

Essence and Modal Knowledge

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Abstract. During the last quarter of a century, a number of philosophers have become attracted to the idea that necessity can be analyzed in terms of a hyperintensional notion of essence. One challenge for proponents of this view is to give a plausible explanation of our modal knowledge. The goal of this paper is to develop a strategy for meeting this challenge. My approach rests on an account of modality that I developed in previous work, and which analyzes modal properties in terms of the notion of a metaphysical law (which is a generalization of the concept of an essential truth). I discuss what information about the metaphysical laws (including essential truths) is required for modal knowledge. Moreover, I describe two ways in which we might be able to acquire this information. The first way employs inference to the best explanation. The metaphysical laws, including the essential truths, play a crucial role in causal and grounding explanations and we can gain knowledge of these laws by abductive inferences from facts of which we have perceptual or a priori knowledge. The second way of gaining information about the metaphysical laws rests on knowledge that is partly constitutive of competence with the concepts that are needed to express the relevant information. Finally, I consider how knowledge of the metaphysical laws can be used to establish modal claims, paying special attention to the much-discussed connection between conceiving and possibility.

During the last quarter of a century, a number of philosophers, influenced by Kit Fine's groundbreaking work, have become attracted to the idea that necessity can be analysed in terms of a hyperintensional notion of essence (Fine 1994; Lowe 2006, 2007, 2012; Hale 2013: Ch. 11, Kment 2006b, 2014). One question that naturally arises for this view is whether it is consistent with a credible account of modal knowledge. If essence is the source of necessity, is our modal knowledge based on knowledge of essences? If the answer is "yes," then how did we acquire the essentialist knowledge that underlies our modal knowledge? That is a question to which there are still few well-developed answers (despite some recent progress; see Lowe 2012, Hale 2013: Ch. 11, Mallozzi 2018, Tahko 2018). And if the answer is "no," then what other routes to modal knowledge are available on the essentialist account?

The goal of this paper is to outline the beginnings of an essentialist account of modal knowledge that promises to answer these questions. I will consider in what cases and to what extent information about essences and other, similar information is required for modal knowledge. Moreover, I will discuss some ways in which we can acquire this information and some ways in which we can use it to establish modal claims. My approach will rest on the essentialist theory of modality and the account of essence that are developed in Kment 2014.

On this view, which will be summarized in section 1, necessity and possibility come in degrees. A claim's degree of possibility is determined by the how great a departure from the way things are is required to make the claim true. The smaller the departure required, the more easily the claim could have been true, i.e. the greater its degree of possibility. To give a more precise formulation, one can introduce a non-modal notion of a world (which covers both metaphysically possible and metaphysically impossible worlds) and define a relation of comparative closeness or overall similarity between worlds. One can then measure a claim's degree of possibility by the proximity to actuality of the closest (possible or impossible) worlds where the claim is true. The degree of overall similarity between two worlds is determined by weighing the similarities and dissimilarities between these worlds against each other. The weightiest respect of inter-world similarity is match with respect to a set of metaphysical principles that I call "metaphysical laws," and which include the essential truths. Worlds that perfectly match actuality in this regard are closer than those that do not—they "form a sphere" around actuality. For a claim to be metaphysically necessary is for it to be true at every world in that sphere.

As discussed in section 2, this view entails that many facts about metaphysical modality have their source in facts about the metaphysical laws, including facts about essences. Moreover, knowledge of many modal facts requires information about the metaphysical laws, including information about essences. Section 3 describes two possible ways in which we can acquire such information. One of them rests on inference to the best explanation. The metaphysical laws are the covering laws of many explanatory connections, including both causal and grounding relationships (section 1.2). Consequently, they play a crucial role in the explanation of many facts of which we have perceptual or a priori knowledge. Starting from this knowledge, we can acquire information about the metaphysical laws by abductive inferences. Another possible way of gaining information about these laws relies on knowledge that is partly constitutive of competence with the expressions or concepts that are needed to express the information. Section 4 contains a selective discussion of some ways in which knowledge about the metaphysical laws can be used to gain modal knowledge. I will pay special attention to the much-discussed connection between conceiving and possibility.

1. Modality and the metaphysical laws

1.1 The nature of modality

I will begin by sketching the basic elements of the metaphysical account of modality (developed in detail in Kment 2014) on which my proposal will rest.¹

Impossible Worlds. Following Daniel Nolan (1997, 2013) and others, I believe that there are impossible worlds as well as possible ones. One way to bring out the motivation for this view is

¹ For other views that have various points of contact with the view to be described, see Lange 1999, 2000, 2005, 2009; Williamson 2005, 2008; Hill 2006. Also cp. McFetridge 1990.

to consider counterpossibles, i.e. counterfactual conditionals with metaphysically impossible antecedents. On the standard account of counterfactuals (Stalnaker 1968, Lewis 1973a, 1986),

$Q \Box \rightarrow P$ iff P at the worlds closest to actuality where Q .

On the assumption that all worlds are metaphysically possible, this account entails that all counterpossibles are vacuously true (since there are no antecedent-worlds), irrespective of the contents of their antecedents and consequents. But to many philosophers that seems very implausible. The fact that the antecedent of a counterfactual is metaphysically impossible often seems not to settle the truth-value of the counterfactual. It is metaphysically impossible for me to be the son of Hillary and Bill Clinton. But that leaves it an open question in what ways I would be different if I were their son. Similarly, it is metaphysically impossible for there to be no numbers, but that does not seem to answer the question whether physical events would have unfolded differently if numbers had not existed. Since this problem arises from disallowing worlds where impossible propositions are true, the obvious remedy—suggested and developed by a number of philosophers (Routley 1989, Mares 1997, Nolan 1997, Zalta 1997, Vander Laan 2004, Kment 2006b, 2014: chs. 2–5 and 7–8, in particular ch. 4)—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 could not have been.^{2,3}

I think of worlds as collections of structured Russellian propositions (which are constructed from the individuals, properties, etc. that they are about). We can introduce non-modal notions of logical entailment and logical consistency for Russellian propositions, to be explained in terms of the logical structures of these propositions. (Roughly speaking, a Russellian proposition is a logical truth just in case it is true in virtue of its logical structure.) To count as a world, a collection of propositions w needs to be logically consistent and to answer every question, in the sense that either P or the negation of P is true at w for every Russellian proposition P . (A proposition is true at w just in case it is logically entailed, in the non-modal sense, by the propositions in w .) Unlike the notion of a possible world, the concept of a world is non-modal.⁴

*Gradability of modal properties.*⁵ Although it is often assumed that necessity and possibility are all-or-nothing matters, I think that there is some linguistic evidence to the contrary: Just as we can

² See Williamson 2008, pp. 171–175, 2017, 2018 for a defense of the claim that all counterpossibles are true. (Also see Lewis 1973a, Stalnaker 1968, 1996.) Many other philosophers, including myself, find the claim implausible and have argued against it (see Nolan 1997, Vander Laan 2004, Kment 2006b, 2014, Brogaard and Salerno 2007a, 2007b, 2013, Lange 2009: sct. 2.7, Berto, French, Priest, and Ripley forthcoming). The debate about the status of counterpossibles is ongoing and I will not be able to join it here.

³ For more on impossible worlds, see Nolan 1997, 2013. See Stalnaker 1996 for some arguments against impossible worlds.

⁴ This view departs from Nolan's by adopting a consistency requirement on worlds. However, we can think of this requirement as no more than a useful idealization that might eventually be abandoned in the course of a full development of the position.

⁵ See also Lewis 1973b; Kratzer 1981, 1991; Lange 1999.

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 believe that we should 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 had been on the team, Katie had been sober, Bob had known the rules, and so forth.” 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 situations 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 situations 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 locutions we use are not always overtly modal. Often (but not invariably) we employ idioms that involve metaphors of proximity, fragility, or security. You are running to catch the train, but the doors close on you before you can jump in, causing you to sigh in frustration “I nearly 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. We say that something was a *close* call, that an event *almost* happened, or that someone came *within a hair’s breadth* of disaster, to communicate that various situations could easily have obtained. The peace between two nations during some period in history can be called *fragile* or *secure* depending on how easily their tensions could have escalated into war.

The theoretical framework of (possible and impossible) worlds can be used to sharpen the account of modality just sketched. 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. One sphere (described in more detail below) is associated with metaphysical modality: a world counts as metaphysically possible just in case it is in that sphere and a proposition is metaphysically necessary just in case it is true at every world in that sphere.⁶

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 words “could” and “must” serve as quantifiers over worlds. The quantification is typically restricted to worlds that meet specific conditions, and it is well known that the restrictions vary greatly between contexts. “Could” expresses a grade of ontic possibility in a given context just in case the quantification over worlds is restricted to the worlds that are within a certain sphere around actuality but there are no other restrictions on these quantifiers.

Many philosophers assume (or write as if they assumed) that the metaphysically possible worlds are all the worlds there are. From their point of view, it is natural to think that the facts of metaphysical modality are about the plenitude of the whole space of ways for reality to be: to say that *P* is metaphysically necessary is to say that that space in its entirety does not afford any worlds where *P* fails to be true. On my own view, by contrast, metaphysical modal claims are not about the plenitude of the space of all worlds, for metaphysically impossible worlds are irrelevant to the truth of a modal claim. Instead, they concern the distances between the worlds of this space—more precisely, the distance that separates actuality from worlds where various propositions are true. *P* is metaphysically possible just in case some *P*-worlds are close enough to actuality to qualify as metaphysically possible. (The same is true for all other grades of ontic possibility as well: *P* has a given grade of ontic possibility just in case *P* is true at some world within a certain distance from actuality.)

Prior to Putnam’s and Kripke’s groundbreaking work, philosophers were often reluctant to accept that we can gain much modal knowledge through sense experience.⁷ Experience can tell us that things are thus-and-so in the actual world. But how could it tell us that something is true at *all* possible worlds, including those that are not actualized?⁸ Similarly, sense impressions might teach

⁶ The graded form of modality I described is similar to what Kratzer (1991: sects. 3.3, 5) calls “circumstantial modality,” which she defines in terms of a closeness ordering. However, there is an important difference in the order of explanation and a closely related further difference between the non-reductive character of her account and the reductive nature of my own. I start with a non-modal concept of a world and a notion of comparative closeness between worlds that is defined non-modally, and I use them to give a non-modal definition of a graded notion of possibility. The graded notion in turn is used to define metaphysical possibility (as well as other specific grades of possibility, such as nomic possibility): The metaphysically possible propositions are those that have at least a certain degree of possibility. Similarly, the metaphysically possible worlds are all and only those whose actualization has at least a certain degree of possibility. In other words, they are the worlds that are actualized at some world within a certain distance from actuality or, equivalently and more simply, they are the worlds that are located within that distance from actuality. By contrast, Kratzer starts with an unanalyzed notion of a possible world, and then defines the closeness ordering and the graded notion of possibility in terms of it. Her view is non-reductive.

⁷ ... except perhaps in a few special cases, for example those in which we gain modal knowledge through testimony.

⁸ This is a modernized version of the train of thought that can be found, for example, in Kant 1787, p. 43. David Hume’s idea that we do not perceive necessary connections in the objects is in a similar spirit.

us that a certain scenario actually obtains (and is therefore possible), but how could it ever teach us that a specific unactualized situation is possible? Moreover, the idea that sense experience might not merely be *relevant* to the evaluation of modal beliefs but *required* for it seemed particularly puzzling. Kripke famously describes this puzzle as follows:

if something not only happens to be true in the actual world but is also true in all possible worlds, then, of course, just by running through all the possible worlds in our heads, we ought to be able with enough effort to see, if a statement is necessary, that it is necessary, and thus know it *a priori*. (Kripke 1981, p. 38)

(Kripke rejects this argument but says little about where it goes wrong.) However, the view of the nature of ontic modality sketched in the previous paragraph makes it entirely unsurprising that empirical evidence is often both relevant and required for determining the modal status of a proposition *P*. *P* is metaphysically possible just in case some *P*-world is close enough (similar enough overall) to actuality to qualify as metaphysically possible, and *P* is metaphysically necessary just in case no $\sim P$ -world is close enough to actuality to qualify as metaphysically possible. We cannot judge whether these other worlds are similar enough overall to actuality unless we know enough about what actuality is like—for the same reason that we cannot make well-informed judgments about the comparative overall similarity of other people to Billy unless we know a fair amount about what Billy is like. And while some of the relevant knowledge about the actual world might be *a priori* (such as knowledge of the mathematical facts that actually hold), a lot of it will be empirical. By the same token, we cannot determine by *a priori* reasoning whether *P* is necessary simply by running through all (metaphysically) possible worlds in our heads to check whether *P* holds at all of them. We would also need to *know* that the worlds we are considering include all the possible ones (it is not enough for this to be *true*). To be metaphysically possible, a world needs to meet a certain minimum standard of similarity to actuality. However, to know that the worlds we are considering meet this condition, we might need substantive knowledge about what actuality is like, and that requires empirical evidence. Note that this account of the relevance of empirical evidence to establishing modal claims generalizes to all grades of ontic modality.⁹

To complete the analysis of modality, and to get clearer about the kinds of knowledge about actuality that is required to establish modal claims, we need an account of the rules that determine the ordering of worlds by their closeness to actuality. Such an account is developed in detail in Kment 2006a and Kment 2014: chs. 8–9. On this occasion, I will confine myself to sketching its most relevant parts.

The ordering of other worlds by their closeness to actuality is determined by the degree to which they resemble actuality with respect to the laws, and to a lesser extent by their similarities to

⁹ There are, of course, numerous other accounts of the relevance of empirical evidence for modal beliefs on the market. For some recent examples, see Jenkins 2010, Roca-Royes 2017, Nolan 2017.

actuality in matters of particular fact.¹⁰ Not all similarities regarding the laws carry the same weight, however. We need to distinguish between natural laws and what I call “metaphysical laws.” The latter include a range of metaphysical principles, such as essential truths and certain ontological principles, that function as covering laws in grounding relationships, as will be explained in more detail in the next section. Let us say that a world *matches actuality with respect to the metaphysical laws* just in case it has the same metaphysical laws as actuality and it perfectly conforms to these laws. Match with respect to the metaphysical laws has greater weight in determining the closeness ordering than similarity in the natural laws. In fact, match with respect to the metaphysical laws is the weightiest respect of similarity: any world that matches actuality perfectly in this regard is closer to actuality than any world that does not, irrespective of how similar the latter world may be to actuality in other ways.¹¹ In other words:

- (1) The worlds that match actuality with respect to the metaphysical laws form a sphere around actuality.

Metaphysical necessity is the grade of necessity corresponding to this sphere. In other words:

- (2) A proposition is metaphysically possible (necessary) iff it holds at some (all) worlds in the sphere of those worlds that match actuality with respect to the metaphysical laws.

1.2 Metaphysical laws and grounding

The metaphysical laws play an important role in a non-causal form of explanation called “grounding” (Kment 2014: ch. 6, 2015). Grounding is the form of explanation 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 relationships connect metaphysically non-fundamental facts to the more fundamental facts that give rise to them.¹² I think that the metaphysical laws play a role in grounding very similar to that of the natural laws in deterministic causation. Metaphysically more fundamental facts typically give rise to less fundamental ones in accordance with the metaphysical laws, just as in a deterministic universe earlier events bring about later ones in accordance with the laws of

¹⁰ See, e.g., Lewis 1986, Bennett 1984, 2001, 2003, among many others.

¹¹ This sketch is somewhat simplified. For further details about the standards of closeness, see Kment 2014: sct. 7.1, chs. 8–9.

¹² For recent discussions of grounding and metaphysical explanation, see Schaffer 2009, 2016, Rosen 2010, Jenkins 2011, Bennett 2011, 2017, Koslicki 2012, Audi 2012a, 2012b, and Fine 2012a, 2012b. For some skeptical voices, see Hofweber 2009, Sider 2011: ch. 8, Daly 2012, and Wilson 2014.

nature. The metaphysical laws are, as it were, the covering laws of such grounding relationships.¹³

The metaphysical laws include the essential truths, which relate to the question of what it takes to be a certain entity or to have a certain property.¹⁴ For example, the essential truths about a non-fundamental property lay down necessary and sufficient conditions for having that property that are formulated in terms of more fundamental entities. An essential truth that lays down such conditions can be called a “real definition” of the relevant property or relation.¹⁵ When the real definition of a property *F* lays down that meeting condition *C* is necessary and sufficient for having *F*, we can express this by saying that to have *F* is to meet condition *C* or that *F*-ness is the property of meeting condition *C*. To illustrate, the following might be a real definition of the property of being a hydrogen atom:

- (3) Something is a hydrogen atom if and only if it is composed of one proton and one electron that stand to each other in a certain configuration (the “H” configuration).

The claim that (3) is a real definition of the property of being a hydrogen atom can be stated more briefly by saying that to be a hydrogen atom is to be composed of one proton and one electron that stand in the H configuration, or that hydrogen-atom-hood is the property of being so composed (Kment 2014: sct. 6.1.2).¹⁶

If the real definition of *F* lays down that condition *C* is necessary and sufficient for instantiating *F*, facts about which entities have *F* are at least partly grounded by facts about which entities satisfy *C*. For example, the fact that

- (i) Hydra is a hydrogen atom

is grounded by the fact that

- (ii) Hydra is composed of one proton and one electron that stand in the H configuration.

Similarly, the fact that (iii) you are not a hydrogen atom is at least partly grounded by the fact that (iv) you are not so composed. (3) functions as a covering law for both instances of grounding. Moreover, the fact that (3) is essential to the property of being a hydrogen atom explains the fact that (ii) grounds (i) and the fact that (iv) grounds (iii).

(It is a crucial assumption of this account that (i) and (ii) state different facts—after all, the fact stated by (ii) is supposed to explain the fact stated by (i) and this is not meant to be a case of self-explanation! I think the assumption is independently plausible. (i) and (ii) do not even talk about the same things. (i) ascribes to Hydra the property of being a hydrogen atom, and this property is not mentioned, or ascribed to anything, in (ii). On the other hand, (ii) says that Hydra stands in the

¹³ Versions of the covering-law conception of grounding and metaphysical explanation are proposed and defended in Rosen 2006, 2017, Kment 2014: ch. 6, 2015, Wilsch 2015a, 2015b, Glazier 2016, Schaffer 2017.

¹⁴ See Fine 1994, 1995.

¹⁵ For a slightly different conception of real definition, see Rosen 2015, 2017.

¹⁶ For other accounts of idioms like “To be *F* is to be *G*,” see Rayo 2013, Dorr 2016.

composition relation to two other objects that are configured in a certain way and instantiate the properties of protonhood and electronhood, respectively. (i) does not say any of this—it says nothing about composition, protonhood, electronhood, or the H configuration.)

In addition to real definitions that lay down necessary and sufficient conditions for having a certain non-fundamental property, there may be others that lay down necessary and sufficient conditions for being a certain non-fundamental entity (specified in terms of more fundamental entities). For example, where “*N*” is a directly referential name for the singleton of the number 2, the following might be a real definition of this set: something is *N* iff it is the set whose sole member is 2.¹⁷ We can express this by saying that to be *N* is to be the set that has 2 as its sole member. Many facts about *N* are grounded in facts that are not about *N* but are instead partly about the more fundamental entities in terms of which *N* is defined (i.e., 2, membership, and sethood). For instance, the fact that *N* figures in many philosophical examples is grounded in the fact that the set whose sole member is 2 figures in many such examples. The real definition of *N* stated above covers this instance of grounding.

The metaphysical laws may include principles other than essential truths as well, for example certain ontological laws. These are principles that tell us that under certain conditions there exists something of a certain kind. Laws of mereological composition are one example. They include principles to the effect that whenever there are things meeting a certain condition *C*, there is something composed of exactly these things. Another example involves principles of plenitude for properties, such as (4).

- (4) For any properties *F* and *G*, there is another property *H* that is their conjunction (i.e., there is a property *H* whose real definition says that something has *H* iff it has *F* and it has *G*).¹⁸

Like essential truths, ontological laws are instantiated in certain cases of grounding. For example, the fact that (i) there is an object composed of *A* and *B* might be grounded by the fact that (ii) *A* and *B* exist and meet condition *C*. The law of mereological composition is the covering law for this instance of grounding, and the fact that it is a law explains the fact that (i) grounds (ii).

Grounding and causation are closely intertwined.¹⁹ In many cases, *X* causes *Z* by causing some other fact *Y* that in turn grounds *Z*. Let me run through a couple of examples. (a) Rubbing your hands together causes them to be hotter than they were previously. It does so by causing an increase in the kinetic energy of your hands’ surface molecules, which in turn grounds the fact that your hands are hotter than they were before. The laws that connect the rubbing to the increase in temperature include various natural laws that are instantiated in the process by which the rubbing

¹⁷ A real definition of an individual is a singular proposition about that individual, wherefore stating such a real definition requires a directly referential name. The most common expressions for {2}, such as “the singleton of two” and “{2},” are not obviously directly referential, which is why I needed to introduce the term “*N*”.

¹⁸ (4) may not itself be a metaphysical law but may instead be a corollary of a more general principle of plenitude for properties that is a metaphysical law (in which case it is the more general principle rather than (4) that covers the relevant instances of grounding).

¹⁹ Kment 2014: sct. 1.2.1, 2015: sct. 1.1. For a similar view, see Schaffer 2016.

raises the kinetic energy. But they also include the real definition of being-hotter-than: x is hotter at t than y is at t^* iff the mean kinetic energy of x 's molecules at t is higher than that of y 's molecules at t^* . (b) By mixing certain ingredients in the right proportions and baking them at a specific temperature for a suitable amount of time, you can cause there to be a Bundt cake. Your actions are connected to the later existence of a Bundt cake by certain laws of nature (for example those instantiated in the various processes that happen during the baking of the cake) together with a metaphysical law, namely the real definition of the property of being a Bundt cake: something is a Bundt cake iff it is made by such-and-such a process from such-and-such ingredients, combined in such-and-such proportions. (c) Suppose, for the sake of illustration, 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 about a certain brain state, which (possibly in combination with certain background facts) grounds a 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 (and the relevant background facts) to the sensation.

These examples illustrate how both natural and metaphysical laws can be instantiated in the chain of explanatory relationships that connect a cause to its effect. I argue in Kment 2014: scts. 1.2.1, 6.4, 2015: sct. 1.1 that that is a pervasive phenomenon. Only a small set of properties and relations—the “physically fundamental ones”—are mentioned in the (fundamental) natural laws. If a fact f involves physically non-fundamental properties or relations and f is caused, then both natural and metaphysical laws must figure as covering laws in the chain of explanatory connections that lead from f 's causes to f . The natural laws alone do not suffice to forge the required connection between f and its causes.

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.

Firstly, they provide information about why certain facts hold. If you know that 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.

Secondly, knowledge of grounding relationships and of the underlying metaphysical laws often enables us to make predictions. Suppose you know that a certain chemical reaction will produce molecules with the chemical structure C_3H_8 . If you also 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.

Thirdly, knowledge of X 's essence and grounds, like knowledge of X 's causes, often gives us a way of controlling whether X is present: we can generate X by bringing about a possible ground of X and prevent X by keeping any possible ground of X from obtaining. If you know that your friend likes Bundt cake and you want to make one for his birthday, it will help you to know what it is to be a Bundt cake, and thus what grounds the fact that a given object is a Bundt cake. For, if you

know that to be a Bundt cake is to be made in such-and-such a way from such-and-such ingredients (and hence that something's being a Bundt cake is grounded in its being so made), then you know how to go about making such a cake. Similarly, if we determine that to be an insulin molecule is to be 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. And if we find out (perhaps by doing philosophy) what it is for an economic system to be just, then that may help us to bring about economic justice by creating an economic order with the relevant features. In this way, real analyses can be of as much immediate and concrete practical interest and importance as investigations into causal connections and the laws of nature.

In fact, acquiring information about the essence of X is often a crucial and necessary step in finding a way to produce X . To acquire the ability to make silk (an imported luxury good with which they had long been familiar), Europeans first needed to learn what it is to be silk: it is to be a fabric woven from fibers produced by the larvae of the silk beetle. Given that knowledge, it was clear, at least in outline, how they needed to proceed: they had to get their hands on some silk-beetle eggs, find out how to breed these insects successfully, and so forth. It would have been hard to create a silk industry without some basic knowledge of what it is to be silk.

2. Metaphysical laws and the grounds of modal facts

On the account of section 1, many but not all modal facts are partly grounded in facts about the metaphysical laws. Suppose that sentence P expresses a Russellian proposition that is metaphysically necessary.²⁰ Then the proposition expressed by P holds at all worlds in the sphere specified in (2). That might be either because

- (i) the proposition expressed by P is a logical truth and therefore holds at all worlds whatsoever, or because
- (ii) the proposition expressed by P is logically entailed by the metaphysical laws and the truths about the metaphysical laws, and therefore holds at all worlds that match actuality with respect to the metaphysical laws.²¹

In case (ii) but not in case (i), the fact that the proposition expressed by P is metaphysically necessary is partly grounded in facts about the metaphysical laws.

²⁰ I am assuming that there is a sense in which a sentence can be said to express a Russellian proposition. To be more precise, I believe that on *one* possible way of individuating the truth-conditions of sentences, the truth-condition of any (truth-apt) sentence is the same as that of some Russellian proposition. That does not imply that the Russellian proposition can serve as the semantic content of the sentence for all purposes.

²¹ By a "truth about the metaphysical laws," I mean a proposition that is either of the form *It is a metaphysical law that P* or of the form *It is not a metaphysical law that P* . (2) entails that a proposition is metaphysically necessary iff it holds at all worlds that have the same metaphysical laws as actuality and that perfectly conform to these laws, i.e. at all worlds where the actual metaphysical laws and the actual truths about the metaphysical laws hold. That entails that a proposition is metaphysically necessary iff it is logically entailed by the metaphysical laws and the truths about the metaphysical laws.

The proposition expressed by P might be a logical truth (true in virtue of its logical structure) even when P is not. For example, on the assumption that “Hesperus” and “Phosphorus” are directly referential, we can take the sentence “If Hesperus exists, then Hesperus is Phosphorus” to express the Russellian singular proposition *If Venus exists, then Venus is Venus*, which contains Venus as a constituent three times over. This proposition, being of the form *If a exists, then a is a* , is a logical truth, while the sentence, being of the form *If a exists, then a is b* , is not. Similarly, “Mars is not Venus” expresses the Russellian singular proposition *Mars is not Venus*, which contains both Mars and Venus as constituents. One could regard this proposition as a logical truth as well, as it may be said in some sense to be true in virtue of two facts about its logical form: the fact that it is of the form *a is not b* and the fact that it is *not* of the form *a is not a* . (Note that all Russellian propositions that have these two formal features are true; see Kment 2014: 78.²²) By contrast, the English sentence “Mars is not Venus” is not a logical truth.²³ Similarly, on the assumption that “is an ophthalmologist” and “is an oculist” express the same property, “All ophthalmologists are oculists” expresses a Russellian proposition that contains the same property twice over and is therefore of the form *All F s are F s*. The proposition is a logical truth even though the sentence is not.

Whether we should take a given sentence to express a logically true proposition often depends on how we answer potentially contentious questions about the contents of the sentence’s constituents. Consider:

(5) Every vixen is female and is a fox.

For the purposes of illustration, consider two very simple toy accounts of the content of “is a vixen.” On the first toy account, “is a vixen” expresses the same as “is female and is a fox” (perhaps we can think of the first phrase as an abbreviation of the second). On this view, “Alice is a vixen” expresses the conjunctive proposition that Alice is female and Alice is a fox. Moreover, (5) expresses the proposition that everything that is female and a fox is female and a fox. This proposition, which contains each of femaleness and foxhood twice over, is a logical truth. On the second toy account, “is a vixen” expresses the property of vixenhood. Thus, “Alice is a vixen” expresses the proposition that Alice is a vixen. (This is not the same proposition as the proposition that Alice is female and Alice is a fox, for the same reason that the proposition that Hydra is a hydrogen atom is not identical with the proposition that Hydra is composed of one proton and one

²² All Russellian singular propositions that make simple non-identity claims are of the form *a is not b* . Moreover, all *false* propositions of this form, i.e. all those that deny that a certain thing a is identical with a , contain the object a as a constituent twice over and are therefore of the form *a is not a* . All Russellian propositions that are of the first but not of the second form are true.

²³ The English sentence “Mars is not Venus” also has the two formal features I described—it is of the form *a is not b* but not of the form *a is not a* —but it is *not* true in virtue of having these two features. (After all, there are many false English sentences that have the same two features, such as “Hesperus is not Phosphorus.”) When an English sentence is about the same entity twice over, this need not be reflected in its logical form in the way it always is in the case of Russellian propositions. The fact that two different names occur in “Hesperus is not Phosphorus” therefore does not guarantee that the sentence is about two different individuals, and therefore does not guarantee the sentence’s truth.

electron that stand in the H configuration. The two propositions do not state the same fact even if they are true. Rather, if they are true, then the one proposition states a fact that grounds the fact stated by the other. Thus, “Alice is a vixen” expresses different propositions on the two toy accounts.) On the second toy account, (5) expresses the proposition that everything that is a vixen (everything that instantiates vixenhood) is female and is a fox. This Russellian proposition contains three properties as constituents—vixenhood, femaleness, and fookhood—and it does not contain any of them more than once. It is not a logical truth. The fact that it holds at all worlds in the sphere specified in (2) is due to the fact that it is logically entailed by an essential truth about vixenhood, namely the proposition that something is a vixen iff it is female and it is a fox. While on the first toy account, (5) is necessary for reason (i), on the second toy account, (5) is necessary for reason (ii).²⁴

There are also many cases where the only credible explanation of the necessity of a sentence is of type (ii). For example, “If water exists, then water has molecular structure H₂O” is necessary because it expresses a proposition that is logically entailed by an essential truth about water. (There is no viable semantic account of “water” on which the sentence expresses a logically true Russellian proposition.) Similarly, the sentence “If Fred exists, then Fred originated from sperm *S* and egg *E*” is necessary because it is logically entailed by an essential truth about Fred.

When the truth of a modal claim is partly grounded in facts about the metaphysical laws, information about these laws is typically required to know that the claim is true. An account of how we can know that such a modal claim is true needs to explain how we are able to know the underlying facts about the metaphysical laws and how this knowledge can be used to establish the truth of the modal claim. I will turn to the first task in section 3 and to the second in section 4.

3. Knowledge of the metaphysical laws

I will discuss two ways in which we may be able to gain knowledge about the metaphysical laws. (I do not claim that they are the only ones.)

The *first* way of acquiring information about the metaphysical laws is by inference to the best explanation (IBE). As discussed in section 1.2, metaphysical laws figure as covering laws in the grounding and causal explanations of non-fundamental facts. We can apply our standards of theory evaluation to find the best account of what causes various non-fundamental facts and how they are grounded in more fundamental facts. (An account of their grounds will be part of a complete account of their causes, as discussed in section 1.2.) A complete such account will involve certain assumptions about the metaphysical laws that cover the grounding relationships involved, and an abductive inference that establishes the account will support these assumptions about the metaphysical laws as well. For example, according to the best account of what grounds facts about

²⁴ It does not matter whether the two toy accounts can be taken seriously as theories about what is expressed by (5). I introduced them merely to illustrate the fact that we cannot in general explain why a given sentence is necessary without making controversial assumptions about the contents of its constituent expressions.

temperature, these facts are grounded in facts about molecular kinetic energy. What makes it so that the sun is hotter than the earth, for instance, is that the sun's mean molecular kinetic energy is higher than the earth's. When made fully explicit, this account requires the assumption that there is a certain metaphysical covering law that is instantiated in the instance of grounding described. The relevant law is the real definition of being-hotter-than: one object is hotter than another iff the mean molecular kinetic energy of the former exceeds that of the latter. When we support our theory of what grounds facts about temperature by an inference to the best explanation, we support the hypothesis about the real definition of being-hotter-than at the same time.

The theory of what grounds facts about temperature is also part of the best account of how facts about temperature are *caused*. Suppose that you have just rubbed your hands and that they are now hotter than they were before. According to the best account of what caused your hands to heat up, the rubbing increased the mean kinetic energy of the molecules on the surface of your hands, and the fact that their kinetic energy is now higher than before grounds the fact that your hands are now hotter. This account requires the aforementioned hypothesis about the real definition of being-hotter-than, and the abductive inference that establishes the account also confirms the hypothesis.

In the examples just considered, the grounding relationships require an essential truth as a covering law. In other cases, an ontological law plays this role. For example, on the best account of facts about macroscopic objects, they are grounded by facts about the arrangement of particles. The metaphysical laws covering these instances of grounding include certain laws of composition.

In some cases, the inference to the best explanation may start from truths that are known a priori and may not require recourse to sense experience. For example, mathematicians had a good grasp of the notion of the limit value of a function long before they knew a precise definition. Eventually, the Bolzano-Weierstrass definition gained widespread acceptance. Perhaps one way to rationalize that acceptance is to regard it as the result of an abductive inference. Mathematicians knew many facts of the form *The limit of $f(x)$, as x approaches a , is y* . According to the best account of what grounds these facts, the fact that $\lim_{x \rightarrow a} f(x) = y$ is grounded by the fact that, for every real number $\varepsilon > 0$, there is a real number δ such that, for all $x \in (a - \delta, a + \delta)$, $|f(x) - y| < \varepsilon$. This account requires the assumption that the Bolzano-Weierstrass definition specifies the real definition of limit.

The conclusion of an abductive inference will often give us no more than a *partial* account of what explains the explanandum. It might be that all it tells us is that the factors that explain the explanandum are of such-and-such general kind. Picking a fruit from the apple tree in your garden, I notice that it is covered with ugly splotches and smells bad. I look at apples from other, nearby trees and the same is true of them. Given this and similar evidence (and a modest amount of background knowledge), I can conclude that the trees in your garden suffer from some disease. This is an inference to the best explanation—I conclude that the best account of what is responsible for the appearance of your apples involves the assumption that your trees are afflicted by disease. This conclusion falls far short of a complete account of what explains my data—I do not know *what* disease your trees have, or why that disease causes the symptoms I have observed. Similarly,

an inference to the best explanation may establish some truths about the essence of *X* without giving us a complete account of its essence (i.e., without giving us a real definition). Suppose that I am able to recognize a Bundt cake by its look, taste, and smell, but I do not know what it *is* to be a Bundt cake. One day, I watch you make a dish that I recognize to be a Bundt cake. I know that the best account of what caused there to be a Bundt cake in the kitchen at the end of the process appeals to specific assumptions about what it is to be a Bundt cake, and I can consequently support certain assumptions about the essence of Bundt-cake-hood abductively. But my evidence may not be sufficient to arrive at a complete account of what it is to be a Bundt cake. Perhaps I have watched you from a distance and noticed that you mixed flour, milk, and eggs, and then added some other ingredients. But I couldn't quite tell what those additional ingredients were, nor do I know precisely in what proportions the ingredients were added to the batter or how a cake was made from the batter. In that case, all that I can conclude from my observations is that being a Bundt cake involves being made from ingredients that include flour, milk, and eggs. But that falls short of complete knowledge of the essence of Bundt-cake-hood.

A *second* way in which it might be possible to acquire information about the metaphysical laws relies not on IBE, but on knowledge that is partly constitutive of competence with the expressions or concepts required to state the information acquired.²⁵ On some views about meaning, it is true of at least some expressions that (a) they express or pick out certain entities (properties, relations, individuals, etc.), and (b) every competent speaker knows, at least implicitly, certain conditions that single out the entity that is picked out or expressed. (Knowledge of these conditions is partly constitutive of knowing the meanings of the relevant expressions, perhaps because it is partly constitutive of mastery of the concepts they express.) Those who believe in metaphysical laws could adopt this view, and they could say that sometimes the condition that singles out the entity that is picked out or expressed by the term is the condition of having a certain real definition. For example, they could hold that "is a vixen" expresses a property,²⁶ and that competence with this predicate requires knowing that a property *P* is the property expressed by the predicate iff *P* meets the following condition: *P* is the property of being female and a fox, i.e. the real definition of *P* lays down that *P* is instantiated by all and only the female foxes. On this view, a competent speaker is in a position to know that the following claims are true:

- (i) If vixenhood exists, then vixenhood is the property of being both female and a fox.
- (ii) If the property of being both female and a fox exists, then it is vixenhood.

²⁵ See Peacocke 1999 (in particular pp. 1–4, 119–75) for an extended discussion of how knowledge that is partly constitutive of concept possession can be used to acquire modal knowledge. His views differ from mine.

²⁶ ... rather than expressing the conjunctive condition of being female and being a fox, as on the first of the two toy accounts considered in the previous section

If the speaker also knows that the property of being both female and a fox exists (perhaps because she knows that femaleness and foxhood exist and that (4) is true), then she is in a position to know that vixenhood is the property of being both female and a fox.

It might be true of “is a vixen” that competent users must know that a property needs to have a certain real definition to be expressed by the term. But the same claim might very well be false for most other predicates.²⁷ However, even when competence with a predicate does not require complete knowledge of a real definition of the property expressed, it might still require knowing that the property expressed has a real definition that meets certain conditions. For example, it might require knowing that the predicate expresses a property P whose real definition lays down that C is a necessary condition for having P (where C is *not* also a sufficient condition for having P). To take a concrete example, competence with “know” might require knowing (at least implicitly) that this predicate expresses a relation R whose real definition logically entails the following: a thinker stands in relation R to a proposition only if the proposition is true, the thinker believes the proposition, and it is not sheer luck that the belief is true. (Which relation is expressed by “know” is partly but not completely determined by the condition that it must be a relation whose real definition entails these principles.) A competent speaker might then be in a position to know that if the relation of knowledge exists, then it is essential to knowledge that it relates a thinker to a proposition only when the aforementioned three conditions are satisfied. (Note that, although these conditions might be necessary conditions for knowledge, but they may not be jointly sufficient.)

A similar account may be true for modal terms like “necessary” and “possible.” For example, competence with these terms (when they express metaphysical modalities) might require knowing, at least implicitly, that they express properties whose real definitions entail the validity of the following schemata. (\diamond_M , \Box_M , and $\Box \rightarrow$ expresses metaphysical possibility, metaphysical necessity, and the counterfactual conditional, respectively.)

(6) P is necessary (possible) iff P is logically entailed by (consistent with) the metaphysical laws and the truths about the metaphysical laws.

(7) $\diamond_M Q, \Box_M (Q \supset P) \vdash \diamond_M P$

(8) $\diamond_M Q, Q \Box \rightarrow P \vdash \diamond_M P$

(These three principles and their uses in establishing modal claims will be discussed in more detail in section 4.) Competent speakers might therefore be in a position to know that if necessity and possibility exist, then (6)–(8) are valid.

One can perhaps give a similar explanation of our knowledge about the essences of material individuals, provided one is willing to endorse what I call “maximal multi-thingism.”²⁸ On this

²⁷ See Putnam 1975 and Johnston & Leslie 2012 for arguments for the claim that competence with most expressions does not require knowledge of necessary and sufficient application conditions of the right kind.

²⁸ Leslie 2011, Kment 2014: 7.1, 2018: sct. 5. The term “multi-thinger” is borrowed from Karen Bennett 2004, who says that she picked it up from Stephen Yablo. I do not know who initially introduced it into the philosophical vocabulary.

view, every material object m is co-located with countless others that differ from m in what is essential to them but are otherwise indistinguishable from m . More specifically, for any set of truths about m that meets certain minimal conditions, there is an object to which just these truths are essential and which is indistinguishable from m in all respects that do not pertain to its essence. For example, the table in my office, T , was made from matter M . It seems plausible that T is essentially made from more than 50% of M , in the sense that being made from more than 50% of M is part of the necessary and sufficient condition for being T that is laid down by T 's real definition. Moreover, suppose that there is no p larger than 50% such that T is essentially made from more than p of M . Maximal multi-thingists hold that T is co-located with another table (or table-like object) T' that is essentially made from 100% of M , and with another such object T'' that is essentially made from more than 75% of M , as well as with infinitely many further objects that differ from T only in what is essential to them. Now suppose that "Woody" is our name for T . The maximal multi-thingist might say that the referent of this name is determined in part by the condition that it is an object that

- (a) is essentially made from more than 50% of whichever matter it was in fact made from, but
- (b) is not essentially made from more than p of this matter, for any $p > 50\%$.

(It is partly because T meets conditions (a) and (b) while T' and T'' do not that "Woody" refers to T and not to T' or T'' .) Maximal multi-thingists could go on to say that being a competent user of "Woody" requires knowing (at least implicitly) that an object needs to meet conditions (a) and (b) to be the referent of "Woody." Competent users are therefore able to know that, if Woody exists, then Woody meets conditions (a) and (b).

4. Modal Knowledge

Knowledge of (6)–(8) and knowledge about the metaphysical laws puts us in a position to acquire modal knowledge in a variety of different ways. I will consider a few examples, starting with the much-discussed method of establishing that it is possible that P is true by conceiving of a scenario in which P is true. To be more precise, there is not really a unique such method, for there are different processes that could be called "conceiving" and that can play an important role in establishing modal claims. I will discuss two of these processes.²⁹

On one way of thinking about the activity of conceiving of a situation where P is true, we can describe the process as involving two steps:

- (i) we form a conception of a certain scenario s that we recognize as possible;
- (ii) we show that s makes P true.

²⁹ For important distinctions between different forms of conceiving, see Yablo 1993, Chalmers 2002, and the other papers in Gendler & Hawthorne 2002.

As a result of this process, we conclude that P is possible. A procedure of this form is very commonly employed in philosophy to demonstrate the possibility of a claim. In particular, it is often used to argue against philosophical analyses that purport to state a necessary and sufficient condition C for the instantiation of a given property (or the applicability of a certain concept) X . For, such arguments typically purport to specify a counterexample to the analysis, i.e. a possible scenario that either makes it true that a certain entity x satisfies C but fails to instantiate X or that makes it true that a certain entity x instantiates X but fails to satisfy C . We are meant to conclude (in the first case) that it is possible for x to satisfy C but not instantiate X , or (in the second case) that it is possible for x to instantiate X without satisfying C . Gettier's refutation of the analysis of knowledge as justified true belief is a classic example. He specified a scenario that we recognize as possible and that makes it true that its main character has a justified true belief in the truth of a certain proposition but does not know that the proposition is true. Having considered the example, we can conclude that it is possible to have a justified true belief that does not amount to knowledge.

So far, my description of the activity of conceiving of a scenario where P is true is very schematic. To flesh in the schema, more needs to be said about what it takes for s to count as making P true. There are different possible answers to this question that yield viable methods of establishing the possibility of a claim. One option is to say that s makes P true just in case s metaphysically necessitates P . Another, somewhat more interesting option is to say that s makes P true just in case s counterfactually implies P : if s had obtained, then P would have been true. On these ways of filling in the schematic description above, establishing that P is possible by conceiving of a scenario where P holds amounts to applying inference rules (7) and (8), respectively (' \diamond_M ' and ' \Box_M ' again express metaphysical possibility and necessity, respectively):

$$(7) \quad \diamond_M Q, \Box_M (Q \supset P) \vdash \diamond_M P$$

$$(8) \quad \diamond_M Q, Q \Box \rightarrow P \vdash \diamond_M P$$

There is no need to say much about (7), which clearly describes a way of establishing the conclusion that it is possible that P . However, a brief note is in order about (8). I think that (8) is a good representation of one common way of establishing modal claims. For example, many of the arguments that Kripke gives in *Naming and Necessity* for his theses about the modal profiles of individuals, natural kinds, and so forth, can naturally be formulated as applications of (8). Suppose, for example, that we want to show that it is merely a contingent feature of water that it plays the water role (i.e., that it has the perceptible features and functions in our lives that we commonly associate with water). We describe a situation that is recognizably possible and where a substance with the same microstructure as water in the actual world fails to play the water role. We ask: if this situation had obtained, would the stuff have been water? The answer, which is partly based on our empirical knowledge of the actual microstructure of water, is "Yes". Hence, if the situation had obtained, then water would have failed to play the water role. That shows that it is possible for water not to play that role. (By contrast, we cannot in the same way show that it is possible for water to have a different microstructure. When we consider any possible situation s

containing a certain substance with a different microstructure, we find it compelling to say that that substance would not have been water if *s* had obtained. It does not matter how similar the substance's other features are to the actual characteristics of water.³⁰)

It is worth mentioning that (8) remains valid if we replace ' \diamond_M ' with any other possibility operator that expresses a grade of ontic possibility. In other words, (8) is a special case of the inference rule expressed by the following schema (where ' \diamond ' is a placeholder for a possibility operator expressing some grade of ontic possibility):

$$(9) \quad \diamond Q, Q \square \rightarrow P \vdash \diamond P$$

(9) is often employed outside of philosophy to establish conclusions about grades of ontic possibility stronger than metaphysical possibility. For example, in a context where "could" expresses such a stronger grade, someone could argue as follows: "Team A could have won. For, they could have replaced their goalkeeper after he was injured, and if they had done that, they would have won." Similarly, upon seeing that a falling brick narrowly misses Fred's head, one might reason thus: "The brick nearly hit Fred's head, and if it had hit his head, Fred would have been killed. Therefore, Fred was nearly killed." On the assumption that "nearly" expresses a high grade of ontic possibility in cases like this (as I suggested above), both utterances are instances of inference rule (9).

(9), and therefore (8), is clearly validated by the account of modality sketched in section 1. A proposition's degree of possibility is measured by the degree of closeness to actuality of the closest worlds where the proposition is true. Now, if ' $\lceil Q \square \rightarrow P \rceil$ ' holds, then the closest *Q*-worlds are *P*-worlds, which entails that the closest *P*-worlds are at least as close as the closest *Q*-worlds. That means that counterfactual implication preserves degree of possibility: if *Q* counterfactually implies *P* (i.e., if ' $\lceil Q \square \rightarrow P \rceil$ ' is true), then *P*'s degree of possibility is at least as high as *Q*'s. Therefore, if a situation has a given grade of ontic possibility and it counterfactually implies a certain claim, then that claim must also have that grade of ontic possibility.

Before we can apply (7) or (8) to show that *P* is metaphysically possible, we need to know that *Q* is metaphysically possible. That is to say, (7) and (8) can be used to show that a given proposition is possible only if we already know that some other proposition is possible. Hence, on pain of infinite regress, some of our beliefs in the possibility of propositions must be acquired by methods other than applications of (7) and (8). And that seems independently plausible. Sometimes it simply strikes us as possible that *Q* is true, where that does not seem to be the result of an inference of the forms (7) or (8). For example, to many readers of Gettier's paper, it simply seems that the scenario he has described is possible. (In many applications of (7) and (8), the acceptance of the first premise is the result of such modal seemings.³¹)

³⁰ For other accounts that place emphasis on counterfactuals in thought experiments intended to establish modal conclusions, see Jackson 1998, 2010; Chalmers 2002; Williamson 2008. Also see Lange 2009.

³¹ Representing a scenario to oneself that strikes one as possible is another process that might be called "conceiving (of the scenario)."

When it strikes an agent as possible that Q is true, this appearance might be based on knowledge of (6) and on the judgment that Q is consistent with the metaphysical laws and the truths about the metaphysical laws. This judgment, in turn, might be based on the agent's (implicit or explicit) knowledge about what the metaphysical laws are. It seems plausible that in such cases, accepting that Q is possible on the basis of the appearances can yield modal knowledge. The knowledge about the metaphysical laws that is involved in generating the judgment that Q is consistent with the metaphysical laws and the truths about the metaphysical laws is of a negative kind: it amounts to the knowledge that there are no metaphysical laws or truths about the metaphysical laws that are inconsistent with Q . Consider a very simply example: the proposition that someone makes a Bundt cake while it is raining strikes me as possible. I accept this impression as veridical and consequently believe that it is possible to make a Bundt cake while it is raining. In order for this belief to be knowledge, my impression that the proposition is possible needs to rest on specific knowledge about the metaphysical laws. The knowledge that is required is of a negative kind and very minimal. I have only the roughest idea of what it is to be a Bundt cake (I had to look up "Bundt cake" when I was writing this paper to find out what it looks like and what the ingredients are). But one thing I have always known is that what makes an object a Bundt cake has nothing to do with the weather conditions at the time when the object came into existence. That much is near-universal knowledge. Similarly, I have very incomplete knowledge of what it is for it to be raining at a given moment, but I know that it has nothing to do with the question of what baked goods are being produced at that moment. I know that there is nothing in the essences of rain and Bundt-cake-hood that precludes the scenario of a Bundt cake's being made while it is raining. I also know that this scenario is not ruled out by the essences of other entities or by (truths about) those metaphysical laws that are not essential truths. If my impression that the scenario is possible is based in the right way on my knowledge of these simple facts, then my resulting modal belief might amount to knowledge.

Our knowledge that the scenario described by Gettier is possible can be given a similar explanation. I may have only a rough idea of the constraints that the essences of belief and reasoning, and all the other (truths about) metaphysical laws, impose on the epistemic positions and cognitive processes of agents, but I know that these constraints do not rule out the situation described by Gettier. This scenario therefore strikes me as possible: I know that an agent could indeed have arrived at the belief that Jones owns a Ford or Smith is in Barcelona in the way described by Gettier.

Just as our acceptance of the first premise of an instance of (7) or (8) typically rests on beliefs about the metaphysical laws, so does our acceptance of the second premise. Consider (7) first. $\Box_M(Q \supset P)$ is true just in case P follows logically from Q , the metaphysical laws, and the truths about the metaphysical laws. We can come to know that $\Box_M(Q \supset P)$ is true by establishing that this condition is satisfied, relying on our knowledge of the metaphysical laws in the process. Consider (8) next. Counterfactual reasoning typically relies on assumptions about which actually

true propositions also hold at the closest antecedent-worlds and can therefore be held fixed. Any claim that follows from the antecedent and the claims that can be held fixed must be true at the closest antecedent-worlds (Kment 2014: section 11.5). Given (1) and the assumption that all worlds are (logically) consistent, if the antecedent is consistent with the metaphysical laws and the truths about the metaphysical laws, then these propositions hold at the closest antecedent-worlds and can therefore be held fixed. If we can infer the consequent from some of these truths and the antecedent, then we can conclude that the counterfactual is true. That might be a very common way of establishing the counterfactual premise in an application of (8), and it requires some knowledge about the metaphysical laws.

Often the amount of knowledge that is needed is fairly modest, however. Consider Gettier's example again. To see that the description of Gettier's scenario metaphysically necessitates the claim (10) below, and to see that it counterfactually implies (10), you need some knowledge about the essence of knowledge.

(10) The agent does not know that Jones owns a Ford or Smith is in Barcelona.

Now, assuming that the knowledge relation is non-fundamental, the real definition of knowledge lays down necessary and sufficient conditions for knowledge. However, you do not need complete information about what these conditions are to recognize that they are not met in Gettier's example. It is enough to know that it is a necessary condition for something to be a case of knowledge that it not involve the kind of epistemic luck found in the example. And that, I think, is a widely known fact. (In section 3 I considered one possible explanation of how we can know this fact.)

I have discussed some of the ways in which knowledge of (6)–(9) and of the metaphysical laws can be used to establish possibility claims. It is obvious that the same knowledge can be applied to establish necessity and impossibility claims as well. For instance, if we know that (6) holds and that part of what it is to be water is to be a substance mostly composed of molecules with structure H_2O , then we are in a position to know that, necessarily, all quantities of water are composed mostly of H_2O molecules. Similarly, we are able to know that it is impossible for the glass to be filled with water without being filled with a substance mostly composed of H_2O molecules.³²

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³² For comments and suggestions, I am indebted to Mark Johnston, Antonella Mallozzi, Daniel Nolan, Gideon Rosen, Jonathan Schaffer, Anand Vaidya, the audience of a talk I gave at the Conceivability and Modality conference at Sapienza University in Rome in June 2017 and to two referees for *Synthese*.

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