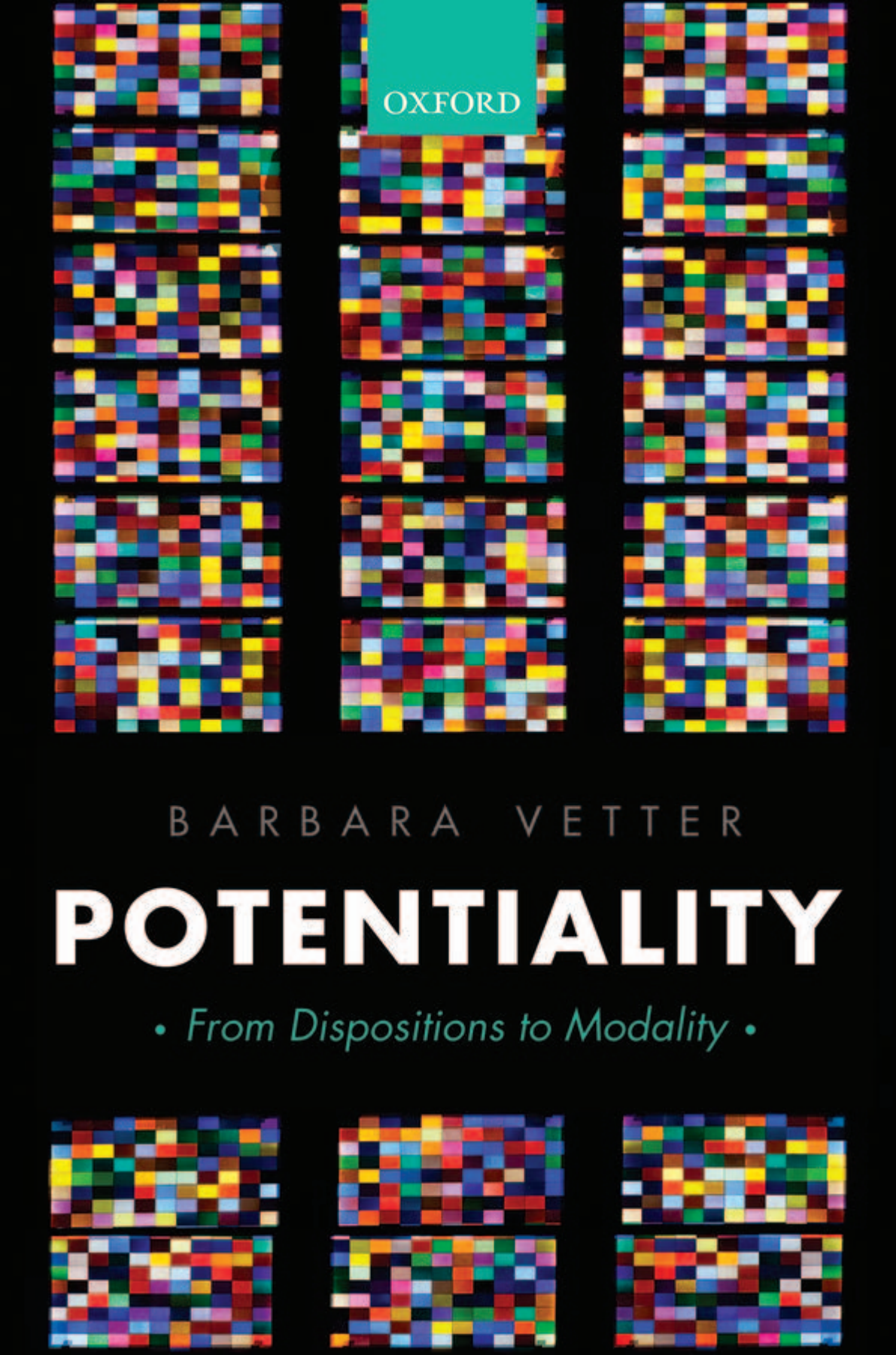
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• From Dispositions to Modality •

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From Dispositions to Modality

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For Benjamin

Acknowledgements

What does it take for something to be metaphysically possible? This book argues that it takes no more and no less than the possession of certain properties, to wit: potentials, by individual objects. It is metaphysically possible that I finish this book because I have the potential to do so; it is metaphysically possible that this book is read because someone or other has a potential to read it. This way of thinking about modality is not only, I take it, very natural; it may well have been the consensus in the history of metaphysics from Aristotle up until the second half of the twentieth century. It has been eclipsed, however, by the spectacular success, in logic and linguistics, of possible-worlds-based accounts. My aim in this book is to rehabilitate the natural and, perhaps, traditional view by the standards of contemporary metaphysics. In so doing, I do not start from nothing. Recent metaphysics has become more hospitable to views of modality that are not based on possible worlds, and to potentials (or powers, or dispositions) in general. What is needed is a detailed statement of the view that shows how it deals with a number of examples, but also how it is set to work in the realms of logic and linguistics. This is what I aim to provide, or rather to begin to provide. The book is meant to be the beginning of a discussion, not its end.

This book has been the work of nearly seven years. It started out as my DPhil thesis at Oxford, supervised by Timothy Williamson and Antony Eagle. Both contributed more than I can acknowledge here in terms of arguments and criticism, but also in terms of motivation and encouragement. Tim was my supervisor for most of my time as a graduate student, and I have learned more about philosophy and how to do it from him than from anyone else. His influence is obvious to me on almost every page of this book. Antony not only supervised my thesis, but also provided extremely helpful, in-depth comments on the penultimate version of the book. I am deeply indebted to both of them. A third substantial intellectual and personal debt I owe to my undergraduate teacher of metaphysics at the University of Erlangen, Friedemann Buddensiek. He set me on my intellectual path twice over, by introducing me to metaphysics and encouraging me to apply to Oxford; my intellectual life would have gone very differently had it not been for his intervention.

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Above all, I thank my family: my parents, my son, and my husband and partner of many years, Benjamin. Without his love, support, and sense of humour, my life in the past years (and in all likelihood this book) would have been very different, and not nearly as good. This book is dedicated to him.

Contents

1

The Project

1.1 Introduction

Individual objects have potentials: paper has the potential to burn, an acorn has the potential to turn into a tree, some people have the potential to run a mile in less than four minutes. Some potentials have names: a vase's fragility is a potential to break or to be broken, a person's irascibility is her potential to get angry. Some potentials are classified as abilities, such as your potential to read English; others are not, such as the paper's potential to burn. Some potentials are classified, by philosophers, as 'dispositions'; these include the vase's fragility, a person's irascibility, and an atom's disposition to decay. Potentials are often ascribed simply with the auxiliary 'can': paper can burn, the acorn can become a tree, some people can run a mile in less than four minutes. This, in fact, is one simple way of stating what all the properties I have so far mentioned have in common: they concern what a given individual *can* do. I call any such property a potentiality.

It goes without saying that the notion of potentiality is of Aristotelian pedigree, and I believe Aristotle's *Metaphysics*, book Θ, to be one of the most illuminating treatments of it. Starting with early modern philosophers such as Descartes, talk of potentiality was long regarded as suspect. In those strands of philosophy that led to contemporary analytic philosophy, David Hume's empiricist criticism of 'necessary connections' has been particularly influential, and the notion of potentiality has been very much out of favour, a fate it shared with many other modal notions, such as essence and a metaphysically substantial notion of necessity and possibility.[1] The latter pair had a revival in analytic philosophy with the development of modal logic and the discovery that a semantics of 'possibly' and 'necessarily' can be treated as a special case of the logic of the existential and

[1] I use the term 'modal' in the wide sense that includes not just metaphysical possibility and necessity, but also essence, dispositions, and laws of nature. Thus Fine's (1994) 'non-modal' account of essence is, in my terms, not non-modal: it is merely an account that rejects the reduction of one modality (essence) to another (necessity). I will say more about modality in this broad sense in section 1.2.

universal quantifier, as long as we allow the quantifiers to range over an infinity of 'possible worlds'. The philosophical debate about the nature of modality has subsequently focussed largely on the nature of those 'possible worlds'. In the process, the modal notions of an object's potentiality or its essential properties have been either neglected or explained in terms of those of possibility or necessity. To many, they have remained suspect.

In recent years, the philosophical climate has changed somewhat. Kit Fine and others have provided accounts of essence as irreducible to, and in fact prior to, necessity (see Fine 1994, Lowe 2008, Oderberg 2007). Anti-Humean accounts of the laws of nature, admitting 'necessary connections' in nature, and some even locating these connections in dispositional properties of fundamental entities, are thriving (see, e.g., Ellis 2001, Bird 2007; David Armstrong, though not an anti-Humean himself, has been instrumental in the rise of anti-Humeanism). Dispositions in general have received a fair amount of attention in the recent metaphysical debate, though they tend to be treated in isolation from other kinds of potentiality, such as abilities. The ideas put forward in the pages to follow are part of that changed climate.

This book is a plea for potentiality. It is a plea for recognizing a unified notion of potentiality instead of selectively focussing attention on only some kinds of potentiality; and most importantly, it is a plea for recognizing potentiality as an *explanans* in the metaphysics of modality, rather than as something in need of explanation and reduction.

Potentiality, as I understand it, is closely related to possibility in ways to be explained in this book. To get a first grasp on the relation between them, we may somewhat metaphorically call it a relation between *localized* and *non-localized* modality.[2] A potentiality is localized in the sense that it is a property of a particular object. That I have the potential to write this book is first and foremost a fact about me; it is a property that I possess. Possibility, on the contrary, is not localized in this way. Its being possible that such-and-such is not primarily a fact about any one particular object; it is a fact about how things in general could have turned out to be. Hence our intuitions about what is possible and what is not can be captured by postulating, for everything that is possible, an entire world that did turn out to be that way. The proper operator for ascribing a potentiality is thus a predicate operator: . . . has a potentiality to . . . (fill in a singular term for

[2] In Vetter (2010) and Vetter (forthcoming), I have used the labels 'local' and 'global' instead of 'localized' and 'non-localized', but I have found those labels to evoke some misleading associations: the potentialities of the world as a whole, discussed in chapters 7.3–7.4, certainly deserve the label 'global', but I emphatically do not want to simply identify possibilities with those potentialities. I hope the revised labels, while somewhat less vivid, are less prone to lead to confusion.

the first blank, and a predicate for the second). Possibility, on the other hand, is aptly expressed by a sentential operator: it is possible that . . . (fill in a sentence).

The distinction is paralleled by the relation of essence to necessity. Essence, like potentiality, is localized: a property is essential *to* a particular object. Necessity, like possibility, is not localized: its being necessary that such-and-such is not primarily a fact about one particular object, but a fact about how the world must be. The difference between essence and necessity has been pointed out and studied by Kit Fine (1994). To cite Fine's famous example, it is necessary that Socrates is a member of his singleton set; but this necessity does not have its source in Socrates himself: it is not essential *to* him.[3]

Potentialities, in short, are possibilities rooted in objects; they are like possibilities, but they are properties of individual objects. They stand to possibility as essence (on the Finean view) stands to necessity.

Explaining the notion of potentiality in this way is not meant to provide a definition or reduction, not only because it is a mere analogy, but also because potentiality, as I will understand it, is the primitive notion in terms of which possibility will be explained. The notion of potentiality itself will be introduced as a generalization of the more familiar notion of a disposition in chapter 3 (a preview of which is given in section 1.5). My plea for potentiality is to show precisely that taking potentiality as a primitive or basic notion is philosophically fruitful; that we can say a great deal about potentiality without defining or reducing it; and that we can say a great deal about other things in terms of potentiality.

In particular, we can say a great deal about possibility in terms of potentiality. This is the one main use to which I want to put the notion of potentiality: to develop an account of possibility (and, thereby, of necessity) that is based entirely on potentiality. Potentiality is, metaphorically speaking, possibility anchored in individual objects; I claim that all possibility is thus anchored in some individual object(s) or other.

My notion of potentiality differs, in ways that will become more conspicuous in chapters 3–5, from contemporary assumptions about dispositions. Nevertheless, I will argue in those chapters that potentiality as I construe it is nothing but the natural generalization of the more familiar dispositions, a generalization which is required in any case by a non-reductive metaphysics of dispositions. Thus the above characterization of the account, that all possibility is anchored in

[3] The distinction between localized and non-localized is not equivalent to the *de re*/*de dicto* distinction. The latter distinction applies primarily to sentences, while the former is straightforwardly metaphysical. Moreover, the distinctions are not co-extensional, as Fine's famous examples show. Thus it is necessary for Socrates to be a member of his singleton set (*de re* necessity), but it is not part of his essence to be a member of his singleton set.

some object(s) or other, will be given a more intuitive grounding in our understanding of dispositions, and the account can justly be called *dispositionalist*.

A dispositionalist account of metaphysical modality is clearly a desideratum in the growing anti-Humean literature.[4] My aim in this book will not be to argue for the theory or to compare it to its rivals. The idea of a dispositionalist theory, I take it, is interesting and plausible enough to deserve further scrutiny. (I will provide some motivation for such a theory in section 1.3, but I do not claim that any of the considerations adduced there force us into accepting the theory.) What is lacking, at least in the contemporary literature, are the details. Before the theory can be evaluated or compared, it needs to be spelled out. This is what I aim to do in this book. It goes without saying that I would not have bothered to spell it out if I did not believe that it was true. But the development of the view should be of interest even to readers who do not share that initial assumption.

In the remainder of this chapter, I will situate the kind of theory to be developed in the context of contemporary modal metaphysics (1.2), provide some motivation for it and outline the basic options in developing it (1.3), and then sketch how the theory will be developed throughout the book, guided by three basic constraints on any theory of modality (1.4–1.7). The aim of this chapter is to give a feeling for how things will go and why; detailed arguments will be given in the chapters that follow.

Let us begin, then, with a brief look at contemporary modal metaphysics.

1.2 Modality

Modality comes in a package. There are, of course, the two familiar modalities of necessity and possibility. There are also such modal phenomena as (if we take them seriously as phenomena; otherwise, there are such modal *notions* as those of): laws of nature, essences, the counterfactual conditional, causation, and dispositions. A reductive approach to modality will try to describe all of these phenomena in a language that is taken from outside the modal package: the language of worlds as maximal spatiotemporally connected entities, for instance. In so doing, a reductive account may nonetheless impose some hierarchy on the modal package. David Lewis, for instance, analyses laws of nature in terms of a best system for the actual world, counterfactuals in terms of possible worlds and laws of nature, causation in terms of counterfactuals, and dispositions in terms of

[4] There are, of course, historical precedents, in particular in the Aristotelian tradition: see Schmid (forthcoming) for a useful discussion of potentiality and possibility in medieval philosophy. What is needed, and what I aim to provide, is a theory that takes account of our contemporary understanding of modal metaphysics, modal logic, and modal semantics.

counterfactuals and causation. A non-reductive account of modality need not be quietist. It will not try to capture the elements of the modal package in terms of something non-modal, but it can impose a hierarchy on the package itself, understanding parts of the package in terms of other parts. Thus Williamson (2007b) suggests that we can account for (at least our knowledge of) possibility and necessity in terms of (our knowledge of) counterfactual conditionals; Lange (2009) provides an account of various forms of necessity, from logical to nomological, in terms of primitive counterfactual conditionals or 'subjunctive facts'; and Fine (1994) suggests that we understand necessity in terms of essence. A more traditional non-reductionist view (found, for instance, in Stalnaker 2003) is the idea that possibility and necessity are (metaphysical or conceptual) primitives, with the help of which we can give an account of possible worlds, and that possible worlds in turn provide, in one way or another, the truth conditions for statements about the rest of the modal package.

The modal package can be partitioned in various ways. The partition that is relevant to my purposes is one which I have introduced above as the distinction between *localized* and *non-localized* modalities. As already indicated, we can make the distinction a little more precise by looking at the canonical expressions required for either kind of modality. The operators for the non-localized modalities may be one-place operators (as in the case of possibility) or two-place operators (as with the counterfactual conditional); but their argument places must always be filled by an entire sentence. Possibilities are possibilities that . . . . The operators for localized modalities, on the other hand, must have at least one argument for the *object* (or objects) to which the modality belongs, and another argument place for that which is intuitively the content of the modality, and which is most naturally expressed by a predicate. Thus we have: . . . is essentially . . . , and . . . has a disposition to . . . the first blank, in each case, requiring a singular (or plural) term to be filled, the second a predicate.[5]

In contemporary metaphysics, the focus has been on the non-localized modalities, and it has generally been assumed that the localized ones can be defined in terms of them. The conditional analysis of dispositions and the modal account of essence[6] are symptoms of that general tendency. Non-localized modality, in turn, has been thought about in terms of possible worlds: thus what is possible

[5] The second argument place may be construed differently for some purposes: thus Kit Fine has used a sentence operator for essence, $\Box_x$, read: 'it is true in virtue of the essence of x that . . .'. Fine (1995c) provides an illuminating discussion of different constructions of the essence operator. For potentiality, the construction as a predicate operator is clearly more intuitive: an object's dispositions are dispositions *to* . . . , not dispositions *that* . . . .

[6] See Fine (1994), who rejects that account.

is simply what is true in some possible world or other. The crucial question then becomes: what are possible worlds? Are they concrete universes, spatiotemporal totalities just like ours, as David Lewis (1986a) has it? Or are they maximal (sets of) propositions (Plantinga 1974, Adams 1974), uninstantiated properties of the world (Stalnaker 1976), recombinations of actual properties (Armstrong 1989a), or mere elements of fictions (Rosen 1990)?

Why have possible worlds been so pervasive in the metaphysics of modality? The simplest and most powerful consideration in favour of possible-worlds talk is its theoretical usefulness. Possible worlds provide a powerful semantics for modal logic, reducing the operators 'possibly' and 'necessarily' to simple and well-understood existential and universal quantification. They also provide an excellent formal model for the context-sensitivity of modal expressions in natural language, by invoking mechanisms—in particular, restricted quantification—that are known to be ubiquitous in natural language already.

But to have a formal model, even a powerful one, is not necessarily to have a good metaphysics. Various philosophers have expressed doubts that possible worlds really provide an insight into the nature of metaphysical modality. Roughly, the reasoning goes as follows: if we give an account of modality in terms of possible worlds, those worlds are either concrete, Lewisian worlds or some kind of abstract entities, such as sets of propositions or uninstantiated properties. As to the former, the 'incredulous stare'[7] is a strong objection; furthermore, it is hard to see what evidence could be adduced for that initially rather implausible claim; and finally, even if it were true that there are infinitely many concrete universes, that does not seem to be a fact about possibility and necessity, but rather a curious contingent fact about the one actual world, which includes all those 'universes'. If, on the other hand, possible worlds are sets of propositions, we need some way to distinguish those sets of propositions that do from those that do not correspond to genuine possibilities; mere logical consistency is not enough. If abstract possible worlds are supposed to deliver a robust account of metaphysical modality, it is hard to see how they can avoid circularity; if not, then they are simply irrelevant to the metaphysical question of what possibility and necessity are. (See Williamson 1998 and Jubien 2007 for contemporary versions of this kind of criticism.)

These considerations, brief as they are, are certainly not decisive. They provide some reason to doubt that the formal apparatus of possible worlds can be simply implanted into a metaphysics of modality, and thereby some reason for theories of metaphysical modality that are, as Contessa (2009) has put it, 'hardcore

[7] See Lewis (1986a).

actualist': theories, that is, which do without any appeal to possible worlds, abstract or concrete.[8] (Note that none of these considerations cast any doubt on the use of possible worlds *as* a formal tool in logic and linguistics. It is only when we try to answer the metaphysical question what possibility and necessity consist in, that these objections apply at all.)

But there is a further motivation for the appeal to possible worlds in the metaphysics of modality, one which concerns our basic metaphysical commitments. It is the widespread assumption of what David Lewis has called 'Humean supervenience':

> Humean supervenience is named in honor of the greater [sic] denier of necessary connections. It is the doctrine that all there is to the world is a vast mosaic of local matters of particular fact, just one little thing and then another. (But it is not part of the thesis that these local matters are mental.) We have geometry: a system of external relations of spatiotemporal distance between points. Maybe points of spacetime itself, maybe point-sized bits of matter or aether or fields, maybe both. And at those points we have local qualities: perfectly natural intrinsic properties which need nothing bigger than a point at which to be instantiated. For short: we have an arrangement of qualities. And that is all. There is no difference without difference in the arrangement of qualities. All else supervenes on that.
>
> Lewis 1986b, ix f.

The aspect of Humean supervenience that is of interest here is its exclusion of modality—the whole modal package—from the supervenience base. The Humean world is, at root, thoroughly non-modal. If modality, in its various facets, is nonetheless to be accounted for—and it is—then we must construct it from the non-modal materials at the supervenience base, or we must find it elsewhere. Possible worlds provide a viable way for the Humean to 'outsource' modality: it is still a matter of deeply non-modal facts; we simply need enough such facts. One Humean world does not provide modality, but many of them do. Thus the metaphysics of modality, for the Humean, becomes a metaphysics of possible worlds.[9]

[8] I discuss a number of such theories under the label 'New Actualism' in Vetter (2011b).

[9] While the rejection of Humean supervenience provides a welcome background and motivation for a dispositionalist account of modality, the account that I am going to develop is not opposed to all aspects of Humean supervenience. (Thanks to Markus Schrenk for pressing me on this point.) Maudlin (2007) distinguishes three aspects in Humean supervenience. The first is *Separability*, the claim that the total physical state of the world supervenes on the local, intrinsic states of each spacetime point and the spatiotemporal relation between them; 'the world as a whole is supposed to be decomposable into small bits laid out in space and time' (Maudlin 2007, 51). The second is *Physical Statism*, the view that '[a]ll facts about a world, including modal and nomological facts, are determined by its total physical state' (Maudlin 2007, 51). The view that I am going to develop can accept both claims; in fact, the 'localizing' impetus of Separability is quite close to that of the potentiality view. What I disagree with is Lewis's view of what the 'small bits' that constitute the physical state of

Humean supervenience, however, is by no means a mandatory assumption.

As Tim Maudlin (2007) notes, it is unclear why we should believe in Humean supervenience in the first place. Lewis's own stated motivation is 'to resist philosophical arguments that there are more things in heaven and earth than physics has dreamt of' (Lewis 1994, 474). Ironically, it is precisely from the philosophy of science that Humean supervenience has recently come under considerable pressure.

Many philosophers of science now argue that the fundamental physical properties, those which make up the supervenience base, are not the Humean's 'qualities', that is, quiddistic properties with no modal profile. Science, as Simon Blackburn and others have argued, 'finds only dispositional properties, all the way down' (Blackburn 1990, 63; see also Molnar 1999, and Bird 2007). What physics tells us about a fundamental property, such as—for the sake of a, probably inaccurate, example—negative charge is how that property enables and disposes its bearers to react and interact with things that have the same or other fundamental properties. Physicists have nothing to say about any 'underlying' qualities or quiddities that are independent of such dispositional patterns, but such qualities are precisely what is required for the Humean's supervenience base.[10] In maintaining that there is more to the properties discovered by science, namely, a quiddistic nature, it is Humean supervenience that is guilty of supposing that 'there are more things in heaven and earth than physics has dreamt of'.

Apart from seeming unwarranted by the standards of physics, the supposition of quiddistic fundamental qualities leads to various problems. If Humean

the world are like—the third element that Maudlin discerns in Humean Supervenience, a condition on acceptable analyses that he labels the *Non-circularity condition*: '[t]he intrinsic physical state of the world can be specified without mentioning the laws (or chances, or possibilities) that obtain in the world' (Maudlin 2007, 51). Potentiality can, presumably, be added into the bracket with chances and possibilities; and it is here that I am anti-Humean. Note that while the view developed in this book is compatible with Separability and Physical Statism and indeed sympathetic at least to the former, it is not committed to either. In chapter 4.2, I briefly discuss the possibility of there being primitive 'joint potentialities' arising from quantum-entangled states. It is precisely such entangled states that Maudlin takes to refute Separability. The criticisms of Humean supervenience that I discuss in the main text are all directed at the combination of Physical Statism and the Non-circularity condition.

[10] In the same paper, Blackburn suggests that this finding should cause concern: 'To conceive of *all* the truths about a world as dispositional, is to suppose that a world is entirely described by what is true at *neighbouring* worlds. And since our argument was a priori, these truths in turn vanish into truths about yet other neighbouring worlds, and the result is that there is no truth anywhere' (Blackburn 1990, 64). Holton (1999) has shown that the worry is ungrounded if it is one of incoherence. The worry that remains is one of regress or circularity, if the fundamental properties are dispositions whose manifestations are in turn dispositions, whose manifestations . . . and so forth. As Holton points out, it is not entirely clear what is so bad about circularity in this case. For a more detailed argument, see chapter 6 of Bird (2007).

supervenience is true, then the fundamental properties are not the dispositions that physics prima facie takes them to be. Accordingly, the name of such a fundamental property (say, 'charge') does not refer to a dispositional property, but to the categorical property that plays the role specified in the disposition's description. (See Lewis 1970.) This, however, leads to a rather unattractive proliferation of possibilities: on the assumption that charge and mass are categorical properties that play their dispositional roles only contingently, it should be possible that they completely swap their roles. (See Black 2000, adapting an argument from Chisholm 1967 concerning haecceitism.) So there should be possible worlds just like the actual one in every detail except that mass plays the charge role and charge the mass role (and the same goes for any number of properties). Perhaps more worryingly, there is no reason why the same role should not be played by two, indeed by any number of, distinct categorical properties, in the actual world:

> Perhaps there is a possible world just like ours, not only in surface appearance, but in all that physics could ever discover, in which the dispositions have a different categorical ground, G′. Perhaps in our own world G′ supports dispositions on Mondays and Wednesdays, while G supports them on the other days.
>
> Blackburn 1990, 64

But that would make it impossible for our theoretical terms such as 'charge' to refer to anything at all: if there is no one categorical property that plays the charge role, then there is no property for 'charge' to refer to (compare the definite description 'the word on this page'), and the best science that we could possibly achieve would merely deal in empty words. (See Bird 2007, 76–79, where this argument is spelled out in much more detail.)

Again, such considerations may not refute the claim of Humean supervenience. But they cast serious doubts on the main motivation for Humean supervenience: its being, apparently, closer to science than its competitors. Without such a motivation, it is hard to see why we should accept Humean supervenience in the first place. And without Humean supervenience, a powerful motivation for a 'Humean' reductive account of modality in terms of possible worlds disappears.

A number of recent, 'anti-Humean', metaphysicians have rejected Humean supervenience for these and related reasons. The thesis of Humean supervenience had, of course, never been fully victorious; there were always different strands within metaphysics. The explicit rejection of Humean supervenience on the basis of a shared commitment to scientific realism, however, is a relatively recent phenomenon. It is championed by *dispositionalists*, such as C.B. Martin, George Molnar, Stephen Mumford, Brian Ellis, and Alexander Bird, who take very seriously the idea, expressed in the above argument against Humean

supervenience, that the world at bottom is dispositional. Dispositional essentialists, most prominently Ellis and Bird, hold that the fundamental properties in nature are (all or most of them) essentially dispositional: what these properties *are* is simply a matter of what they enable or dispose their bearers to *do*.

If the world is irreducibly dispositional, it is irreducibly modal. There is, then, no need to outsource all modality to other possible worlds, and reason to hope that no such outsourcing is needed. Possible-worlds talk has its place, of course, as a formal model in some areas, and perhaps as a descriptive and heuristic tool. But we should not make the mistake either of thinking that 'possible worlds' are genuinely worlds, or that they have any special connection with possibility. Possible worlds can be used to model a variety of phenomena, from metaphysical modality through obligation, knowledge, and belief to vagueness. For some of these phenomena, it is useful to include 'possible worlds' that are metaphysically impossible: as is well-known, the modelling of epistemic states in terms only of metaphysically possible worlds has the consequence that a subject is taken to know and believe all that is metaphysically necessary and never to believe anything that is metaphysically impossible. A more realistic model might differentiate between different instances of knowledge or belief concerning metaphysically necessary or impossible matters by including metaphysically impossible worlds. Thinking that there is a tight connection between metaphysical modality on the one hand, and possible worlds as a formal tool on the other, may prove unhelpful both in accounting for metaphysical modality and in using the tool of possible worlds in other areas.

The world as the dispositionalist envisages it, I said, is irreducibly modal. But the modality that it fundamentally contains is *localized*: it is the dispositions of objects to behave thus-and-so. It becomes natural, then, to use this local modality in accounting for other phenomena that are otherwise explained in terms of possible worlds. One suitable explanandum for dispositionalists has been the laws of nature, which are thought to be fully grounded in the dispositional essences of the properties that they concern (Ellis 2001, Bird 2007). Another is causation, for which there are currently different dispositionalist proposals on the table (Mumford and Anjum 2011, Bird 2010, Hüttemann 2013). A third obvious candidate is the focus of this book: metaphysical modality.

1.3 Dispositionalism about modality

Dispositionalism about modality is the view that metaphysical modality is, in some way or another, to be accounted for in terms of dispositional properties. By 'metaphysical modality', I mean the non-localized modalities of metaphysical

possibility and necessity. The view has been suggested in the writings of dispositionalists such as Bird (2007, 218, fn.146) and Pruss (2002). Borghini and Williams (2008) and Jacobs (2010) have begun to spell it out.

Dispositionalism about modality has a number of advantages. One is the simple fact that it is parsimonious given the dispositionalist metaphysics just outlined: if we already have dispositional properties, we do not need anything else to account for modality. Parsimony depends on background commitments: if you do not believe in irreducible dispositions, then of course a dispositionalist theory of modality is not going to be cost-efficient. There are, however, two further and less background-dependent benefits of dispositionalism about modality.

One is the naturalness of the ontological picture that comes with it. As metaphysical realists, we tend to think of the world as consisting in objects that have properties; the paradigmatic cases of real, mind-independent facts are, at bottom, facts about things having properties.[11] Metaphysical modality is puzzling because it does not fit into the schema of objects-with-properties. It seems to consist of facts that float free of any particular object: its being possible that there are talking donkeys, for instance. One of the attractions of Lewisian modal realism is that it anchors those free-floating facts in objects. One of its drawbacks is that the objects are otherworldly donkeys for or against whose existence we can in principle have no evidence. Dispositionalism promises to share the attraction without succumbing to the drawback: it, too, anchors possibilities in objects. But its objects are just the ordinary objects of this, the actual, world, with which we are in regular epistemic contact. It remains to be seen how exactly the view will account for the particularly free-floating possibilities such as that of there being talking donkeys. But if it succeeds, then it does so by anchoring possibilities in realistically respectable bits of the world, ordinary concrete objects.

The second notable benefit of dispositionalism about modality is epistemological. Dispositionalism, I said, avoids the drawback of a possible-worlds metaphysics by anchoring possibilities in the right kind of objects: actual objects, with which we have epistemic contact. By anchoring them in the *dispositions* of such objects, dispositionalism promises a plausible story about the epistemology of modality. We clearly have a great deal of knowledge about the dispositions of the individual objects around us (as well as of our own). Such knowledge arises from, and is used in, both everyday and scientific contexts. We learn early on that glasses are fragile, that sugar is water-soluble, and that some people are irascible.

[11] The intuitive picture may, of course, be questioned. One well-known challenge to it comes from Ladyman et al. (2007). But Ladyman et al. would have more fundamental disagreements with the kind of metaphysics in which this book is engaging.

We use that knowledge in dealing carefully with fragile glasses and irascible people, and in putting sugar into our tea. Dispositional properties such as solubility in various substances, fitness for survival in a given environment or the ability to fly, and the various behavioural dispositions of human agents, play a crucial role in chemistry, biology, and psychology. It is an interesting question, and one which it is beyond the scope of this book to answer, *how* we acquire the relevant knowledge. Inference to the best explanation will certainly play a role,[12] as will various mechanisms for generalizing from one observed glass, sugar cube, or bird to others that are relevantly similar. Given a sufficiently rich view of perception, it is not implausible even to think that in some cases we can perceive an object to have a certain disposition: I can see that the glass is fragile, just as I can see that it is a champagne glass. For present purposes the crucial points are, first, that we clearly *have* such knowledge, whatever exactly our account of it is; and second, that such knowledge is not a matter of philosophical speculation, but of both practical and scientific knowledge about the world. Systematic theorizing about dispositions in philosophy will go beyond both our ordinary grasp and our scientific understanding of dispositions in some ways (as is witnessed by chapters 3–5 of this book). But it is informed by, and continuous with, the empirical knowledge that we already have of dispositions.

If metaphysical modality is based on dispositions, then our ways of knowing about dispositions are, in principle, ways of knowing about metaphysical modality. The epistemology of metaphysical modality may then be just a generalization of those empirical ways of knowing about dispositions. For those with roughly empiricist inclinations in the epistemology of modality, dispositionalism promises a good answer to what Christopher Peacocke (1999) has called the 'integration challenge': the challenge of providing for a given phenomenon a metaphysics and an epistemology which fit together' that is, which describe the phenomenon metaphysically in such a way that we can know about it, and our ways of knowing about it in such a way that they can be ways of knowing about that kind of thing.

Dispositionalism about modality does better in this respect than other standard views on the metaphysics of modality. Lewisian modal realism is notorious for its divorce between the metaphysics of modality—which is a matter of concrete worlds, all except one of which are inaccessible to us—and its epistemology—which is largely a matter of applying Recombination, the idea that everything can co-exist with anything. It seems like black magic that the epistemology of Recombination should just happen to get the metaphysics of possible

[12] See chapter 3.5 for more on the relation between dispositions and explanations.

worlds right, given that there is no connection by which the latter might have informed the former. Other possible-worlds-based views of modality fare hardly better: their possible worlds are abstract and rather remote from the everyday concerns in which our initial modal knowledge is embedded, such as the knowledge that I can ride a bike, that it can rain later, that my precious vase can break easily if handled without care, and so on.

It is sometimes argued that, in order to meet the integration challenge, we must give up on the idea that modality is mind-independent. This is Peacocke's own moral (Peacocke 1999, ch. 4): if modality is a matter of *concepts*, as he suggests, then it is hardly puzzling that we can acquire knowledge about it. Our knowledge of modality, in such a case, would be best explained by a *rationalist* epistemology. In this book, I will be interested in an account of modality that does take it to be entirely mind-independent. (My account, that is, is a *realist* one, in a well-established sense. I will use the term 'realism' in a stronger sense below.) Dispositionalism promises to provide such an account and a plausible empiricist epistemology for it.

There may be independent reason for being suspicious about an object–property ontology, or about empiricist approaches to modal epistemology, and I am not going to argue for either of the two views. Dispositionalism about modality is part of an attractive package which features an anti-Humean view of the natural properties, an intuitive ontology, and a modal epistemology that is well equipped to solve the integration challenge. Dispositionalism about modality is worth spelling out, even if only to see more clearly what the package as a whole would amount to.

There are two basic versions of dispositionalism about modality, differing in the *kind* of modality that is said to be grounded in dispositional properties: counterfactual conditionals or possibility.

In the current philosophical literature, a disposition such as fragility is generally characterized by a counterfactual conditional such as 'If x were struck, x would break'. Where the project was to reduce dispositional talk to something else, these counterfactual conditionals have generally been appealed to as terms of the reduction. Dispositionalists, of course, will be opposed to such a reduction. But that need not prevent them from making use of the very same link that their opponents detect between a disposition ascription and a counterfactual conditional, and merely reversing the order of explanation. A first stab (and no more than that) at a dispositionalist theory of counterfactual conditionals would be the following:

(C) A counterfactual of the form 'If x were S, then x would be M' is true just in case x has a disposition to M if S.

For instance, the counterfactual conditional 'If the glass were struck, it would break' is true just in case the glass is fragile' and its truth or falsity is *explained* by the glass's having or lacking the disposition. A theory along these lines is suggested, for instance, by Bird (2007). Jacobs (2010) has spelled it out in some more formal detail. The approach has the virtue that, given an account of counterfactual conditionals, it can then define possibility and necessity in terms of them (see Jacobs 2010).

Ironically, (C) fails for the same reasons that have initially motivated dispositionalists such as Martin (1994) to reject a reductive analysis of dispositions. The case for this failure has been made by Eagle (2009) (for a closely related argument with a slightly different target see Schrenk 2010). A disposition is a matter of how things stand with a particular object—dispositions are, more often than not, intrinsic properties of their bearers.[13] The truth of a counterfactual, however, depends on more than the intrinsic nature of a particular object. That is why the truth-values of a disposition ascription and the corresponding counterfactual conditional can diverge. A vase that is safely packed remains fragile, yet the corresponding counterfactual 'If the vase were struck, it would break' is false of it. (This is a classic case of 'masking' or 'antidotes'; see Johnston 1992 and Bird 1998.) A live wire disposed to conduct electricity if touched may be equipped with a fail-safe mechanism that turns off the electricity if it were touched, thus rendering false the conditional 'If the wire were touched, it would conduct electricity'. (This is Martin's (1994) case of an 'electro-fink'.) Such cases make the prospects of a reductive analysis based on (C) rather poor, no matter which way the analysis is meant to go.[14]

But there is another way for the dispositionalist about modality. Objects possess many dispositions without manifesting them (any fragile but unbroken glass will serve as an example); the manifestation of such a disposition is merely *possible*. Dispositions are thus linked not only to counterfactual conditionals, but also to possibility. This opens another route for the dispositionalist who wants to ground modality in dispositions. Schematically, the second route is as follows:

(P) A possibility statement of the form 'It is possible that *x* is M' is true just in case *x* has a disposition to be M.

For instance, it is true that the glass possibly breaks just in case the glass is fragile; and the truth or falsity of the possibility claim is explained by the

[13] As McKitrick (2003) has shown, not all dispositions are intrinsic. I will discuss *extrinsic* dispositions in detail in chapter 4. The account that I give there may help with a semantics of counterfactual conditionals, and I return to the problem in chapter 6.

[14] Maier (ms) tries to solve these problems by ascribing dispositions to the world as a whole. Although intriguing, I think that his proposal takes away much of the intuitive appeal of the original theory, which arose from its basis in our thought about ordinary middle-sized objects.

glass's having or lacking the disposition. A view along these lines is proposed by Borghini and Williams (2008) and briefly sketched in Pruss (2002).

(P) is, to a first approximation (and *only* to a first approximation), the view that I will develop in this book. The official version of the view, a descendant of (P), will be stated only in chapter 6.1. (So hold the counterexamples! I will say a bit about them in the next section, and much more in the remainder of the book.) But before the view can be properly stated and defended, much work has to be done to develop the right notion of dispositions—or, as I will call it, of potentiality.

In chapters 2–3, I am going to argue that we should not have expected anything other than (P) in the first place. The dispositions that we ascribe in ordinary language are not nearly as closely related to counterfactual conditionals as most philosophers have thought. The important link, rather, is between dispositions and possibility. If we wanted to reduce dispositions away, we would have to reduce them to (a special kind of) possibility; and if, on the other hand, we want to base modality in general on dispositions, we should start with possibility as (P) does. Necessity, of course, can be defined in the usual way. Counterfactual conditionals will not be at the focus of my account, though I will make some suggestions on how to integrate them in chapter 6.

(P) is only a first step towards a dispositionalist theory of modality. The agenda for the theory can be brought into focus by looking at the different constraints that a theory of metaphysical modality will have to meet.

1.4 Three constraints

A first constraint on any theory of metaphysical modality is *extensional correctness*. We have certain firm convictions about what is or is not metaphysically possible or necessary, and these had better come out mostly true on any metaphysical account of modality. There is some room for negotiation—perhaps some of our firm convictions are just an artefact of philosophical theorizing, which has happened to be opposed to dispositionalism. But negotiation must end somewhere. Otherwise we have just changed the topic (or we must embrace an error theory of our beliefs about modality, an undesirable last resort in my opinion). My objection to (C) above was based on a failure of extensional correctness.

A second constraint is *formal adequacy*.[15] Modal logic has studied various systems for formalizing modality, and there is wide agreement on some minimal

[15] This constraint, and the difficulties in addressing it, have not received much attention in the literature so far; a notable exception is Yates (forthcoming). Yates's proposal for addressing the constraint leads to a more modest dispositionalism than mine.

conditions that a system has to meet in order to count as a formalization of (metaphysical) necessity and possibility. Thus we know that possibility, for instance, is closed under logical implication (if it is possible that *p*, and *q* follows from *p*, then it must be possible that *q*), is closed under and distributes over disjunction (it is possible that *p*-or-*q* iff it is possible that *p* or it is possible that *q*), and is implied by actuality (if *p*, then possibly *p*). The dispositionalist about modality should provide an account that is not merely compatible with, but which explains or entails those features. Otherwise it may reasonably be doubted that the dispositionalist account really is an account of *modality*. Again, there is some room for negotiation—philosophers have argued over which system of modal logic is best suited to characterize metaphysical modality, and while most accept that victory goes to **S5**, some have defended a weaker system, **T**, as the best formalization of metaphysical modality (see Salmon 1989). An otherwise plausible metaphysics of modality may take a stand with the minority here, if that is what its principles require. But the minimal conditions just given are not up for negotiation.

A third constraint may be called *semantic utility*. Utterances in natural language are rife with modality. Speaking about what can, might, or must happen is crucial to human communication. In metaphysics, we use our grasp of natural-language modals to think about the modal claims made by philosophers. It had better turn out that these two usages of modal terms are not referring to different kinds of modal reality. Our modal metaphysics should provide the materials for a semantics of at least a significant part of natural-language modality. This is not trivial: as has often been noted, modality in natural language is highly context-sensitive (see, for instance, Kratzer 1977 and 1991). If modal metaphysics provides the semantic materials for natural-language modality, its materials must be such as to allow for contextual variation. Again there is some room for negotiation, and I will argue in chapter 6 that dispositionalism does not, and need not, provide a semantics for epistemic and deontic modals. But some parts of modal language must be accounted for.

There may be other constraints (epistemic accessibility, as outlined above, comes to mind). But these three are crucial; and they are, prima facie, difficult for the dispositionalist to meet. Take extensional correctness first: it is possible of many things that they break without those things' being fragile (a sturdy steel bridge will serve as an example). So we seem to have possibilities without a corresponding disposition—and hence a problem for extensional correctness.

The semantic utility of dispositionalism, further, requires that there are contexts in which we would have to ascribe to a sturdy steel bridge the disposition to break—after all, there are contexts in which it is perfectly true to say that the bridge *can* break. And it requires, further, that there are contexts in which a highly

fragile but safely packed glass does *not* count as disposed to break—after all, there are contexts in which it is perfectly true to say that the glass is so safely packed that it cannot break.

However, the most difficult constraint for the dispositionalist to meet is formal adequacy. Dispositions do not appear to be governed by the same formal principles as possibility. If the glass is disposed to break, is it thereby disposed to be such that it is raining or it is not raining? If the manifestations of dispositions were closed under logical implication, it would have to be. But such reasoning is far removed from an intuitive understanding of dispositionality. And if it is not correct, how can the dispositionalist explain the formal structure of possibility itself? To make matters worse, it is hard to see how (P) should even be formulated at the right level of generality. As it stands, it can account only for a limited range of possibilities—those whose content can be stated with a simple predication of the form '*a* is F'. But what of the more complex or free-floating possibilities, such as the possibility that Jill and Jack are both 5 feet tall, the possibility that it is raining or sunny, or the possibility that there are talking donkeys? (P) does not even tell us what to do with them; it has the wrong logical form. And its logical form is no accident either. It arises from the fact that dispositions are dispositions *of* a particular object *to* behave in some particular way, a fact to which I have appealed in distinguishing dispositions, as a *localized* modality, from other parts of the modal package.

One option in responding to the problem of logical form is to make no more than the more restricted claim embodied in (P). But such a move would hardly deserve the name of a theory of metaphysical possibility in general.

Alternatively, we might try tinkering with the relation that is to hold, according to (P) or its improved successors, between a disposition and a possibility. Perhaps all we need to claim is that every true possibility statement has a truthmaker in some dispositional property or properties. If there is no strict 'if and only if' relation, then the form of disposition ascriptions and the form of possibility statements need not be made to 'fit' together as they do in (P). I think such a move, while more audacious than the first, is still too timid. For it gives us no obvious way of finding out whether or not the constraint of formal adequacy has been met in general. Truthmaking and similar notions do not (yet?) seem to afford the generality and rigour needed to check whether or not those constraints hold.

I prefer a third way of responding to the challenge of logical form: tinkering with the form of disposition ascriptions. What we need is a general understanding of an object's having a disposition *for it to be the case that p*. Given such an understanding, we can then examine the logical principles that govern those

dispositions: are they, for instance, closed under logical implication?[16] Further, given those principles, we can very easily check the logic of possibility that they imply in conjunction with a bridge principle similar to, but more general than, (P). Formally speaking, this is the path of least resistance. Metaphysically speaking, however, it is not. For it requires some hard work on the required notion of dispositionality.

Most of this book will be devoted to developing such a notion which is wide enough to make sense of dispositions for it to be the case that *p*, for any value of *p*. I will drop the term 'disposition' and adopt, instead, that of 'potentiality'. Potentiality, again, is intended to be simply the best generalization of our (perhaps) more intuitive notion of dispositions. It will be argued, first, that dispositions (and potentialities in general) are individuated solely by their manifestation, so any theory along the lines of (C) will be precluded from the start. Second, it will be argued that we can make sense of potentialities *for it to be the case that p* without giving up the paradigm of a *localized* modality. Third, potentiality will be argued to exhibit the minimal formal features of possibility itself: closure under logical implication, distribution over disjunction, and implication by actuality. Fourth, potentialities will be shown to be so broad as to accommodate the constraints of extensional correctness and semantic utility too. The strategy in all this will be to start with simple, intuitive examples and to generalize from there, arguing that any limit on potentiality short of those that I want to adopt would be metaphysically arbitrary.

Potentiality so understood differs from possibility mainly in being relative to a particular object. We may think of potentiality *as* possibility that is relativized to a particular object, but on the view here proposed that would get the direction of explanation wrong. Rather, we should think of possibility as potentiality *in abstraction from* its bearer. A possibility is a potentiality of something or other, no matter what. An improved version of (P) therefore reads as follows:

(P′) It is possible that *p* just in case something has a potentiality for it to be the case that *p*.

(P′) is closer to, but still not identical to, the final version of the view that will be stated in chapter 6.1. The final version will read as follows:

POSSIBILITY It is possible that $p =_{df}$ Something has an iterated potentiality for it to be the case that *p*.

[16] Strictly speaking, what might or might not be closed under logical implication are not dispositions, but their manifestations. For convenience, I will continue to speak in this loose way throughout the book. Thus chapter 5 argues that potentiality—strictly speaking: the manifestations of an object's potentialities—is (are) closed under logical implication.

To understand, let alone evaluate, POSSIBILITY, we will need to do more work yet on the notion of potentiality. For the time being, therefore, I will stick with (P′). (P′) already makes it clear that the burden of the theory rests on its conception of potentiality. A large part of the book will be spent discharging that burden, and arguing that the required theory of potentiality is independently plausible.

1.5 Potentiality

As I am going to use the terminology, every disposition is a potentiality but not every potentiality is a disposition. Some potentialities are abilities, such as my ability to walk, which may or may not have a dispositional equivalent. Some potentialities are what we might call powers or potentials, which appear to be weaker than dispositions—such as a sturdy steel bridge's potential to break, or my potential to jump out of the window (which, fortunately, is no disposition at all). It is not always clear from the literature on dispositions how extensively we are to conceive of dispositions; perhaps there is a sense of 'disposition' in which the potentials just noted, and many others like them, do qualify as dispositions. Never mind; I do not want to quibble about terminology, so I will use the term 'potentiality' instead. It has a suitably general ring to it, and it has the virtue of being an obviously theoretical term with few pre-philosophical intuitions that would constrain its use. I will not, however, provide an explicit definition of this theoretical term; it is going to be the primitive in terms of which I define other things. You may justly wonder what the point is of a term that has neither an intuitive, pre-philosophical content nor an explicit definition. I reply that while the term itself has little usage outside philosophy, we have a rather firm pre-philosophical grasp on part of its extension. That part will turn out not to be very precisely circumscribed, and I use the term 'potentiality' for whatever is the best and most general *precise* notion that includes the pre-philosophical extension. Let me be more specific.

Our understanding of potentiality begins with dispositions. Fragility, solubility, irascibility, elasticity, and so on are properties that we ascribe all the time to objects in both everyday life and science. We appear to have a good pre-theoretical understanding of what it takes for an object to possess such a property, and we use that understanding to guide our actions: being careful not to drop fragile objects, putting soluble sugar in our coffee, avoiding provoking behaviour around irascible people, and putting elastic bands around objects to hold them in place.

As so often in metaphysics, we can start with an intuitive understanding but we cannot stop with it. We need a more general understanding of what those

properties are that we ascribe and rely on in everyday talk, thought and behaviour. But in order to gain that general understanding, we also need to generalize the subject matter and extend our conception of dispositionality beyond the obvious, everyday examples. Such an extension will be necessary for the purpose of giving a theory of modality; the intuitive examples of dispositions are clearly not enough to account for all the possibilities there are. But it will also be necessary in order to give a non-reductive account of those properties. Here is why.

Disposition terms are often context-sensitive, and they are often vague. What counts as fragile in the context of an antiquities shop may differ from what counts as fragile in the context of space travel. Whatever the context, there are borderline cases between what does and what does not count as fragile.[17] An ordinary context will probably determine that champagne glasses, tea cups, and tumblers count as fragile while blocks of steel, wooden desks, and brick stones do not. But what about an ordinary plant-pot that is easier to break than the brick stone, though less easily broken than the tumbler: is it fragile or not? There may be no one right answer to that question (or if epistemicism is correct, it will be impossible to determine the right answer).[18] The plant-pot is a borderline case of fragility in the given context.

However, both vagueness and context-sensitivity are features of language, not the world.

In the case of context-sensitivity this is obvious. What a context-sensitive term such as 'I' refers to varies with the context in which it is uttered. But that to which it refers in a given context—a particular individual—does not, of course, turn into something else when the word is uttered in a different context. Similarly, which property is ascribed by 'fragile' may vary with contexts. But the properties that are ascribed in the various contexts remain the same properties. Contextual variation concerns only which of them are ascribed.

Vagueness, too, is a feature of language, not the world.[19] If it is vague whether a particular stone is part of Mount Everest, that is not because there is an object, Mount Everest, which is indeterminate with regard to whether or not it includes that stone. Rather, it is because the name 'Mount Everest' is vague—there is no right answer to the question whether it refers to the mountain so delineated as to include the stone, or the mountain so delineated as to not include it; or, if

[17] I adopt a common first characterization of vagueness: any predicate that gives rise to borderline cases and a Sorites series is vague.

[18] Epistemicism is the view that vague predicates have perfectly precise boundaries, but that we cannot know where they lie. See Williamson (1994).

[19] This view, while not uncontroversial, is widely accepted. See Williamson (2003) for a detailed discussion.

epistemicism about vagueness is correct, there is a right answer (perhaps a different one in different contexts), but one which we are in principle unable to know. Similarly, if it is vague whether the plant-pot counts as fragile, that is not because there is a property, fragility, which is indeterminate with regard to whether or not the plant-pot is included in its extension. Rather, it is because the term 'fragile' is vague—there is no right answer to the question whether it ascribes a property that (determinately) includes, or a similar property that (determinately) does not include, the plant-pot in its extension; or if epistemicism is correct, there is a right answer (probably a different one in different contexts) which we are in principle unable to know.

If disposition terms are vague and context-dependent, then we cannot simply rely on our grasp of them in spelling out the underlying metaphysics, even if that metaphysics is to be non-reductive. We must try to understand the precise, context-independent background on which the various precisifications of a vague term, and the various shifts in context, operate.

Traditionally, this background has been provided by possible-worlds semantics. It is, on that framework, an entirely precise and context-independent matter which possible worlds there are. Vagueness and context-sensitivity of disposition terms (and other modal expressions) can then be modelled as indecision and contextual shifts regarding which of these worlds count as relevant, and exactly which kind of quantification is applied to them.

A non-reductive metaphysics of dispositions will provide a different background for vagueness and contextual shifts, one that is dispositional, but general enough to accommodate all the borderline cases and all the contextual resolutions. Specifically, we will see in chapter 3 that the context-sensitivity of disposition terms such as 'fragile' is a matter of *degrees* of fragility: whether something counts as fragile in a given context is a matter of *how* fragile it is, context setting a minimum degree which needs to be satisfied for the predicate to be true of a thing.[20] The context-independent metaphysical background must consist, for the dispositionalist, of a property that comes in degrees, some of which will, while others won't, be sufficient for the true application of 'is fragile'. We might call that property a disposition, and distinguish between the context-insensitive and the context-sensitive use of 'disposition'. Or we might reserve the term 'disposition' for the context-sensitive use and introduce a new term for the context-insensitive metaphysical background. The decision is a purely terminological one. I have chosen the second option and the term 'potentiality'. Thus in my terminology, having a disposition such as fragility is a matter of having

[20] This has been forcefully argued by Manley and Wasserman (2007).

the right potentiality (in this case the potentiality to break or be broken) to a contextually sufficient degree.

Once we have introduced potentiality in this way, it can be argued that the potentialities which objects have outrun the dispositions that we are willing to ascribe to them. A chunk of gold will not, in any context, count as fragile. (Let us suppose, in any case, that this is so.) Yet there is no *deep* distinction between a chunk of gold and a champagne glass with regard to fragility; the difference is one of degree. We can see this by imagining a series of objects, each just a little less fragile than the last, from a champagne glass through a tumbler, a plant pot, a rock, and a diamond, down to the chunk of gold. Apart from contextual (and hence linguistic, not metaphysical) constraints, the difference between the objects in this series, so far as fragility is concerned, is one of degree, not all or nothing. If the potentiality to break is that property whose degrees provide the metaphysical foundation for the comparative ordering, then that potentiality must be possessed all the way through the series; any stopping-point would be arbitrary.[21]

I have anticipated some of the argument of chapter 3 to show how it is non-reductive realism about dispositions, together with quite general metaphysical assumptions (in this case, the rejection of vague or arbitrary cut-offs in metaphysics), which forces us to expand the intuitive notions of dispositions that form our starting point. This expansion is just what we need to account for metaphysical possibility. The considerations just sketched, for instance, motivate a conception of potentiality that can account for the possibility, say, of a large block of concrete or even a chunk of gold breaking. Neither would count in an ordinary context as 'fragile', but each has the potentiality to break, albeit to a relatively minimal degree. Saying otherwise would require the arbitrary cut-offs that I have shunned. And so it is non-reductive realism itself, not the project of accounting for metaphysical possibility, that motivates the expansion. My theoretical term 'potentiality' is defined as that, *whatever it is*, which results from such expansion in the end.

In a nutshell, the argument of this book is that a conception of potentiality which is general enough to satisfy the constraints of non-reductive realism is also general enough to satisfy the constraints on a dispositionalist theory of modality: extensional correctness, formal adequacy, and semantic utility. We have just seen some steps towards extensional correctness. Formal adequacy

[21] The rejection of arbitrary cut-offs will play a role, in different ways, in chapters 3.4, 4.3, and 5.3.3. I have little to say in its defence, but I take it to be a widespread and natural line of thinking about metaphysics.