

# Modality, Metaphysics, and Method

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Since the modal turn of the 1960's and 1970's, modality has played a central role in metaphysical theories about numerous topics. For example, many philosophers have defined an essential feature of an object as a property it *must* have if it exists. Others have tried to give an account of truth-making in terms of a modal relationship between worldly entities and true claims. Various relations of supervenience have been used in an attempt to capture theses of the forms *The B-facts are nothing over and above the A-facts* or *The A-facts are more fundamental than the B-facts*. Counterfactual conditionals have been put to heavy work in several areas of metaphysics as well. And there are many more examples. These developments made it natural to think of the exploration of modal facts as one of the chief occupations of the metaphysician.

More recently, this idea has come in for criticism. Not that there aren't important connections between metaphysical theses on the one hand and modal claims on the other. If understood a certain way, the claim that the A-facts are more fundamental than the B-facts arguably entails a substantive supervenience thesis. From the claim that  $x$  is essentially  $F$ , it follows that it's necessary that  $x$  is  $F$  if  $x$  exists. And perhaps the thesis that  $x$  is a truth-maker of  $P$  entails that  $x$ 's existence necessitates  $P$ 's truth (or something along these lines). The problem is that in all of these cases the entailment seems to hold only in one direction – from the metaphysical claim to the modal one. The supervenience of the B-facts on the A-facts alone doesn't entail that the A-facts are more fundamental than the B-facts in any interesting sense, a necessary property of a thing needn't be essential to it, and  $P$ 's truth-makers may not be the only entities whose existence necessitates  $P$ 's truth. There is therefore no obvious way of formulating modal claims that are equivalent to the metaphysical theses at issue, let alone modal claims that capture the intended contents of these theses. Metaphysical theories that employ counterfactual

conditionals have faced equally daunting problems. Perhaps the best-known example is the counterfactual analysis of causation, which has been plagued by counterexamples.

Such examples raise serious doubts about whether modal concepts deserve to play the central role they have occupied in many metaphysical theories since the modal turn. It should therefore come as no surprise that a number of philosophers have recently argued that much of that role should instead be assigned to such notions as grounding and metaphysical explanation, and related concepts such as essence and fundamentality. Maybe the best way of spelling out the idea that the A-facts are more fundamental than the B-facts is in terms of grounding, and perhaps the distinctive feature of the essential truths is their special explanatory role. Similarly, the truth-maker of a true claim  $P$  may be thought of as some entity whose existence partly grounds the truth of  $P$ , or something along these lines.<sup>1</sup>

I am sympathetic to this shift of focus from the modal to the explanatory domain. At the same time, I believe that it is possible to explain and justify the extensive use of modal considerations in many areas of thought whose ultimate concern is with explanation. The goal of this chapter is to apply the theoretical framework developed in my (2014) to give a somewhat unified explanation of a number of uses we make of modal notions in the explanatory reasoning of metaphysics and ordinary life. The theoretical framework has two main parts that I will sketch briefly below: a set of speculative working assumptions about explanation and its connections to essence and the laws (section 1), and an analysis of modality (section 2). This account entails that modal facts, e.g. counterfactual dependencies, supervenience relationships, and facts about which propositions are necessary, often *reflect* explanatory connections or facts that are of interest because of their central explanatory role (e.g., facts about the essences of things). Modal facts therefore constitute an important set of data in the study of explanatory relationships. For example, a hypothesis about essence, grounding, or metaphysical fundamentality can be evaluated partly in light of its consistency with the modal facts and its ability to explain them. In these cases, modal facts are not themselves the ultimate

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<sup>1</sup> For relevant discussions of supervenience, see Horgan (1993), Wilson (2005), Stoljar (2009); for discussions of truth-making, see Restall (1996), Rodriguez-Pereyra (2006); for a discussion of essence, see Fine (1994).

targets of the investigation. They are of interest solely in their role as evidence. I will try to illustrate this with a number of case studies, including the appeal to modal facts to support or refute philosophical analyses (section 3), uses of the concept of supervenience to evaluate metaphysical theses about relative fundamentality (section 4), and the role of counterfactuals in explanatory reasoning (section 5).

This chapter will be a somewhat programmatic wide-angle overview of a specific approach to understanding the role of modal thought in explanatory reasoning. In the interest of brevity, my exposition will simplify the view in some respects. Many parts of the account are worked out in further detail in my (2014), while others remain to be developed.

## **1. Explanation, laws and essence**

### 1.1 Causation and grounding

To say that  $x$  explains  $y$ , in the sense in which I will use the phrase, is to say that  $x$  is the reason why  $y$  obtains, or that  $y$  is due to  $x$ . Explanation in this sense is a metaphysical relation, not an epistemic one.<sup>2,3</sup> Causes partly explain their effects, but  $x$  can also partly explain  $y$  without being a cause of  $y$ . My first example of such non-causal explanation will stay fairly close to the causal case. I hold that effects are typically explained not by their causes alone, but by these together with certain facts about the laws of nature. The coffee cup falls, hits the floor, and breaks into a million pieces. Why did it happen? In part, it's because you pushed the cup off the table and because you have a planet under your kitchen floor. But another part of the reason is that there is a law of nature to the effect that any two massive bodies attract each other with a certain force. It's partly because that is a natural law that the planet attracted the cup.<sup>4</sup> This is an example of non-

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<sup>2</sup> I don't claim that what follows is an exhaustive list of all kinds of non-causal explanation, but it includes all cases that will concern me in this chapter.

<sup>3</sup> I will also occasionally use "explanation" in other senses, e.g. in the sense of "account of why  $x$  obtains," and I will similarly use "explain" in the sense of "provide an account of why  $x$  obtains." This is the sense in which I will be using the term when I speak of a theory's power to explain certain data, or of inference to the best explanation. The context will disambiguate.

<sup>4</sup> I am simplifying by pretending that Newtonian physics is true.

causal explanation: the fact that a certain law is in force partly explains certain goings-on but it doesn't cause them.

My second example of non-causal explanation is the relation often called "grounding." Grounding is the kind of explanatory connection described in statements like the following:

What *makes* 28 a perfect number is the fact that it is a positive integer equal to the sum of its proper positive divisors.

This particle is a hydrogen atom *because (in virtue of the fact that)* it is composed of one proton and one electron in such-and-such configuration.

Grounding holds between metaphysically non-fundamental facts and certain more fundamental facts that give rise to them.<sup>5</sup> On the account I will sketch in section 1.2, there is a far-reaching structural analogy between grounding and causation. Certain general metaphysical principles, which I will call "laws of metaphysics," play essentially the same role in grounding as the natural laws in causation: metaphysically more fundamental facts typically give rise to less fundamental ones in accordance with the metaphysical laws, just as deterministic causes bring about their effects in accordance with the laws of nature. In such cases, the non-fundamental facts are explained by their grounds together with certain facts about the metaphysical laws. The metaphysical laws include the *essential truths*, which will be discussed in more detail in section 1.2. To a first approximation, an essential truth about a non-fundamental entity *e* states a condition the satisfaction of which is part of what it is to be *e*, or (in some cases where *e* is a property or relation) part of what it is to instantiate *e*. These essential truths are metaphysical laws that determine how the more fundamental entities need to be arranged in order for certain facts involving *e* to obtain. Such laws are typically instantiated in the grounding of a fact about *e* by facts about more fundamental entities. In these cases, the grounded fact is explained partly by its ground and partly by some facts about *e*'s essence

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<sup>5</sup> For recent discussions of grounding, see Schaffer (2009), Rosen (2010), Jenkins (2011), Koslicki (2012), Audi (2012a, 2012b), and Fine (2012a, 2012b). For skepticism about the notion and some of its recent uses, see Hofweber (2009), Sider (2011: ch. 8), Daly (2012), and Wilson (2014).

(i.e., some fact about what it is to be  $e$  or some fact about what it is to instantiate  $e$ ). For example, suppose that what it is to be a gold atom is to be an atom with atomic number 79. Then the fact that  $a$  is a gold atom is explained partly by the fact that  $a$  is an atom with atomic number 79 and partly by the fact that that's what it is to be a gold atom.<sup>6,7</sup>

Grounding and causation are closely intertwined. In many cases,  $X$  causes  $Z$  by causing some other fact  $Y$  that in turn grounds  $Z$ . For the sake of the example, suppose that the physical facts ground the mental facts by giving rise to them in accordance with the laws of metaphysics. You take a sip of coffee, which brings it about that your brain is in a certain state, which in turn grounds the fact that you enjoy a certain taste sensation. The sipping causes the sensation via an explanatory chain that features both causal and grounding links. The explanation of the sensation involves the sipping, the natural laws that link it to the ensuing brain state, and the metaphysical laws connecting that state to the sensation. The example illustrates how natural and metaphysical laws can both figure in the causal explanation of a fact.

Grounding connections and the laws of metaphysics underlying them are of interest to us for many of the same reasons as causal connections and the underlying laws of nature. For one thing, they provide information about why certain facts hold. If you know that what it is to be water is to be made up of molecules with chemical structure  $H_2O$ , then you can infer that the fact that the riverbed is filled with water is explained by the fact that it is filled with a substance that has that molecular structure. Knowledge of grounding relationships and of the underlying metaphysical laws also often enables us to

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<sup>6</sup> Although the fact that  $a$  is an atom with atomic number 79 and the fact that that's what it is to be a gold atom both partly explain  $a$ 's being a gold atom, I will only call the former but not the latter fact a *ground* of the fact that  $a$  is a gold atom. The reason for this terminological choice is that it seems better suited to highlight the similarities of grounding to causation under determinism. In both types of explanation, the explanandum is explained by the fact that certain laws are in force, together with certain other facts that are connected to the explanandum by these laws. In the case of causation under determinism, these other facts are the causes. I need a term that covers just those facts whose role in grounding is analogous to that of the causes in deterministic causation. The term "ground" seems to be a natural choice.

<sup>7</sup> A similar view about the explanatory role of the essential truths and its similarity to the explanatory role of the natural laws is discussed in Rosen (2010). See in particular the passages about the principles that Rosen calls "Essential Grounding" and "Natural Necessity" (119–20).

make predictions. If you know that a certain chemical reaction will produce a lot of molecules with the chemical structure  $C_3H_8$  and you know that to be a molecule with that structure is to be a propane molecule, then you can predict that the reaction will produce propane. The first piece of knowledge without the second would not have sufficed for the prediction. Moreover, knowledge of  $X$ 's grounds, like knowledge of  $X$ 's causes, frequently gives us a way of controlling whether  $X$  is present. Suppose we determine that what makes something an insulin molecule is the fact that it is a molecule with chemical structure  $S$ . We can infer that if we find a way of synthesizing molecules with structure  $S$  and moving them to the right body parts, we will be able to influence a person's insulin levels. Similarly, if we find out (perhaps through philosophical analysis) which features of an economic system make it just, then that may in principle enable us to bring about economic justice by creating an economic order with the relevant features.

I have cast this discussion in terms of facts that explain or ground other facts, as if explanation and grounding were relations between entities called "facts." I regard this as a mere manner of speaking that commits us neither to accepting nor to denying that there are entities that play the role typically associated with facts, or that explanation and grounding are relations between such entities. Statements that seem to describe explanatory relationships between facts can be paraphrased as claims that make no apparent reference to facts but are instead cast in terms of explanatory connectives like "because".<sup>8</sup> For example, the claim that

the fact that  $a$  is a gold atom is explained partly by the fact that  $a$  is an atom with atomic number 79 and partly by the fact that that's what it is to be a gold atom

amounts to something like this:  $a$  is a gold atom partly because  $a$  is an atom with atomic number 79 and partly because being an atom with that atomic number is what it is to be a gold atom.

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<sup>8</sup> See Correia (2010: sct. 1.1) and Fine (2012b: sct. 4) for discussions of views along these lines.

## 1.2 Essence and grounding

On one popular and plausible philosophical view, the entities that populate reality are partially ordered by their relative metaphysical fundamentality. Facts about non-fundamental entities are grounded in (hold in virtue of) facts about more fundamental entities, and are in some sense ‘fixed’ by the facts that ground them. For example, one may think that the property of being a methane molecule is less fundamental than certain physical properties like that of being a proton, and that facts about the former property are partly grounded in facts about the latter properties. Similarly, certain sociological properties may be less fundamental than certain psychological properties, and facts about the former may be partly grounded in facts about the latter. I will try to show in this section that we can sharpen these ideas by using the notion of essence to shed light on the fundamentality ordering of entities and its connection to grounding.

First, some preparatory remarks about how I am thinking of essence. It is often said that an account of the essence of *a* should tell us what it *is*, or what it *takes*, for a thing to be *a*. On one natural interpretation, this amounts to the thought that the essential truths about *a* state (necessary and/or sufficient) conditions for something to be *a*. For example, it may be an essential truth about Fred that someone is Fred only if he originated from a certain sperm and egg. Similarly, it may be an essential truth about the number 1 that something is the number 1 only if it is the successor of 0, and also that something is the number 1 if it is the successor of 0. More generally, it’s plausible that essential truths about an entity *a* are often of the following forms:

(Id-N) Something is *a* only if it meets condition *C*.

(Id-S) Something is *a* if it meets condition *C*.

I will say that essential truths of the forms (Id-N) and (Id-S) state *a*’s identity conditions, and that an essential truth of the form (Id-N) lays down that *C* is a necessary condition for being *a*, while an essential truth of the form (Id-S) lays down that *C* is a sufficient condition for being *a*.

I believe that there are other kinds of essential truths as well, in addition to those that state identity conditions. When asked what the essence of moral goodness is, *one* way we could try to answer the question is by specifying the identity conditions of the property,

i.e. by stating what it is for a property to be moral goodness. But another way to respond is to specify what it is for something to be good. In other words, we would specify essential truths that state, not the conditions under which something *is* goodness, but the conditions under which something *has* or *instantiates* goodness. Such essential truths could be said to state *instantiation conditions* of a property, and to be of the following forms:

(In-N) Something has *F* only if it meets condition *C*.

(In-S) Something has *F* if it meets condition *C*.

For example, it may be essential to being a gold atom that something is a gold atom only if it is an atom with atomic number 79, and also that something is a gold atom if it is an atom with that atomic number. Essential truths that state instantiation conditions obviously exist for polyadic relations as well, but for the sake of simplicity I will always use monadic properties as examples.<sup>9</sup>

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<sup>9</sup> Two clarifications. *Firstly*, the schemata (Id-N), (Id-S), (In-N), and (In-S) merely display the simplest forms that essential truths stating identity or instantiation conditions can take. Many variations of these forms are conceivable. For example, just as there are essential truths about individual entities, there may be truths that are essential to several entities collectively. (To illustrate, it may be an essential truth about (Newtonian) mass and force taken collectively that two things are mass and force respectively only if they are governed by Newton's axioms.) I will focus on essential truths of the simplest kind, though I think what I will say also applies (*mutatis mutandis*) to the more complex kinds. *Secondly*, it shouldn't be assumed that all ingredients of reality must be individuals, properties, or relations – or entities of any kind, for that matter. For example, it's possible that in order to describe reality completely, we need to use some primitive piece of ideology that relates to some aspect of the universe that doesn't belong to one of these three ontological categories, and which may not be an entity at all. (For instance, it may be held that the sentence operator "it's essential to *x* that *P*," which I have used above, is an example of such a piece of ideology.) Moreover, just as there are essential truths about individuals, properties, and relations, there may be essential truths about those ingredients of reality (if any) that don't belong to these categories. Such essential truths can't be of the forms (In-N) or (In-S), and if the relevant ingredient of reality isn't an entity, then they can't be of the forms (Id-N) or (Id-S) either. Instead, they state conditions under which (to speak metaphorically) the relevant ingredient combines with other entities or aspects of reality to form a fact. For the sake of simplicity, I will formulate my discussion throughout the rest of this paper in terms of individuals, properties, and relations. However, I think that everything I will say also applies, *mutatis mutandis*, to other ingredients of the universe.



In my view, the class of essential truths about an entity is closed neither under metaphysical necessitation nor under logical consequence. (On my conception of essentiality, the essential truths about an entity are sparse, not abundant.<sup>10</sup>) Although the essential truths about 1 may include the proposition that something is 1 if it is the successor of 0, it doesn't follow that they include the proposition that something is 1 if it is 1, or the proposition that everything is self-identical – even though the latter two propositions follow from the first one.

In order to see how to use the concept of essence to shed light on the grounding of less fundamental facts by more fundamental ones, it will be helpful to consider another common way of glossing essentialist claims. When asked to paraphrase the claim that what it is to be a gold atom is to be an atom with atomic number 79, a philosopher may say: being an atom with atomic number 79 is what *makes* something a gold atom. Now, the locution “*x makes y z*” is typically used to state explanatory connections, and it's natural to think that that's how the phrase is used in the present case as well. That suggests that for any gold atom *a*, the fact that *a* is an atom with atomic number 79 explains the fact that *a* is a gold atom. And that seems independently plausible. For example, when asked why Goldie is a gold atom, it seems natural to say that she's a gold atom partly because she's an atom with atomic number 79 (and partly because that's what it is to be a gold atom). Similarly, it seems plausible to say that you're not a gold atom because you're not an atom with atomic number 79. More generally: if the essential truths about a property *F* lay down that *C* is a sufficient condition for having *F* and if *a* meets condition *C*, then the fact that *a* meets condition *C* grounds the fact that *a* has *F*. Similarly, if the essential truths about a property *F* lay down that *C* is a necessary condition for having *F* and if *a* doesn't meet condition *C*, then that grounds the fact that *a* doesn't have *F*.

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<sup>10</sup> Some might be tempted at this point to distinguish between a “constitutive” notion of essence that is not closed under consequence and a “consequentialist” notion that is the closure under consequence (or under some restricted form of consequence) of the constitutive notion (see Fine 1995). However, I don't find it clear that the consequentialist conception can be said to capture any metaphysically interesting notion of essence (see Kment 2014: 157–8). In any case, I will be concerned with a notion that isn't closed under consequence.

We can give an analogous account of the role that essential truths stating identity conditions play in grounding. I said that essential truths of the forms (In-S) and (In-N) state conditions under which something instantiates  $F$ , and that the fact that a certain entity has (fails to have)  $F$  is grounded in the fact that this entity meets (fails to meet) the relevant condition. Similarly, essential truths about an entity  $a$  that are of the forms (Id-S) and (Id-N) determine conditions under which a given property is instantiated by  $a$ . For example, if the essential truths about  $a$  lay down that  $C$  is a necessary condition for being  $a$ , then it's a necessary condition for property  $F$  to be instantiated by  $a$  that  $F$  be instantiated by something that meets condition  $C$ . If a property fails to meet this condition, then that fact grounds the fact that  $F$  is not instantiated by  $a$ . Similarly, if the essential truths about  $a$  lay down that  $C$  is a sufficient condition for being  $a$ , then it's sufficient for  $F$  to be instantiated by  $a$  that  $F$  be instantiated by something that meets condition  $C$ . If a property meets this condition, then that fact grounds the fact that  $F$  is instantiated by  $a$ . An essential truth about  $a$  that lays down that  $C$  is a sufficient condition for being  $a$  also determines a sufficient condition for  $a$ 's *existence*:  $a$  exists if there is something that satisfies  $C$ . Moreover, the fact that  $a$  exists is grounded in the fact that there is something that satisfies  $C$ . So, just as the essential truths that state the instantiation conditions of a property are involved in grounding facts about which entities have this property, essential truths that state the identity conditions of an entity  $a$  are involved in grounding facts about which properties  $a$  has, as well as in grounding the fact that  $a$  exists.

The concept of essence can also be used to explain the idea of one entity's being more metaphysically fundamental than another. There is more than one possible way of doing this. I will give one example. Suppose we think of propositions in a broadly Russellian way, i.e. we conceive of them as structured complexes that contain the entities (individuals, properties, and relations) they are about as constituents. Let's say that a proposition  $P$  *mentions*  $a$ , or that  $P$  is (*a singular proposition*) *about*  $a$ , just in case  $a$  is part of the subject matter of  $P$  in virtue of the fact that  $P$  has  $a$  as a constituent. For instance, the proposition that ascribes the property  $F$  to the individual  $a$  mentions both  $a$  and  $F$ . A proposition doesn't count as mentioning  $a$  if it contains a description that singles out  $a$  but doesn't contain  $a$  itself as a constituent. For example, the proposition

that the author of *Waverley* is tall doesn't mention Walter Scott; it only mentions *Waverley*, the relation of authoring, and tallness (and perhaps the identity relation). We can define relative fundamentality in several steps (the definitions below are similar in various ways to those offered by other philosophers, and I claim no originality for them):<sup>11</sup>

*x* immediately essentially depends on *y* iff *x* and *y* are distinct and some essential truth about *x* mentions *y*. *x* essentially depends on *y* iff *x* stands to *y* in the ancestral relation of immediate essential dependence.

A biconditional (of either finite or infinite length<sup>12</sup>) of the form *An entity x is a iff x meets condition C* is a *real definition<sub>Id</sub>* of *a* iff (i) the right-hand side of the biconditional doesn't mention *a* or any entities that essentially depend on *a*, and (ii) the essential truths about *a* lay down that *C* is both a necessary and a sufficient condition for being *a*.

A biconditional (of either finite or infinite length) of the form *An entity x has F iff x meets condition C* is a *real definition<sub>In</sub>* of the property *F* iff (i) the right-hand side of the biconditional doesn't mention *F* or any entities that essentially depend on *F*, and (ii) the essential truths about *F* lay down that *C* is both a necessary and a sufficient condition for instantiating *F*.

An entity *a* is *non-fundamental* iff (i) *a* has a real definition<sub>Id</sub>, and (ii) if *a* is a property or relation, then *a* also has a real definition<sub>In</sub>. Otherwise, *a* is *fundamental*.

*a* is *definable partly in terms of b* iff *a* is a non-fundamental entity and there is some real definition (of either kind) of *a* whose right-hand side mentions *b*.

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<sup>11</sup> The definitions below differ slightly from those given in Kment (2014: sct. 6.1.3). The point of the changes is to simplify the discussion in the rest of this paper and to avoid terminology that might be slightly misleading in the context of the discussion of the next couple of sections.

<sup>12</sup> It wouldn't be plausible to impose the requirement that real definitions need to be finite. For example, it seems perfectly reasonable to think that an infinite set *S* that contains the entities *a*, *b*, ... (and no others) has the following infinitely long real definition<sub>Id</sub>: an entity *x* is *S* iff *x* is the set containing *a*, *b*, ... and no other entities.

*b* is more fundamental than *a* just in case *a* stands in the ancestral relation of partial definability to *b*.

At the beginning of this section I mentioned the idea that facts about less fundamental entities are grounded in facts about more fundamental ones. More precisely:

- (1) Every fact about a non-fundamental entity *a* is grounded in some facts that aren't about *a* but that are instead about entities in terms of which *a* is partly definable (and that may be about other entities as well).

We can spell out this thought using the deflationary construal of fact discourse described in section 1.1 together with the Russellian conception of propositions. Let the expression “the fact that ... and the fact that ... and ... together ground the fact that ...” be a variably polyadic operator whose function resembles that of “because,” but which is restricted to instances of grounding. Idea (1) can then be interpreted as the claim that all instances of the following propositional schema are true: for any non-fundamental entity *e*, if the proposition that *P* is a true proposition mentioning *e*, then there is a true proposition of the form *The fact that Q<sub>1</sub> and the fact that Q<sub>2</sub> and ... together ground the fact that P, and neither the proposition that Q<sub>1</sub> nor the proposition that Q<sub>2</sub> nor ... mentions e but some of these propositions mention some entities in terms of which e is partly definable*. I think that this principle is largely correct, though for reasons I explain in some detail in my (2014: sect. 6.3.2), I think that we should allow for some exceptions: some facts about the essence of a non-fundamental entity *a* (such as facts expressed by propositions of the forms *It's essential to a that P* and *It's not essential to a that P*) are not grounded in anything.<sup>13</sup> Moreover, some other facts about *a* are partly grounded in such ungrounded facts about *a*'s essence, and these other facts needn't be grounded in any facts that aren't about *a*. (As an illustration, assume that the fact that it's essential to *a* that *P* is ungrounded and that the proposition that *Q* is false. Then the disjunctive fact that either *Q* or it's essential to *a* that *P* isn't grounded in any facts that aren't about *a*, but is grounded

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<sup>13</sup> That means that on my account, some facts about the essence of a non-fundamental entity are metaphysically fundamental. Some philosophers would object to the idea that there can be metaphysically fundamental facts about non-fundamental entities (see Sider 2011: sect. 7.2). I reply to this worry in Kment (2014: section 6.3.2).

instead in the fact that it's essential to  $a$  that  $P$ .) Apart from that, I think that (1) is true: if  $f$  is a fact about the non-fundamental entity  $a$  but not a fact about  $a$ 's essence, then  $f$  is grounded in some facts each of which is either (i) a fact that isn't about  $a$  but is about some entities in terms of which  $a$  is partly definable or (ii) a fact about  $a$ 's essence. When suitably developed, the view sketched in this section can accommodate this principle. For it entails that for any non-fundamental entity  $a$ , the real definition(s) of  $a$  determine conditions under which various facts involving  $a$  obtain, where these conditions don't involve  $a$  but instead involve the more fundamental entities in terms of which  $a$  is defined. The satisfaction or non-satisfaction of these various conditions ground the relevant facts about  $a$ .

I mentioned above that it seems plausible that facts that are grounded are in some sense fixed by their grounds, just as it seems plausible that under determinism effects are in some sense fixed by their causes. In the case of causation, it's natural to think of the fixing as a kind of *nomic* connection: under determinism, the causes and the laws together determine the effect. As mentioned in section 1.1, I think it's attractive to say something similar about grounding: if the facts  $gg$  ground the fact  $f$ , then there are some "metaphysical laws" such that the  $gg$  and these laws together determine  $f$ . The cases of grounding discussed above illustrate this pattern. In these examples, the relevant metaphysical laws are essential truths that state identity or instantiation conditions. But there may also be cases of grounding that involve other kinds of metaphysical laws.<sup>14</sup> For example, it seems plausible that for any two properties  $F$  and  $G$ , there is a property that is their conjunction. Moreover, it's natural to think that the fact that there exists a conjunction of  $F$  and  $G$  is grounded in the existence of  $F$  together with the existence of  $G$ . In this case, the metaphysical law that forges the connection between the grounded fact and its ground may be a law of property existence – perhaps an ontological law that entails that any properties have a conjunction. Other instances of grounding may involve further kinds of ontological laws, such as laws of mereological composition or of class

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<sup>14</sup> For more discussion about whether such further metaphysical laws are needed in the theory of grounding, see Kment (2014: 169–73). The argument presented there is a descendant of an argument discussed by Gideon Rosen (2006) for the conclusion that an account of necessity needs to appeal to general metaphysical principles other than essential truths.

existence, or they might involve laws that are neither essential truths nor ontological laws.

When I say that a grounded fact is *determined* by its ground together with the metaphysical laws, I am using a hyperintensional notion of determination that is subject to a strong relevance constraint. While it's not easy to give a completely general account of this concept, the examples of this section suggest that one necessary (though not sufficient) condition for determination is logical entailment. In other words, it seems plausible that the following thesis holds (I'll call it the 'covering-law conception of grounding'):

(CLG) For any fact  $f$  that is grounded, the facts that ground  $f$  and the metaphysical laws together logically entail  $f$ .<sup>15</sup>

The talk of facts in (CLG) can again be understood in the deflationary way sketched in section 1.1. Using the variably polyadic grounding operator introduced above, we can interpret (CLG) as the claim that the following propositional schema is valid: if the fact that  $Q_1$  and the fact that  $Q_2$  and ... together ground the fact that  $P$ , then the proposition that  $Q_1$  and the proposition that  $Q_2$  and ... and the metaphysical laws together logically entail the proposition that  $P$ . Propositions are again to be conceived of along roughly Russellian lines. A Russellian proposition has a logical form, and the notion of logical entailment that I used in formulating the schema is to be understood non-modally in terms of logical form (see my 2014: scts. 4.2–4.3, 5.1). I will endorse (CLG) thus understood as a working assumption. It's important to note that (CLG) merely states a *necessary* condition for certain facts to ground another fact. The condition is obviously not *sufficient*: the facts  $ff$  and the metaphysical laws together may logically entail  $g$  even if the  $ff$  don't ground  $g$ . A fortiori, (CLG) isn't a *definition* or *analysis* of grounding.

We can formulate a covering-law conception of causation under determinism that is very similar to (CLG) – the main difference is that the laws that connect causes to their

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<sup>15</sup> Note that (CLG) is consistent with the possibility that some cases of grounding don't instantiate any metaphysical laws, provided that in these cases the grounded fact is entailed by its ground alone. As a possible example of this, consider the fact that Fred's hair is either red or black. This fact may be grounded in the fact that Fred's hair is black. For all (CLG) tells us, it's possible that in this case the ground and the grounded fact aren't connected by any metaphysical laws.

effects under determinism may include both natural and metaphysical laws. Under determinism,

(CLC) For any fact  $f$  that is caused, the facts that are causes of  $f$ , together with the natural and metaphysical laws, logically entail  $f$ .<sup>16</sup>

The talk of facts in (CLC) can be paraphrased in terms of the explanatory operator “because,” understood in a causal sense (as in “there was a fire partly because there was a short circuit”). Let’s say that the facts  $g$  *nominally determine* the fact  $f$  just in case the  $g$  and the metaphysical and natural laws together logically entail  $f$ . (CLC) tells us that under determinism, it’s a *necessary* condition for the facts  $g$  to include all causes of the fact  $f$  that the  $g$  nominally determine  $f$ . But (CLC) doesn’t state a *sufficient* condition for the  $g$  to include all of  $f$ ’s causes, and a fortiori (CLC) isn’t an analysis of causation. (CLC) can be strengthened in various ways. For example, it seems plausible that under determinism a fact  $f$  about time  $t+1$  is nominally determined, not just by all of its causes taken together, but also by those of its causes that obtain at  $t$  (i.e., by those facts about the state of the universe at  $t$  that are causes of  $f$ ). It’s an interesting question whether the idea that (CLC) and its strengthened variants are meant to capture – that under determinism an effect is nominally determined by its causes (and also by those of its causes that obtain at a specific earlier time  $t$ ) – is in fact true. But whether true or not, I think that this idea underlies a lot of ordinary thinking about causation, at least as a working assumption. As I will argue in section 5, we can appeal to this fact to explain the importance of counterfactual thought in reasoning about explanation.

## 2. Modality

The second part of the theoretical apparatus I will employ in this chapter is the view of modality developed and defended in my (2014: chs. 2–3). In this section, I will give a brief summary of this account.<sup>17</sup>

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<sup>16</sup> This statement of the covering-law conception of causation is somewhat simplified. See Kment (2014: 250–6) for a more precise formulation. Also, see Kment (2014: 326–7) for a generalization to certain cases of causation under indeterminism.

Although it is often assumed that necessity and possibility are all-or-nothing matters, I think that that is far from obvious. There is some linguistic evidence to the contrary. Just as we can say that such-and-such could have been the case, we can say that this could more easily have been the case than that. On the face of it, that sounds like a comparison of degrees of possibility. I take this appearance at face value: possibility and necessity come in degrees. Proposition *P* has a higher degree of possibility than proposition *Q* just in case *P* could more easily have been true than *Q*. Similarly, a true proposition *P* has a higher degree of necessity than another true proposition *Q* just in case *Q* could more easily have been false than *P*.

To get a better handle on claims about how easily something could have been the case, it is useful to consider how we would ordinarily support such a claim. When talking about a soccer game, we may say: “The game ended in a draw, but our team could easily have won. If the goalkeeper had stood two inches further to the right a minute before the end, the other team would not have scored their goal.” In less favorable circumstances, we may say instead: “Our team couldn’t easily have won. They would have beaten their opponents only if Mary hadn’t played with a cast on her leg, Bob had known the rules, Katie had been sober, and the goal had been to score low rather than high.” How easily our team could have won depends on how great a departure from actuality is required for them to win. If they win in some scenarios that are only minimally different from the way things in fact are, then we can say that they could easily have won, or that their winning had a high degree of possibility. We can say the opposite if all scenarios where they win depart very significantly from actuality. Similarly, for any true proposition *P*, how easily *P* could have failed to be true depends on how great a departure from actuality is required for *P* not to be true. The greater the departure required, the higher *P*’s degree of necessity.

Talk about degrees of possibility is ubiquitous in ordinary life, but the idioms we use are not always overtly modal. You are running to catch the train, but the doors close on

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<sup>17</sup> For other accounts of modality with varying degrees of contact to the present one, see Lange (1999, 2004, 2005), Williamson (2005, 2007), Hill (2006), and Kment (2006). Also see Lewis (1973a: sct. 2.5, 1973b: sct. 2.1), McFetridge (1990: 150 ff.), and Kratzer (1991, in particular scts. 3.3 and 5).



you before you can jump in, causing you to sigh in frustration “I almost made it.” Your utterance expresses the thought that you could easily have caught the train: a minimal departure from actuality – the doors closing half a second later – is all that was necessary. Similarly, in a sentence like “Smith came closer to winning than Jones did,” we compare two unrealized scenarios – Smith’s winning and Jones’s winning – by their proximity to actuality. I think that such comparisons also underlie counterfactual judgments like “If I had pressed this button, there would have been an explosion.” For on the best known view of counterfactuals, which I accept, the conditional is true just in case some button-pressing scenarios where an explosion takes place depart less from actuality than any button-pressing scenarios without explosion.<sup>18</sup>

At first blush, the attempt to explain necessity in terms of the comparative closeness to actuality of non-actual scenarios may seem circular to some readers, since the very property of being a non-actual situation is often thought to be modal. Many philosophers, when they hear “non-actual situations” or “alternatives to actuality,” think of *unactualized metaphysically possible situations* or *unactualized ways things could have been*. However, I think that it is a mistake to identify the space of unactualized scenarios with the class of unrealized metaphysically possible scenarios. Consider counterfactual conditionals as an example. Roughly speaking, a counterfactual is true just in case its consequent is true at the closest worlds where its antecedent holds. On the assumption that all worlds are metaphysically possible, this account yields the dubious consequence that all counterfactuals with metaphysically impossible antecedents are vacuously true (since there are no antecedent-worlds), irrespective of the specific contents of their antecedents and consequents. But that seems very implausible. Many philosophers assume that it is metaphysically impossible for there to be no numbers. But even on the assumption that that is true, it seems that in discussing whether mathematical facts contribute to explaining physical events, we can ask – non-trivially – whether these events would unfold any differently if numbers didn’t exist. Since this problem arises from disallowing worlds where impossible propositions are true, the obvious remedy –

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<sup>18</sup> That’s the “standard” account of counterfactuals, as proposed by Stalnaker (1968) and Lewis (1973a, 1986).

suggested and developed by a number of philosophers – is to lift this restriction. Instead of appealing to *possible* worlds, we can formulate the account in terms of worlds more generally, including both possible and impossible worlds. Worlds are simply ways for reality to be, and they include both ways reality *could* have been and ways reality *couldn't* have been.<sup>19</sup>

On the account I give in (Kment 2014: chs. 4–5), worlds are defined non-modally as classes of propositions that describe reality in logically consistent and maximally detailed ways. (The notion of a proposition is Russellian, as described before, and logical consistency is to be understood non-modally in terms of the logical forms of propositions.) This framework can be used to sharpen the account of modality sketched above. One world, the “actual world” or “actuality,” has the special distinction of being a wholly correct description of reality. Other worlds depart from actuality to varying degrees. The degree of possibility of a proposition *P* is determined by how close the closest *P*-worlds are to actuality: the closer these worlds, the more easily *P* could have been true. The class of all worlds within a certain distance from actuality may be called a “sphere” around the actual world. The ordering of unactualized worlds by their closeness to actuality generates a system of nested spheres. For each sphere there is a grade of necessity that attaches to just those propositions that are true at *every* world in that sphere, as well as a grade of possibility attaching to all propositions that are true at *some* world in the sphere. The larger the sphere, the greater the associated grade of necessity.

To complete the analysis of modality, an account needs to be given of the rules that determine the ordering of worlds by their closeness to actuality. Different worlds differ from or resemble actuality in different respects, and a theory of the closeness ordering needs to specify how much weight attaches to these different similarities and differences. It is a common observation that we employ different standards of closeness in different contexts. However, following David Lewis, I believe that there is a specific set of rules

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<sup>19</sup> For uses of impossible worlds to account for counterfactuals with impossible antecedents, see, e.g., Nolan (1997). See Williamson (2007: 171–5) for an argument against non-trivial truth-values for counterpossibles. For some arguments against impossible worlds, see Stalnaker (1996).

about the weights of different similarities and differences that applies in most contexts.<sup>20</sup> The notions of comparative necessity and possibility that will concern me in this paper are defined in terms of the standards of closeness determined by this set of rules.

By these standards, the weightiest similarities between worlds are those that concern the metaphysical laws. To simplify somewhat, worlds that have the same metaphysical laws as actuality and perfectly conform to these laws are closer than worlds that don't meet these conditions. The former worlds therefore form a sphere around actuality. Match in the natural laws and similarities between the histories of two worlds matter to the closeness ordering as well (although to a lesser degree than similarities in the metaphysical laws). Metaphysical necessity is the grade of necessity corresponding to the sphere of worlds that match actuality with respect to the metaphysical laws: a proposition is metaphysically necessary just in case it is true at every world in that sphere. Other spheres correspond to further grades of necessity, some lower and some higher than metaphysical necessity.

I call the relations of comparative possibility and necessity and modal properties defined in terms of them (such as metaphysical necessity) “ontic modal” properties and relations, to distinguish them from various other kinds of modal properties, like those of epistemic or deontic modality. The ontic modal properties and relations include the relation of counterfactual dependence, since we can define this relation by the following schema: the proposition that  $Q$  counterfactually depends on the proposition that  $P$  iff both propositions are true and the proposition that  $(\sim P \ \& \ \sim Q)$  has a higher degree of possibility than the proposition that  $(\sim P \ \& \ Q)$ .<sup>21</sup> Throughout this chapter, I am using “modal” in the sense of “ontic modal.” The remaining sections will discuss different ways in which questions about explanatory relationships and about the laws underlying them can be settled by reasoning that employs concepts of specific ontic modal properties and relations, such as the notions of metaphysical necessity and of counterfactual dependence.

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<sup>20</sup> See Lewis (1986), Kment (2014: sct. 2.7). An account of these rules is given in Kment (2014: chs. 8–9).

<sup>21</sup> This definition is very similar to the definition of the counterfactual conditional in terms of comparative possibility that is given by David Lewis in his 1973a: sct. 2.5.

### 3. Modality, metaphysical laws, and explanation

On the account sketched in sections 1 and 2, the modal facts reflect both facts about the metaphysical laws and facts about explanatory relationships. The modal facts can therefore reveal a lot both about the metaphysical laws and about explanatory connections, though in both cases there are also clear limits on what they can show. I will consider the two cases in turn and will try to bring out the significant analogies between them.

According to the view summarized in section 2, there are two important connections between the facts about the metaphysical laws and the modal facts.<sup>22</sup> *Firstly*, there is a pattern of unidirectional entailment. From the hypothesis that  $P$  is a metaphysical law it follows that  $P$  is metaphysically necessary. But the converse entailment doesn't hold. The assumption that  $P$  is necessary is consistent with the thesis that  $P$  isn't a metaphysical law but (say) a logical consequence of some other propositions that are metaphysical laws. Consequently, the information that a certain proposition  $P$  is necessary doesn't generally put us in a position to know that a certain proposition is a metaphysical law.<sup>23</sup> *Secondly*, there is an explanatory connection: the fact that a certain proposition is metaphysically necessary is typically explained by certain facts about the metaphysical laws.<sup>24</sup> For instance, if  $P$  is a metaphysical law, then that fact explains the fact that  $P$  is metaphysically necessary. Similarly, if  $Q_1, Q_2, \dots$  are metaphysical laws and  $P$  follows logically from  $Q_1, Q_2, \dots$ , then these two facts explain the fact that  $P$  is metaphysically necessary.

These two connections between metaphysical lawhood and metaphysical modality allow us to appeal to the modal facts in evaluating hypotheses about the metaphysical laws. To begin with, a thesis about the metaphysical laws often yields modal predictions.

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<sup>22</sup> The view about the connection between modality and the metaphysical laws that I will sketch in this paragraph and the next is similar in many respects to Kit Fine's well-known view about the connection between modality and essence. See Fine 1994.

<sup>23</sup> ... except in special cases, e.g. those where  $P$  is a proposition of the form  $Q$  is a metaphysical law.

<sup>24</sup> There might be exceptions. For example, if  $P$  is a logical truth, then  $P$ 's necessity might be explained by the fact that  $P$  is a logical truth and not by any facts about the metaphysical laws.

For example, the claim that  $P$  is an essential truth about  $a$  entails that  $P$  is a necessary truth. Therefore, if we can show that  $P$  is *not* necessary, then that shows that the claim about  $a$ 's essence is incorrect. By contrast, if the modal predictions of this claim are borne out, we *can't* infer that the claim is true. But the finding may nevertheless provide support for the claim by a more indirect route such as inference to the best explanation: the thesis that  $P$  is an essential truth about  $a$  will receive confirmation to the extent that it provides an attractive explanation of the modal data.

This procedure of assessing hypotheses about the metaphysical laws in light of their modal implications is arguably exemplified by many applications of the “method of cases.” While this method is frequently represented as a technique for evaluating analyses of concepts, I suspect that it is in fact often used to assess claims about the real definitions of specific properties and relations. Suppose a philosopher claims that what it is for an act or institution to be just is for it to meet condition  $C$ . That's a claim about the essence of the property of being just. More precisely, it amounts to the claim that the following biconditional is a real definition<sub>in</sub> of being just: something is just iff it meets condition  $C$ . In order for this proposal to be correct, the biconditional must be metaphysically necessary. We can test this modal consequence of the account against individual cases. If we find a possible scenario where an act or institution meets condition  $C$  but isn't just, or is just but doesn't meet condition  $C$ , then that counts against the view. On the other hand, if all possible scenarios we consider conform to the theory, then the theory may gain some support from its ability to explain these cases.

The views sketched in sections 1 and 2 also imply that there is a pattern of unidirectional entailment (similar to the one discussed above) between grounding claims and modal propositions. Given (CLG), the hypothesis that the facts  $gg$  ground the fact  $f$  implies that  $f$  is logically entailed by the  $gg$  and the metaphysical laws. Since the metaphysical laws are metaphysically necessary, it follows that  $f$  is metaphysically necessitated by the  $gg$ .<sup>25</sup> The thesis that the  $gg$  ground  $f$  therefore entails the existence of

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<sup>25</sup> The assumption that there is a necessary connection between grounded facts and their grounds seems plausible to me and is accepted by many of the philosophers who operate with the concept of grounding (see, e.g., Rosen 2010, Fine 2012b), though it should be mentioned that some philosophers disagree (e.g., Leuenberger 2014).

a modal connection between the *gg* and *f*. It's obvious that the converse entailment doesn't hold: the *gg* may necessitate *f* without grounding *f*. Hence, if we can show that the *gg don't* necessitate *f*, then we can infer that the *gg don't* ground *f* (though it may still be that the *gg* are *among* the facts that ground *f*). By contrast, even if we can show that the *gg* necessitate *f*, we can't simply infer that the *gg* ground *f*. However, we may be able to appeal to the modal connection between the *gg* and *f* to support the grounding claim more indirectly, via an inference to the best explanation. We may argue, for example, that the best explanation of the modal connection involves assumptions about the metaphysical laws that (when combined with the theory of section 1.2 about the connection between grounding and the metaphysical laws) entails that the *gg* ground *f*. For instance, suppose we have found that the fact that an object meets condition *C* necessitates the fact that that object has property *F*, and we can argue convincingly that the best explanation of this modal fact involves the assumption that what it is to have *F* is to meet condition *C*. Given the view of section 1.2, this assumption entails that *a*'s meeting condition *C* grounds *a*'s having *F*. This grounding claim consequently receives some support as well. I will try to show in section 4 that it is often in arguments of the two kinds described in this paragraph that the concept of supervenience proves useful in metaphysics.

What I said about grounding is also true (*mutatis mutandis*) of causation under determinism. If *f* is not necessitated by the *gg* and the natural and metaphysical laws, then we can apply (CLC) to conclude that the *gg don't* include all the causes of *f*. By contrast, if the *gg* and the laws do necessitate *f*, we *cannot* immediately infer that the *gg* include all of *f*'s causes. However, we may be able to support this conclusion by an inference to the best explanation.

The foregoing reflections show that it's more straightforward to use (CLG) to show that certain facts *don't* ground *f*, or to use (CLC) to show that certain facts *don't* include all the causes of *f*, than to use these principles to show that a certain fact *is* among the facts that ground *f* or among the causes of *f*. However, we can sometimes show the latter by showing the former, provided we have the right background knowledge. My explanation of how this can be done will focus on causation under determinism, although variants of the method can be applied to causation under indeterminism and to grounding.

Suppose we want to know whether the fact  $g$  is a cause of the fact  $f$ , that it's part of our background knowledge that  $f$  was caused, and that the class of facts  $C$  (of which  $g$  is a member) includes all of  $f$ 's causes. If we can show that the facts in  $C - \{g\}$  don't nomically determine  $f$ , then it follows by (CLC) that  $C - \{g\}$  doesn't include all of  $f$ 's causes. Given our knowledge that  $C$  does include all of  $f$ 's causes, we can infer that  $g$  must be a cause of  $f$ . I'll argue in section 5 that we are applying a version of this procedure when we use counterfactual dependence as a criterion for the existence of an explanatory connection.

#### **4. Supervenience and relative fundamentality**

Many philosophers have used the notion of supervenience to articulate certain claims about relative fundamentality. One example of such a claim is the thesis of physicalism. This thesis has been characterized in various different (and not obviously equivalent) ways, e.g. as the claim that everything is (or is *ultimately* or *at bottom*) physical, that there is nothing "over and above" the physical, that (perhaps with some qualifications) the physical facts determine all other facts, and in other such ways. Anyone discussing this thesis faces two important questions: (a) How should we understand "physical"?<sup>26</sup> (b) Given any specific way of understanding "physical," what exactly is the relationship that everything has to the physical according to physicalism? In other words, what does it mean to say that certain phenomena are "nothing over and above" the physical, or that everything is "at bottom" physical or "is determined by" the physical? Different combinations of answers to the two questions yield different forms of physicalism.

I will largely set question (a) aside and focus on question (b). It is in trying to answer the latter question that many philosophers have employed the concept of supervenience.<sup>27</sup> As an illustration of this approach, I will consider a strategy proposed by Frank Jackson. This strategy can be described as starting from the following preliminary statement of physicalism: the physical facts determine all other facts. If we interpret "determine" as "metaphysically necessitate," we can state this thesis more precisely as a supervenience

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<sup>26</sup> See Ney (2008) for a survey of the literature about this question.

<sup>27</sup> For example, Lewis (1983), Chalmers (1996), Jackson (1998).

thesis: any possible world that matches actuality in all physical facts – any “physical duplicate” of actuality – is indistinguishable from actuality. That won’t quite do as it stands, however. For physicalism is presumably consistent with the existence of possible worlds that are physical duplicates of actuality but also contain immaterial spirits, and (according to physicalism) such worlds aren’t indistinguishable from the actual world. The supervenience base therefore needs to be enriched with a “totality fact” that rules out the existence of such extra stuff. Physicalism can then be described as a combination of two theses: a “totality proposition” that says that nothing exists except certain physical stuff and entities whose existence is determined by the physical facts, and the principle that the physical facts and the fact stated by the totality proposition together determine all the other facts. Interpreting “determine” once again as expressing metaphysical necessitation, the two commitments can be captured by a new supervenience thesis.<sup>28</sup> Call a possible world  $w$  a “minimal physical duplicate” of actuality just in case  $w$  is a physical duplicate of actuality and  $w$  contains nothing except what it must contain in order to be a physical duplicate of actuality. Physicalism can then be formulated as the following thesis:

(2) Every minimal physical duplicate of actuality is a perfect duplicate of actuality.

Such attempts to formulate physicalism in terms of supervenience face a number of objections.<sup>29</sup> While it seems plausible that physicalism entails a suitably formulated supervenience thesis, many philosophers have pointed out that the converse entailment doesn’t seem to hold. For example, the relevant supervenience theses are consistent with the belief in the necessary existence of an immaterial god, a commitment that seems to be at odds with a physicalist worldview. Moreover, some philosophers have argued that supervenience claims like (2) are also consistent with certain forms of emergentism that are incompatible with physicalism (Wilson 2005). And there are other objections along these lines as well.<sup>30</sup> I share these misgivings about supervenience formulations of physicalism (but won’t have space for further discussion of them or of the responses that

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<sup>28</sup> Jackson (1998: 9–14).

<sup>29</sup> For brief overviews of this large literature, see Stoljar (2009), McLaughlin and Bennett (2014).

<sup>30</sup> See, e.g., Hawthorne (2002), Leuenberger (2008).



can be given by proponents of supervenience formulations<sup>31</sup>). I will argue that the theoretical framework of section 1.2, including the notions of essence and grounding, provides more promising ways to state physicalist commitments.<sup>32</sup> Supervenience relationships are important to the debate about physicalism not because the debate is about them, but because of their role in arguments for and against physicalism.

I will assume an understanding of the expression “physical” that is broad enough so that the term applies to some entities that don’t belong to the physical domain alone, but that are equally present in other domains and that need to be mentioned in a complete account of the physical. Examples of such domain-neutral items include the relation of parthood, metaphysical lawhood, and essentiality. I won’t address any of the other difficult questions that can be raised about the notion of a physical entity, but will simply pretend that some satisfactory explanation of the concept has been given. I will say that an entity is *ultimately physical* iff it is physical and doesn’t essentially depend on any non-physical entities. As a further rough working definition, let’s say that a fact is a *physical fact* just in case it’s a fact about which ultimately physical entities there are, or about the distribution of ultimately physical properties and relations over ultimately physical entities, or about the laws governing the ultimately physical entities. Finally, an entity *a* is *definable in ultimately physical terms* just in case (i) there is a real definition<sub>Id</sub> of *a* whose right-hand side mentions only ultimately physical entities, and (ii) if *a* is a property or relation, then there is also a real definition<sub>In</sub> of *a* whose right-hand side mentions only ultimately physical entities. Note that there is no obvious reason for thinking that an entity that is definable in ultimately physical terms must itself be a physical entity.<sup>33</sup> A functionalist might believe that some mental properties are second-order functional properties that could have been realized by ectoplasmic properties (even if all of their *actual* realizers are physical). Such functional properties could be classified

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<sup>31</sup> Jackson himself responds to some of these objections in his (1998: ch. 1).

<sup>32</sup> For discussion of other versions of the suggestion that theses about relative fundamentality can be articulated using the notion of grounding or related concepts, see Fine (2001), Rosen (2010), Dasgupta (forthcoming).

<sup>33</sup> See McLaughlin and Bennett (2014) for a discussion of some questions about the closure properties of the class of physical properties and relations.

as non-physical by some reasonable standards, despite the fact that they might well be definable in ultimately physical terms.

The theoretical framework of section 1.2 affords several ways of explaining the idea that the universe is physical at bottom. For example, we may offer a formulation along the following lines as a first shot:

- (3) Every entity is either an ultimately physical entity, or it is definable in ultimately physical terms and its existence is grounded in physical facts.

(While I think that (3) stands in need of some refinement,<sup>34</sup> it won't be necessary to discuss the revisions required, since our present topic isn't physicalism but the role that supervenience claims can play in evaluating claims about the way the universe is layered. (3) will merely function as a toy example of such a claim that is cast in terms of essence and grounding.) Proponents of (3) can accept that there are non-physical entities. However, they will say that for any entity *e* that isn't ultimately physical, what it is to be *e* is to meet a certain condition that can be formulated in ultimately physical terms and the existence of *e* is grounded in physical facts. Moreover, for any property or relation *P* that isn't ultimately physical, what it is to instantiate *P* is to meet a certain condition statable in ultimately physical terms. Something along the lines of (3) seems to be one natural way to explain the physicalist idea that the physical realm forms the bottom layer of the universe from which the rest of reality somehow derives.

At the beginning of this section I mentioned a different way of spelling out this idea. On that approach, physicalism amounts to the conjunction of the following two theses:

- (i) There is nothing except certain physical stuff and things whose existence is determined by the physical facts.
- (ii) The physical facts and the totality fact stated by (i) together determine all other facts.

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<sup>34</sup> One example: A philosopher could hold that some non-physical entities aren't themselves definable in ultimately physical terms, but are linked to the level of ultimately physical entities by a chain of several definitions. Some views of this kind may reasonably be classified as physicalist, despite their inconsistency with (3).

The attempt to capture these theses in modal terms yielded the supervenience formulation (2). It is worth noting that thesis (3) entails two claims with close affinity to (i) and (ii) respectively, though these theses are cast in terms of grounding rather than in modal terms. To begin with, it's obvious that (3) implies a version of (i), namely the claim that nothing exists except ultimately physical entities and entities whose existence is grounded in the physical facts. (3) also entails a thesis that is closely related to (ii), though it will take a little more effort to see this. (3) tells us that all entities that aren't ultimately physical are definable in ultimately physical terms. From this claim it follows by the account of section 1.2 that all facts about any non-ultimately-physical entities *ee* (except for certain facts about their essences) are grounded in facts that are wholly about ultimately physical entities (possibly in combination with certain facts about the essences of the *ee*). Now, if (3) is true, then the range of facts that are wholly about ultimately physical entities isn't limited to the physical facts in the sense defined above. It also includes a totality fact that isn't a physical fact. Let *a, b, ...* be all the ultimately physical entities and let *p, q, ...* be all the entities that aren't ultimately physical. If (3) holds, then the essential truths about *p, q, ...* state certain conditions  $C_p, C_q, \dots$  cast in ultimately physical terms that are necessary and sufficient for identity with *p, q, ...* respectively. The following totality proposition must therefore be true:

- (4) Nothing exists other than *a* and *b* and ... and one thing that meets condition  $C_p$  and one thing that meets condition  $C_q$  and ... .

Since (4) mentions only ultimately physical entities, it states a fact that is wholly about ultimately physical entities. But it's not a physical fact in the sense defined above. (To see this, it is enough to note that there are possible worlds that match actuality in all physical facts, but that also contain certain fundamental non-physical properties that don't actually exist, so that (4) is false at these worlds.) So, what (3) entails is the following claim: the facts that are wholly about ultimately physical entities – including the physical facts and the totality fact stated by (4) –, together with the facts about the essences of non-ultimately-physical entities, ground all other facts (i.e., they ground all

facts about non-ultimately-physical entities other than facts about their essences). This thesis is akin to (ii).<sup>35</sup>

If we formulate physicalism along the lines of (3), then we can account for the aforementioned unidirectional entailment from physicalism to certain supervenience theses. As discussed in section 3, the claim that certain facts *gg* ground another fact *f* entails that the *gg* metaphysically necessitate *f*, though the converse entailment doesn't hold. Consequently, (3) entails certain modal theses but not vice versa. For example, it's easy to show that (3) entails the following supervenience thesis:

- (5) Every possible world that matches actuality in all facts that are wholly about ultimately physical entities is indistinguishable from actuality.<sup>36</sup>

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<sup>35</sup> The proponent of (3) holds that (a) for any entity *e* that isn't ultimately physical, *e* is definable in ultimately physical terms, and (b) for any entity *e* that isn't ultimately physical, *e*'s existence is grounded in physical facts. The observations of the preceding paragraph allow us to see that (b) is a non-redundant part of this statement of physicalism. On the account of section 1.2, the claim that *e* is definable in ultimately physical terms entails that *e*'s existence is grounded in facts that are purely about ultimately physical entities. But not every such fact is a physical fact, as we have just seen. Hence, (a) doesn't obviously entail (b). Moreover, it's not clear (to me at least) that we can omit (b) from the statement of physicalism. For all I know, there might be a condition *C* statable in ultimately physical terms such that it is true to say: if something exists that meets condition *C*, then that existence fact is neither a physical fact nor grounded in physical facts. (Perhaps this is so if *C* is the condition of being an individual that is *not* material and *not* a space-time region and *not* a field and has *no* spatio-temporal location and....) Some eccentric philosopher might say (implausibly perhaps, but not inconsistently) that there is some non-physical entity *a* such that the proposition *Something is a iff it meets condition C* is a real definition<sub>Id</sub> of *a*. On this view, *a*'s existence is grounded in the fact that something meets condition *C*, which is not a physical fact. It would be implausible to classify this view as physicalist. And yet, the proponent of the view may accept (a). Clause (b) of our statement of physicalism is needed to classify the view as incompatible with physicalism.

<sup>36</sup> In order to see that (given the account of section 1.2) thesis (3) entails (5), recall first what we said earlier: (3) entails that the facts that are wholly about ultimately physical entities, together with the facts about the essences of non-ultimately-physical entities, ground (and therefore metaphysically necessitate) all other facts. Now, let *w* be a possible world that matches actuality in all facts that are wholly about ultimately physical entities. By (3), the existence of any actually existing entity *e* that is not ultimately physical is grounded in (and hence metaphysically necessitated by) the actual physical facts, so any such entity must exist at *w* as well. Now, every actual fact about the essence of an actually existing thing obtains at every possible world where the thing exists. Hence, all actual facts about the essences of actually existing non-ultimately-physical entities must obtain at *w*. Since these facts together with the actual facts that are wholly

While (3) entails this supervenience thesis, the converse entailment doesn't hold – (3) is stronger than (5). For example, (5), like (2), is consistent with the existence of a necessarily existing immaterial god. By contrast, (3) seems to rule out this possibility, since the existence of such a god presumably wouldn't be grounded in the physical facts. (Moreover, such a god would be unlikely to be definable in ultimately physical terms.)

Although physicalism isn't a supervenience thesis, facts about supervenience relationships have an important role to play in the debate about the truth of physicalism. For example, since (3) entails the supervenience thesis (5), any reason to doubt the latter thesis will translate into an argument against (3). On the other hand, if it can be made plausible that (5) is true and that (3) is entailed by the most attractive explanation of the modal fact stated by (5), then that will provide support for (3).

## **5. Counterfactuals and explanation**

It is undeniable that counterfactuals play a central role in reasoning about explanatory relationships. If you want to know whether Fred's tactless remark on Friday caused his fight with Susie on Sunday, what could be more natural than to ask whether they would have fought without the remark? If the answer is "no" – if the fight counterfactually depends on the remark – then that gives you good reasons for believing that the remark caused the fight. Similarly, if it can be shown that life wouldn't have developed if the value of some physical constant had been outside a certain range, then that supports the claim that the existence of life is explained in part by the fact that the value was within that range. Counterfactuals guide our judgments about explanatory relationships. This observation has motivated analyses of causation and explanation in counterfactual terms, for such theories can give a straightforward account of the connection between counterfactuals and explanatory judgments. However, counterfactual analyses have fallen on hard times. Simple counterfactual dependence is not necessary for causation, as is shown most famously by over-determination and preemption cases, and decades of

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about ultimately physical entities metaphysically necessitate all other actual facts, it follows that all actual facts obtain at  $w$ . In other words,  $w$  is indistinguishable from actuality.

concerted efforts to specify a more complex pattern of counterfactual dependencies that is both necessary and sufficient for causation have been unsuccessful.<sup>37</sup>

These findings provide good motivation to search for a different account of the central role of counterfactuals in explanatory reasoning. They also suggest that the method of settling explanatory questions by counterfactual reasoning suffers from certain characteristic limitations: while we can often draw a (defeasible) inference from counterfactual dependence to the existence of an explanatory connection,<sup>38</sup> cases of over-determination and preemption suggest that the converse inference (from counterfactual independence to the *absence* of an explanatory relationship) is not very reliable. A good account should not only explain why counterfactual reasoning is often a useful method of assessing explanatory claims, but should also predict and explain the limitations of the procedure.

As I try to show in my (2014: chs. 10–12), the covering-law conception of causation allows us to formulate a theory with these virtues. On this theory, the use of counterfactual reasoning to assess explanatory claims is an extension of a very common procedure for investigating causal relationships that John Stuart Mill called “the method of difference.”<sup>39</sup> Consider a humble example of this method. Your laptop is plugged in, but the battery, though nearly depleted, is not charging. To find out whether the problem is due to a battery defect, a malfunctioning adapter, or a dead outlet, you vary one factor at a time while holding the others fixed. For example, using the same battery and adapter, you plug into a different outlet. If the battery starts charging, you conclude that the issue was caused by an outlet problem.

*Scenario 1: A B C D*

*E*

*Scenario 2:  $\bar{A}$  B C D*

*$\bar{E}$*

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<sup>37</sup> For a recent overview of the counterfactual approach to causation and its problems, see Menzies (2014).

<sup>38</sup> Some of the reasons why this inference is defeasible are discussed in Kment (2014: scts. 10.3.1 and 12.1).

<sup>39</sup> Mill (1956: bk. III, ch. VIII, sct. 2)

Idealizing somewhat and focusing on deterministic contexts,<sup>40</sup> we can give the following simplified and schematic description of the method of difference. The agent observes a scenario where  $A$  is present at time  $t$ , accompanied by the surrounding conditions  $B-D$ , and where  $E$  obtains at  $t+1$ . She also observes a second situation where  $A$  is absent but which matches the first scenario in containing  $B-D$ . This time,  $E$  does not obtain at the next moment. If she believes that in the first scenario no factors that obtained at  $t$  other than  $A-D$  were causally relevant to the presence of  $E$ , then she can take her observations to support the claim that  $A$  is a cause of  $E$  in the first scenario. Sophisticated versions of this procedure are applied in scientific experiments. (In these cases, Scenario 1 is the “experimental condition,” Scenario 2 is the “control condition,” and  $B-D$  are the background factors that the experimenters are controlling for.) Much simpler applications are common in everyday life, as the laptop example illustrates.

We can appeal to the covering-law conception of causation to explain how the method of difference works: Since  $B-D$  obtain in Scenario 2 but  $E$  doesn't, the agent can conclude that  $B-D$  don't nomically determine  $E$ . But by the covering-law conception, the causes of  $E$  that obtain at  $t$  in Scenario 1 must nomically determine  $E$ . So,  $B-D$  can't include all the causes of  $E$  that obtain at  $t$  in Scenario 1. Given the assumption that  $A-D$  do include all of these causes, it follows that  $A$  must be a cause of  $E$ . (A different version of the same method can be used to show of a fact  $f$  that it is one of the facts that ground another fact  $g$ . However, I will continue to focus on the case of causation.<sup>41</sup>)

The method of difference is limited in scope. If we have observed  $A$  followed by  $E$ , and we want to show that  $A$  was a cause of  $E$ , we have to find or create another situation where  $A$  doesn't obtain but which otherwise matches the scenario we have observed in all relevant ways. That is often impossible in practice. And the method is useless when our goal is to find out not what caused  $E$ , but which *laws* were involved in  $E$ 's explanation. For the laws never vary between different scenarios that actually obtain. If my reconstruction of Mill's method is on the right track, however, then there is a straight-

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<sup>40</sup> For an account of counterfactual reasoning about causation under indeterminism, see Kment (2014: sct. 12.3).

<sup>41</sup> See Schaffer (2015) for further discussion of the connection between grounding and patterns of counterfactual dependencies.

forward extension of it that remedies these shortcomings. On my account, the sole function of Scenario 2 is to show that  $B-D$  don't nomically determine  $E$ . But given the right background knowledge about the laws, we can show the same by mental simulation. We mentally represent an unactualized world where  $B-D$  obtain at  $t$  but  $A$  doesn't, and where history then unfolds in accordance with the actual (metaphysical and natural) laws. If  $E$  fails to obtain at  $t+1$  in this situation, then  $B-D$  don't nomically determine  $E$ . Using the covering-law conception, we can infer that  $B-D$  don't include all causes of  $E$  that obtain at  $t$  in the actual scenario. Given our background assumption that  $A-D$  do include all of  $E$ 's actual causes that obtain at  $t$ , we can conclude that  $A$  is actually a cause of  $E$ . The type of mental simulation I just described is a simplified version of the reasoning by which we determine whether  $E$  depends counterfactually on  $A$ : we imagine a scenario where  $A$  is absent, while holding fixed various other facts that actually obtain ( $B-D$  and the laws), and we then determine whether  $E$  obtains in that situation. The situation imagined serves the same purpose as Scenario 2 (the "control condition") in the method of difference, and by holding fixed the right facts we achieve the same as by controlling for background conditions in an experiment. The same type of mental simulation can also be used to show that certain laws are involved in explaining  $E$ , only in that case we need to imagine a scenario that is relevantly different from actuality with respect to the laws (while resembling actuality in other relevant respects).

As I try to explain in my (2014: ch. 11), a fully developed version of this method requires an ordering of unrealized scenarios by their closeness to actuality that is governed by the specific standards we actually employ in counterfactual reasoning. Roughly speaking, this ordering gives us an easy way of deciding, for any fact  $A$ , which unrealized scenarios we need to consider if we want to test whether  $A$  partly explains a certain other fact: of all scenarios where  $A$  fails to obtain, we should consider those that are closest to actuality in the ordering.

When sufficiently developed (Kment 2014: chs. 10–12), this account explains why the counterfactual dependence of one fact on another is often good evidence for the claim that the second fact partly explains the first. At the same time, the account predicts and explains the fact that we cannot infer the absence of an explanatory connection from the observation that  $E$  is counterfactually independent of  $A$ . On the covering-law conception



of causation, it's a *necessary* condition for  $B-D$  to include all of  $E$ 's causes at  $t$  that  $B-D$  nomically determine  $E$ . But it's not a *sufficient* condition. Now, if  $E$  fails to obtain at worlds that conform to the actual laws and where  $B-D$  obtain without  $A$ , then it follows that  $B-D$  don't nomically determine  $E$ . So,  $B-D$  don't meet the necessary condition for including all causes of  $E$  that obtain at  $t$ . Given the assumption that  $A-D$  do include all of these causes, we can conclude that  $A$  is a cause of  $E$ . By contrast, if  $E$  obtains at worlds that conform to the actual laws and where  $B-D$  obtain without  $A$ , then the most we could possibly conclude (given additional background assumptions) is that  $B-D$  nomically determine  $E$ . But since that isn't a sufficient condition for  $B-D$  to include all causes of  $E$  that obtain at  $t$ , we can't conclude that  $B-D$  include all of these causes and therefore can't infer that  $A$  isn't a cause.<sup>42</sup>

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<sup>42</sup> For helpful comments, I am indebted to Daniel Berntson, Chris Daly, Cian Dorr, Adam Elga, Dmitri Gallow, Tristram McPherson, David Plunkett, Jonathan Schaffer, Nat Tabris, and the members of a graduate seminar on grounding that I taught at Princeton in the fall of 2014.

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