphysicians. Furthermore, despite the disagreement about the nature of grounding, there is at least some willing-

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<sup>4</sup> Schaffer (2003), Tahko (2014), Morganti (2014), Morganti (2015).

<sup>5</sup> Fine (2001), Tahko (2014).

<sup>6</sup> For discussions of well-foundedness, see: Dixon (2016), Rabin and Rabern (2016). See Mariani (2022) for extensive criticism of views about derivative indeterminacy that make strong assumptions about absolute fundamentality.

<sup>7</sup> Wilson (2014), Griffith (2018), Richardson (2020).

ness to work from a common set of assumptions about grounding. Those assumptions are the ones that I have outlined previously.

Of course, there will be those who reject grounding who nonetheless want to consider derivative indeterminacy. The best I can do is to suggest that my account has mainly assumed there is a way to define indeterminacy using metaphysical necessity and an asymmetric dependence relation. To see whether my arguments work for other relations, one must work out the details for one's favorite notion of metaphysical dependence.

### 3 The Impossibility Argument

Any account of derivative indeterminacy must face an impossibility argument given by Barnes (2014, p. 342). She claims that: if indeterminacy exists, it cannot be derivative.

Her precise argument can be formulated as follows. Let  $f$  and  $d$  be variables over descriptions of the world at its fundamental and derivative level, and let  $F$  and  $D$  be names of particular descriptions.

#### ARGUMENT

1. For any complete true description of how things are fundamentally,  $f$ , and any complete description,  $d$ , of how things are derivatively, either  $f$  entails  $d$  or  $f$  is incompatible with  $d$ . (Premise)
2. Entailment is determinacy preserving. (Premise)
3. For some complete description,  $D$ , of a way for things to be derivatively, it is indeterminate whether  $D$  is true. (Premise)
4. For some complete description,  $F$ , of a way for things to be fundamentally, it is determinate that  $F$  is true. (Premise)
5. Either  $F$  entails  $D$  or  $F$  is incompatible with  $D$ . (From 1)
6. If  $F$  entails  $D$ , and  $F$  is determinately true, then  $D$  is determinately true. (From 2)
7. If  $F$  is incompatible with  $D$ , and  $F$  is determinately true, then  $\neg D$  is determinately true. (From 2)
8. Either  $D$  is determinately true or  $\neg D$  is determinately true. (From 4, 5, 6 and 7)
9. Contradiction. (From 3 and 8)

Before we can delve into the details of this argument, we immediately encounter a problem: Barnes' argument is formulated in terms of entailment between descriptions of the world, but our conception of metaphysical dependence concerns grounding between non-representational facts. There is a mismatch between the conception of derivative indeterminacy that Barnes criticizes and the conception of derivative indeterminacy currently on offer.

We might simply replace "entailment" with "grounding," but the resulting argument will still concern grounding between descriptions. To start, it is unclear what a description is, exactly. A description can be a sentence or the proposition expressed by one. In either case, grounding between descriptions will not necessarily yield the same results

as grounding between non-representational facts, anymore than grounding between concepts will parallel or coincide with grounding between objects. Furthermore, it seems odd to focus on grounding between descriptions of facts as opposed to the facts themselves. The utilitarian does not say that sentences about rightness are grounded in sentences about maximizing happiness; they say that what makes an act right is the fact that it maximizes happiness. Sentential or propositional grounding seems unmotivated here, a likely artifact of the linguistic setting in which indeterminacy is usually discussed.

Eva (2018) accepts the linguistic framing of Barnes' argument but defends a formal way of making derivative indeterminacy intelligible. However, I believe a complete defense of derivative indeterminacy requires us to reject the linguistic framing entirely. So instead of considering Barnes' original argument now, I will first consider a simplified, fact-friendly version of Barnes' argument. Let  $[F]$  and  $[D]$  be arbitrary facts.

ARGUMENT\*

1.  $[F]$  is fundamental and determinately obtains. (Premise)
2.  $[D]$  is derivative and it is indeterminate whether it obtains. (Premise)
3.  $[D] \leftarrow [F]$ . (Premise)
4. If  $[D] \leftarrow [F]$  and  $[F]$  determinately obtains, then  $[D]$  determinately obtains. (Premise)
5.  $[D]$  determinately obtains. (From 1, 3, and 4)
6. Contradiction. (From 2 and 5)

Premises 1-3 encode the idea that indeterminacy is fully grounded in determinacy. Premise 4 captures a fact about the logic of determinacy: namely, that grounding is determinacy-preserving. From a more technical perspective: if we take  $[D] \leftarrow [F]$  and  $[F]$  to determinately obtain, then Premise 4 says that the determinacy operator obeys a determinacy-theoretic version of modal axiom  $K$ .<sup>8</sup> I believe ARGUMENT\* captures the spirit of ARGUMENT, or at least as much spirit that can be translated into the grounding framework.<sup>9</sup>

At first glance, this is a very powerful argument. The most controversial assumption is Premise 4, which takes grounding to be determinacy-preserving. Mariani (2022) rejects this assumption, arguing that grounding connections might be themselves indeterminate. While I am sympathetic to indeterministic grounding, I think there is a simpler reason to reject ARGUMENT\*: namely, that it is ambiguous between two different conceptions of indeterminacy grounding.

On the first conception of indeterminacy grounding, facts that are determinate (like  $[F]$ ) ground facts (like  $[D]$ ) of which it is indeterminate whether they obtain. Call this the *direct view*, since it says that  $[D] \leftarrow [F]$ . Given this view, ARGUMENT\* is valid.

<sup>8</sup> Suppose  $\Delta(\phi)$  means: it is determinate that  $\phi$ . Then the resulting principle is:  $\Delta(F \rightarrow D) \rightarrow (\Delta(F) \rightarrow \Delta(D))$ .

<sup>9</sup> I can say more to justify ARGUMENT\*. The obvious difference between ARGUMENT and ARGUMENT\* is the presence of grounding between facts. Another difference is that ARGUMENT\* has no equivalent of Premise 1 or Conclusion 5 from ARGUMENT. Why not? Because a fundamental fact  $[F]$  can ground a derivative fact  $[D]$  even if, in some possible worlds,  $[D]$  is grounded in a different fundamental fact. Barnes (2014, p. 342) recognizes this modification of her argument, in the case of grounding. This change is the reason why ARGUMENT\* is shorter than ARGUMENT.

On the second conception of indeterminacy grounding, indeterminate facts, or facts about what is indeterminate, are grounded in facts about what is determinate. Call this the *indirect view*. Let  $[\Delta F]$  mean: the fact that  $[F]$  determinately obtains. And let  $[\nabla D]$  mean: the fact that it is indeterminate whether  $[D]$  obtains. On the indirect view, either (a)  $[\nabla D] \leftarrow [\Delta F]$  or (b)  $[\nabla D] \leftarrow [F]$ , where  $[F]$  is determinate. I should emphasize that the indirect view is not what Wilson (2013) calls an *object level* view of indeterminacy. So  $[\nabla D]$  does not mean:  $D$  indeterminately obtains.

ARGUMENT\* is invalid if we take the indirect view. We see this clearly if we rewrite the argument as follows.

ARGUMENT\*\*

1.  $[\Delta F]$  is fundamental. (Premise)
2.  $[\nabla D]$  is derivative. (Premise)
3.  $[\nabla D] \leftarrow [\Delta F]$ . (Premise)
4. If  $[D] \leftarrow [F]$  and  $[\Delta F]$  obtains, then  $[\Delta D]$  obtains. (Premise)
5.  $[\Delta D]$  obtains. (From 1, 3, and 4)
6. Contradiction. (From 2 and 5)

This argument is invalid because Premise 4 does not allow us to derive Conclusion 5. The principle generating Premise 4 only allows us to derive the following: if  $[\nabla D] \leftarrow [\Delta F]$  and  $[\Delta \Delta F]$  obtain, then  $[\Delta \nabla D]$  obtains. This only gets us higher order determinacy, which is compatible with first-order indeterminacy. To make ARGUMENT\*\* valid, you would need to replace Premise 4 with the following principle: if  $[\nabla D] \leftarrow [\Delta F]$  and  $[\Delta F]$  obtains, then  $[\Delta D]$  obtains. To start, this principle is not simply a determinacy-preserving principle; it strips away indeterminacy and replaces it with determinacy. Second, this principle is contradictory because it allows us to derive  $[\nabla D]$  (by the factivity of grounding) and  $[\Delta D]$  (by modus ponens).

Now let us revisit Barnes' original argument, with its assumptions of sentential grounding. I hold that ARGUMENT fails if we assume the indirect view of derivative indeterminacy. In its first premise, ARGUMENT assumes that every fundamental description  $f$  directly entails (or grounds) derivative descriptions  $d$ . But the indirect view holds that the dependence is between  $\Delta f$  and  $\nabla d$ , not  $f$  and  $d$ . Even if I set aside my issues with sentential grounding, I think ARGUMENT fails because Premise 1 identifies a conception of derivative indeterminacy that is not mandatory.<sup>10</sup>

Barnes' original argument is couched in terms of entailment rather than grounding, but she thinks her argument would be valid if we replaced entailment with grounding. She writes: "if the relationship between the fundamental and derivative—whether entailment or grounding or 'in virtue of', and so forth—is determinacy preserving, the argument will still go through" (2014, p. 342). I have shown that: even assuming that grounding is determinacy preserving, the argument is invalid.

I have argued that the indirect view of indeterminacy grounding, represented in ARGUMENT\*\*, does not lead to a contradiction. But is the indirect view plausible? I think so. Consider an analogy in which we ground contingency in possibility. Let  $[C(P)]$  mean: the fact that it is contingent whether  $P$  obtains. Let  $\diamond$  represent the

<sup>10</sup> Eva (2018, p. 37) makes a similar claim.

usual possibility operator. I would say that  $[C(P)]$  is grounded in  $[\diamond P]$  and  $[\diamond \neg P]$ . I would not say, of a fact such that it is contingent whether it obtains,  $[P]$ , that it is fully grounded in two possible facts,  $[P]$  and  $[\neg P]$ . The fact that it is contingent whether  $[P]$  is grounded in the fact that it is possible that  $[P]$  obtains and possible that  $[\neg P]$  obtains. In other words: the modal status of the  $[P]$  must be an explicit part of the ground-theoretic account; removing their status leads to the absurd situation in which we are committed to  $[P] \leftarrow \{[P], [\neg P]\}$ .

Similarly, the fact that *it is indeterminate* whether  $[D]$  obtains is grounded in the fact that  $[F]$  *determinately obtains*.<sup>11</sup> The key assumption of the indirect view is that we are not directly grounding the fact that  $D$  indeterminately obtains; rather, we are grounding the fact that it is indeterminate whether  $D$  obtains.

The indirect view still generates questions, most obviously: what is the status of  $[D]$  if  $[\nabla D]$  obtains? I answer this question in §7. For now, my point is that the impossibility argument only succeeds against a very specific conception of derivative indeterminacy. Once we abandon description grounding and the direct view of indeterminacy grounding, we see nothing incoherent in assuming that the indeterminate is fully grounded in the determinate.

The resulting discussion has had the effect of sharpening our notion of derivative indeterminacy. We modify FIRST PASS as follows.

#### SECOND PASS

Indeterminacy is derivative just in case: for any fact of the form  $[\nabla S]$ ,  $[\nabla S] \leftarrow \Gamma$ , where every  $\gamma \in \Gamma$  has the form  $[\Delta \phi]$ .

The second pass is a more precise version of the first, indicating that we are taking the indirect conception of derivative indeterminacy.

## 4 Metaphysical Supervaluationism

The second pass clarifies what it means for indeterminacy to be *derivative*, but it does not give us a specific account of indeterminacy. And for us to have a successful account of derivative indeterminacy, we have to focus on a more specific account of indeterminacy, itself. There are many theories on the market, but I will adopt a version of *metaphysical supervaluationism*.<sup>12</sup>

<sup>11</sup> Strictly speaking, we could directly ground  $[\nabla D]$  in  $[F]$ , where the latter determinately obtains, as opposed the fact that  $F$  determinately obtains ( $[\Delta F]$ ). This means there is a slight disanalogy from the contingency case, in which the modal status must be part of the grounded. This does not matter in practice, as facts about what is determinate are plausibly fully grounded in facts that determinately obtain. If grounding is transitive, it follows facts about indeterminacy are grounded in facts about determinacy. So it is harmless to choose  $[\Delta F]$  rather than  $[F]$  as a ground of  $[\nabla D]$ .

<sup>12</sup> The most prominent competitor to metaphysical supervaluationism is Wilson (2013)'s determinable-based theory of indeterminacy. This theory differs from metaphysical supervaluationism in two ways. First, the determinable-based theory takes indeterminacy to consist in an indeterminate fact obtaining. Second, the determinable-based theory defines indeterminacy in terms of possessing a determinable property but lacking a unique determinate of that property. I do not focus on the determinable-based view because there is an argument against derivative indeterminacy when understood in a supervaluationist way, but no equivalent argument against the determinable-based view.

To understand metaphysical supervenience, we should start with its inspiration: semantic supervenience. The story, here, is one where we account for (purely) semantic vagueness by suggesting that vagueness is semantic indecision. We associate each sentence with a set of possible precise meanings called precisifications. Then we define notions of determinate truth and falsity by recording what is true and false according to those precisifications. A sentence *S* is *determinately true/false* just in case it is true/false on every possible precisification of the meaning of *S*. A sentence *S* is *indeterminate* just in case *S* is true according to one precisification and false according to another. For example, the sentence “Jack is bald” is determinately true when said of a man with only ten hair follicles because every precisification of “bald” is one in which a man with only ten hair follicles counts as bald.

The metaphysical supervenience takes the basic machinery of semantic supervenience but gives it a metaphysical interpretation. Instead of quantifying over possible *meanings*, we quantify over *precisificational possibilities*.<sup>13</sup> If we have a notion of a precisificational possibility, we can then say what it is for Jack to be determinately bald/non-bald. Jack is determinately bald/non-bald just in case Jack is bald/non-bald in every precisificational possibility. It is indeterminate whether Jack is bald just in case Jack is bald in some precisificational possibilities but not others.

It is important to recognize that, in the case of the metaphysical supervenience, you are not directly specifying the truth conditions of “Jack is bald” by reference to precisificational possibilities. You can do this, but it is optional from the perspective of metaphysics. What matters is that we can define the indeterminacy of the *property* of being bald by reference to precisified worlds.

What are precisificational possibilities? Perhaps the most prominent version of metaphysical supervenience, offered by Barnes and Williams (2011), takes precisificational possibilities to be ersatz possible worlds. Akiba (2004) adopts a more worldly interpretation and calls them precisified worlds. Parsons (2000) takes them to be super-resolutions, ways of making the world determinate. Williams (2008b) suggests that precisificational possibilities are actual worlds. These accounts differ in their details, but the template remains the same: we define determinacy and indeterminacy with respect to a set of precisificational possibilities, where these possibilities are worldly (or at least as worldly as possible worlds).<sup>14</sup>

## 5 Precisificational Possibilities as Centered Worlds

The remaining question is: what version of metaphysical supervenience should I adopt? More specifically: what is the relevant notion of precisificational possibility? I wish there were an existing account that I could use, off the shelf with no modifications, but some tinkering will be necessary. My view is composed of two parts: a definition of determinacy and indeterminacy, and an account of precisificational possibility.

<sup>13</sup> Akiba (2004), Parsons (2000), Williams (2008b), Barnes and Williams (2011).

<sup>14</sup> There are also views that are similar to metaphysical supervenience although their key constructions do not quantify over possibilities (Morreau, 2002; Rosen & Smith, 2004)



The definition of determinacy and indeterminacy is straightforward.  $[S]$  determinately obtains (or  $[\Delta S]$  obtains) just in case  $[S]$  obtains in every precisificational possibility.  $[S]$  determinately fails to obtain (or  $[\Delta \neg S]$  obtains) just in case  $[S]$  fails to obtain in every precisificational possibility. It is indeterminate whether  $[S]$  obtains (or  $[\nabla S]$  obtains) just in case  $[S]$  obtains in one precisificational possibility and  $[\neg S]$  obtains in another.

One point of difference between my definition of determinacy and indeterminacy, and that of other metaphysical supervaluationists, is that I make no reference to sentences, propositions, truth, or other semantic notions. In contrast, it is common for metaphysical supervaluationists to define determinate truth in terms of precisificational possibilities.<sup>15</sup> The way that I separate metaphysics and semantics will be important for what comes later in Sect. 7.

My account of precisificational possibility is more complex, as it is a mix of various suggestions in the literature. The basic idea is that precisificational possibilities are *centered worlds*, where the center of each world is a perspective on some possible world.

Let me explain. Centered worlds are possible worlds that center some feature or property. The classic application of centered worlds concerns self-locating or *de se* contents.<sup>16</sup> However, the most relevant application, for our purposes, is in the metaphysics of perspectival properties.<sup>17</sup> On these views, we represent possibilities as pairs of worlds and perspectives. For example, suppose  $p$  is the perspective of someone who thinks burgers are tasty and  $w$  is a world in which burgers exist. Then  $\langle w, p \rangle$  is a centered world in which burgers are tasty in  $w$  according to  $p$ . This can be useful, as we can characterize the property of *tasty-to- $p$*  as the set of centered worlds in which  $x$  is tasty, given  $p$ 's perspective. We represent the property of *tasty simpliciter* as the set of centered worlds  $\langle w, p \rangle$ , for every  $w$  and  $p$ , in which an object is tasty in  $w$  according to  $p$ .

In textbook discussions of taste predicates, philosophers typically hold fixed perspectives and vary worlds. However, we might also want to hold fixed a world and vary perspectives. Suppose we are in the actual world  $w_{@}$  and we only care about whether burgers in  $w_{@}$  are tasty according to low-brow and high-brow perspectives, represented as  $l$  and  $h$ . Say that a burger is *super-tasty (or non-tasty)* at  $w_{@}$  if it is tasty (or non-tasty) according to  $l$  and  $h$ . Say that a burger is *indeterminately tasty* at  $w_{@}$  otherwise.

Now we can easily apply the centered worlds framework to indeterminacy.<sup>18</sup> Every metaphysical possibility  $w$  determines a set of perspectives on that possibility. I take a *precisificational possibility* to be a pair of an ordinary metaphysical possibility  $w$  and a perspective on that possibility  $w^*$ ; the centered world would be  $\langle w, w^* \rangle$ . This leads to a refined conception of determinacy and indeterminacy. We say that  $[S]$  determinately

<sup>15</sup> Parsons (2000), Akiba (2004).

<sup>16</sup> Lewis (1979).

<sup>17</sup> Einheuser (2006), Brogaard (2008), Egan (2012), MacFarlane (2014), Merlo and Pravato (2021).

<sup>18</sup> If we conceive of centered worlds as purely formal devices—tuples that enable us to have multidimensional modal logics—then centered worlds are already common to accounts of indeterminacy. For example, Litland and Yli-Vakkuri (2016) uses triples to model the interaction between vagueness and modality. The contribution of this paper mainly lies in the philosophical interpretation of centered worlds.

obtains at a world  $w$  just in case  $[S]$  obtains at  $\langle w, w^* \rangle$ , for every  $w^*$ . We say that  $[S]$  determinately fails to obtain at a world  $w$  just in case  $[S]$  fails to obtain at  $\langle w, w^* \rangle$ , for every  $w^*$ . Finally, we say that it is indeterminate whether  $[S]$  obtains at  $w$  just in case, for some  $w^*$  and  $w^{**}$ ,  $[S]$  obtains at  $\langle w, w^* \rangle$  but fails to obtain at  $\langle w, w^{**} \rangle$ .

I have defined precisificational possibilities as pairs of ordinary possibilities and perspectives on those possibilities. But what are perspectives, exactly? I take them to be broadly representational, in the vein of ersatz or anti-realist theories of possibilities. I do this, not because I want to advocate for anti-realism, but because I want to assume the least metaphysically committal view of indeterminacy.

Here is a simple way to apply the view. On one perspective of the actual world, perhaps [Jack is bald] obtains. From another perspective, perhaps it does not obtain. The important thing is that the perspectives are perspectives on specific worlds, so we can then say that it is indeterminate whether [Jack is bald] obtains in  $w$  because of perspectives on  $w$ .

You may wonder: why appeal to centered worlds when you could merely appeal to perspectives held by agents in ordinary worlds? The benefit of centered worlds is that they allow us to make sense of cases in which people do not exist. Einheuser (2006) makes this point. For example, suppose  $w$  does not contain humans. Does it follow that there are no facts about determinacy or indeterminacy at  $w$ ? No. This is because what is determinate or indeterminate is determined by perspectives *on*  $w$ , and those need not be held by individuals *in*  $w$ .

Now I should say how my account incorporates insights from various metaphysical supervaluationists. Like Akiba (2004), I define determinacy in reference to precisificational possibility. The difference is that I take precisificational possibilities to be centered worlds. From Williams (2008b), I inherit the broad idea that there are multiple versions of worlds, in the sense that there are multiple perspectives on worlds; however, I fall short of adopting the strict view that there are multiple actual worlds. Lastly, my view is similar to that of Barnes and Williams (2011) in the sense that the precisificational possibilities are less than fully objective. My view differs from theirs because it gives a metaphysical definition of indeterminacy.

There may be a non-perspectival interpretation of  $w^*$ , but my current goal is to sketch an account in which derivative indeterminacy is possible, so I am purposefully choosing an account that is deflationary in the sense that precisificational possibilities are not as fundamental as metaphysical possibilities.<sup>19</sup> Some metaphysicians may be somewhat disappointed at this choice. For them, worldly indeterminacy means perspective-independent indeterminacy. I believe this is a mistake. The worldliness of colors, tastes, and so on, is not threatened by their perspective-dependence. Or at least, the threat is unclear in absence of a compelling argument.

<sup>19</sup> One natural non-perspectival form of metaphysical indeterminacy is quantum indeterminacy (Bokulich, 2014; Glick, 2017; Calosi & Wilson, 2019; Torza, 2020; Calosi & Mariani, 2020; Calosi & Wilson, 2021; Calosi & Mariani, 2021). Some have tried to account for quantum indeterminacy using the metaphysical supervaluationist framework (Mariani et al., 2021; Darby & Pickup, 2021). Though for challenges to this view, see Darby (2010), Skow (2010), Corti (2021).

## 6 Definitions and Grounding

So far, I have given a definition of derivative indeterminacy, but a definition is not necessarily a ground-theoretic account. I have to reconcile these two theoretical pictures.

Here is the definition offered in the last section.

### DEFINITION

It is indeterminate whether  $[S]$  obtains at  $w$  just in case, for some  $w^*$  and  $w^{**}$ ,  $[S]$  obtains at  $\langle w, w^* \rangle$  but fails to obtain at  $\langle w, w^{**} \rangle$ .

This definition is not a ground-theoretic account because it is a biconditional and biconditionals are symmetric. Grounding, on most accounts, is asymmetric.

Why does the difference matter? Why not settle with a biconditional instead of a grounding claim? Because biconditionals are not relations of metaphysical dependence, that's why! Everyone uses biconditional to characterize indeterminacy, even those who think there is no such thing as derivative indeterminacy. Since Fine (1994), however, metaphysicians have recognized that necessary biconditionals do not always specify relations of metaphysical dependence. You know the story: Socrates necessarily covaries with his singleton, but Socrates does not metaphysically depend on his singleton. The same story holds for grounding between necessary facts. So a necessary biconditional does tell us which notion is prior, if any.

Luckily, there is a way of reconciling the definition of derivative indeterminacy with a ground-theoretic account. We simply adopt a ground-theoretic account of definition. Specifically, I am interested in the notion of a *real* or *metaphysical* definition. A real definition of a thing tells us what a thing is, or what it is for something to be the case. The real definition of rightness, for example, tells us what it is for something to be right. Real definitions are not to be confused with nominal, or semantic definitions. We are not defining the meanings of words or concepts; we are defining things themselves.

There are different concepts of real definition, but I will rely on one described by Rosen (2015). Read  $\Box P$  as: it is metaphysically necessary that  $P$ . Say that  $F$  is a *real definition* of  $G$  just in case  $\Box(\text{if } x \text{ is } F \text{ or } G, \text{ then } x \text{ is } G \text{ in virtue of being } F)$ . So if rightness is defined in terms of maximizing happiness, then necessarily: if an act is right or maximizes happiness, that act is right in virtue of maximizing happiness. For Rosen, the "in virtue of" relation is metaphysical grounding.

The current notion of real definition successfully describes necessary and sufficient conditions for definienda. To see this, suppose that  $F$  is a real definition of  $G$  and that grounding is *factive*; viz., if  $[a \text{ is } G] \leftarrow [a \text{ is } F]$ , then  $[a \text{ is } G]$  and  $[a \text{ is } F]$  obtain. Then it follows that  $\Box(x \text{ is } F \text{ if and only if } x \text{ is } G)$ . So if rightness is defined in terms of maximizing happiness, then necessarily: an act is right just in case it maximizes happiness. Rosen's account of real definition is useful because it entails a biconditional even though the relation of real definition itself is asymmetric. And that is just what we need, in the current context.

For reference, recall my second pass.

### SECOND PASS

Indeterminacy is derivative just in case: for any fact of the form  $[\nabla S]$ ,  $[\nabla S] \leftarrow \Gamma$ , where every  $\gamma \in \Gamma$  has the form  $[\Delta\phi]$ .

We refine this, using the machinery of real definition, into a third pass. Just let  $PP_w$  be the set of precisificational possibilities determined by  $w$ ; remember, these take the form  $\langle w, w^* \rangle$ . And let  $[\Delta S_p]$  be the fact that  $S$  determinately obtains at a precisificational possibility  $p$ .

### THIRD PASS

Indeterminacy is derivative just in case: necessarily, for any fact of the form  $[\nabla S]$  and possible world  $w$ , if either (a)  $[\nabla S]$  obtains at  $w$  or (b) every  $\gamma \in \Gamma$  has the form  $[\Delta S_p]$  or  $[\Delta \neg S_p]$ , and some  $p_1, p_2 \in PP_w$  are such that  $[\Delta S_{p_1}]$  and  $[\Delta \neg S_{p_2}]$  obtain, then  $[\nabla S] \leftarrow \Gamma$ , where every  $\gamma \in \Gamma$  has the form  $[\Delta S_p]$  or  $[\Delta \neg S_p]$ , and for some  $p_1, p_2 \in PP_w$ ,  $[\Delta S_{p_1}], [\Delta \neg S_{p_2}] \in \Gamma$ .<sup>20</sup>

This third pass is complex to state precisely, but the basic idea is simple. When there is discord amongst the precisificational possibilities with respect to  $[S]$ , it is indeterminate whether  $[S]$  obtains *because* there is discord amongst the precisificational possibilities. The relevant determinate facts concern  $S$  rather than other possibly irrelevant determinate facts. And when it is indeterminate whether  $[S]$  obtains, this fact holds because there is discord amongst the precisificational possibilities. Note that THIRD PASS is strictly stronger than DEFINITION; THIRD PASS entails the necessary biconditional in DEFINITION but also specifies when certain asymmetric grounding relations hold.

My final account of derivative indeterminacy is THIRD PASS. No more passes are necessary. If my account is correct, I have shown that indeterminacy can be derivative. This does not show that indeterminacy exists, but it does make its existence more plausible. To be committed to indeterminacy is not necessarily to be committed to *fundamental* indeterminacy. The latter claim is much stronger than the former. An analogy may be helpful here. Consider two theorists who believe in ethical facts. One theorist thinks ethical facts are grounded in natural facts. The other thinks ethical facts are fundamental. For many people, the naturalist view is more compelling than the fundamentalist one because naturalism does not commit us to fundamental ethical facts. Similarly, one might want to think indeterminacy exists without being committed to indeterminacy being a fundamental feature of the world. My account allows for this possibility.

## 7 Logic and Metaphysics

On my view, we can be committed to indeterminacy without revising our view of the world as being fundamentally determinate. But what are the logical consequences of indeterminacy? Specifically: is the existence of indeterminacy compatible with classical logic? Yes. I am a *compatibilist* in the sense that I believe derivative indeterminacy is compatible with classical logic. However, unlike most compatibilists, I give a metaphysical, rather than logical, defense of this claim.

<sup>20</sup> If you want a stronger account, you can substitute “it lies in the nature of indeterminacy” for “necessarily.” This gives you an essentialist real definition of indeterminacy. Simple necessity suffices for my purposes.

Let me explain. Several philosophers have argued that indeterminacy does not require an unacceptable departure from classical logic. This idea has existed since the original supervaluationist treatment of indeterminacy (Fine, 1994). The compatibilist tradition has been continued by recent arguments by Williams (2008a) and Cobreros (2011), who argue, against Williamson (1994), that supervaluationism is not objectionably revisionary. Their basic approach is to characterize a supervaluationist entailment relation in a way that does not generate objectionable results. I call this the *logical defense* of compatibilism because it assumes that proving that indeterminacy is compatible with classical logic requires characterizing a classical (or classical-enough) formal logic. Inversely, if you want to disprove compatibilism, you should show that the logic of indeterminacy generates unacceptably revisionary logical consequences.<sup>21</sup>

My defense of compatibilism is fundamentally different from the logical one. I believe that indeterminacy is compatible with classical logic, not because I believe I can construct a logic without revisionary consequences, but because I think that the logic of indeterminacy is generally independent of the metaphysics of indeterminacy. Whether indeterminacy is compatible with classical logic depends on how classical logic is intended to model indeterminacy, and if we make the right metaphysical assumptions, classical logic provides a perspicuous model of an indeterministic world. My defense of compatibilism depends more on metaphysics than logic.

At the moment, it is unclear how the logical approach applies to the layered conception of reality. Suppose there is indeterminacy in the world. Is classical logic intended to model the fundamental level or the derivative level? And if it models one of these levels, must it model both? To answer these questions, we need to distinguish between fundamental and derivative logics.

Suppose there is a fundamental level, for the sake of simplicity. A *fundamental logic* would be a logical language that perspicuously describes the fundamental facts.<sup>22</sup> For example, “There are no cars” is true, on a fundamental logic, because there are no fundamental facts that have cars as constituents. Similarly, “There is no indeterminacy” is true because there are no fundamental facts about what is indeterminate. Arguably, the fundamental logic is classical, as there is no fundamental indeterminacy that threatens classical logic.

In contrast, we can also have a derivative logic. A *derivative logic* allows us to consider what happens at the derivative level. So “There are no cars” would be false, on a derivative logic, because there are derivative facts that have cars as constituents. “There is no metaphysical indeterminacy” would be false for similar reasons. A derivative logic might be non-classical, as it purports to be a perspicuous model of the derivative facts, and the derivative facts include facts about what is indeterminate. For example, you might adopt the relevant metaphysical supervaluationist semantics.

In light of the distinction between fundamental and derivative logic, I claim that fundamental logic may be classical even if our derivative logic is non-classical. Or to put it in a more metaphysically robust way: the fundamental logical structure of

<sup>21</sup> E.g., Jones (2011), Williamson (2018).

<sup>22</sup> Note that this differs considerably from Sider (2011)’s treatment of a fundamental logical language. He thinks a logic can be fundamental without necessarily describing fundamental entities. This approach is too different to discuss in this paper.

the world could be classical even if the derivative logical structure of the world were non-classical.

A sample logic may make this point more concrete. Since we are dealing with facts, a perspicuous logic would somehow make use of these entities. The natural approach is to adopt a simple truthmaker semantics for our fundamental logic.<sup>23</sup> Let us suppose that every true atomic sentence  $\phi$  has a truthmaker of the form  $[\phi]$ , and that truthmakers can be divided into two categories: derivative and fundamental. On a fundamental logic, an atomic sentence  $\phi$  is made true by a fundamental truthmaker  $[\phi]$  and it is false otherwise. Given this logic, we get the desired result that “There are no cars” is true because it lacks a fundamental truthmaker of the form  $[\text{Cars exist}]$ .

Now suppose  $[\nabla S]$  obtains. Given that indeterminacy is derivative,  $\nabla S$  is false (in the fundamental logic) because  $[\nabla S]$  does not obtain at the fundamental level. It sounds strange to say that  $\nabla S$  is false even though  $[\nabla S]$  obtains, but remember that our fundamental language restricts the scope of facts to the fundamental. Similarly,  $\neg S$  is true in the fundamental logic because  $[S]$  must fail to obtain at the fundamental level if  $[\nabla S]$  obtains. We could run the same story about  $S$  being fundamentally false.

For comparison, suppose we hold fixed the fact that  $[\nabla S]$  obtains but consider a derivative language, one which ranges over the derivative in addition to the fundamental. Then you might say that  $\neg S$  is not determinately true and that  $\nabla S$  is true, using a simple metaphysical supervaluationist semantics to make sense of these claims. In that case, the derivative language would give a different verdict than the fundamental language.

On this general picture, the fundamental logic is one where both the excluded middle and bivalence can hold even if metaphysical indeterminacy exists. The trick is simple: the definition of our fundamental language eliminates the possibility that anything indeterminate could threaten these theorems. This is why I say that the compatibility of classical logic and indeterminacy depends on how classical logic is intended to model indeterminacy; if we take classical logic to model fundamental reality, then compatibilism is a simple feat.

I am not arguing that, in fact, the fundamental logic is classical and the derivative logic is non-classical.<sup>24</sup> My point is that the existence of derivative indeterminacy does not obviously impinge on the classicality of fundamental logic (if there is such a thing). It follows that the existence of indeterminacy is independent of the logical theses that it is traditionally associated with.<sup>25</sup>

Before moving on, I should make two notes about my defense of compatibilism.

First, my defense of compatibilism, unlike most, does not rely on modifying supervaluationism. When I say that the fundamental logic can be classical, I mean it can resemble the classical first-order logic that we are all taught as part of our basic philosophical training. No revisions to this logic are needed.

Second, the metaphysical defense of compatibilism does not mean that the logic of indeterminacy is metaphysically insignificant. The logic of indeterminacy can be

<sup>23</sup> For more robust truthmaker theories of content, see Yablo (2014) and Fine (2017a), Fine (2017b).

<sup>24</sup> In fact, I have doubts about the very existence of a fundamental logic. I am also skeptical about whether classical logic needs saving. This is just to emphasize the fact that my defense of compatibilism is not motivated by a belief in the metaphysical fundamentality of classical logic.

<sup>25</sup> See Eklund (2011) for a different defense of this thesis.

important even in the absence of a perceived threat to classicality. Most obviously, we need a logic of derivative indeterminacy because we simply need to know how derivative indeterminacy works, in a systematic way. Here is an analogy. Modality and time need not be fundamental for modal and temporal logic to be interesting and metaphysically important. The same goes for indeterminacy and its logic.

Of course, my view lowers the stakes of the logic of indeterminacy, but this is a feature of derivative indeterminacy, as a whole. The fact that indeterminacy is derivative means that existence of metaphysical indeterminacy does not depend on it being fundamental, so it no longer has to meet all the constraints imposed on the fundamental.

## 8 Conclusion

My goal has been to (a) clarify how (at least some) metaphysical indeterminacy could be derivative and (b) argue that derivative indeterminacy is less metaphysically and logically committal than sometimes thought. My account benefits both the friends and foes of derivative indeterminacy. Given a concrete proposal, we can refine or criticize that proposal as necessary. The proposal does not settle every question about metaphysical indeterminacy. Is fundamental indeterminacy possible? What is the nature of precisificational possibilities? Does higher-order indeterminacy exist? These are questions to be resolved in future investigations. My hope is that the current account will put such investigations on firmer footing.

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