

# ***Actualist Modal Realism***

by

**Adam Russell Murray**

A Thesis submitted to the Faculty of Graduate Studies of  
The University of Manitoba  
in partial fulfilment of the requirements of the degree of

**Master of Arts**

Department of Philosophy  
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## *Abstract*

Since it seems plausible to think that things could have been different from the way that they are, it also seems plausible to think that there are ways that things could have been. Or so I argue in this essay. I defend a version of *actualist modal realism*: the view that the world we inhabit and call “actual” is but one of infinitely many actually existing possible worlds, and that each of these worlds corresponds to a total way that things might have been. In the space I have available, I have tried to select those issues, arguments and objections that have received substantial attention in the literature from philosophers working in modal metaphysics.

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## *Introduction:*

Since it seems plausible to think that things could have been different from the way that they are, it also seems plausible to think that there are ways that things could have been. Or so I argue in this essay. I defend a version of *actualist modal realism*: the view that the world we inhabit and call “actual” is but one of infinitely many actually existing possible worlds, and that each of these worlds corresponds to a total way that things might have been. In Chapter 1, I define and motivate modal realism, and consider some different ways in which one might be a modal realist. I also introduce the version of modal realism that I defend in the remainder of the essay. I call this version of modal realism *world-stateism*. I conclude the chapter by arguing that world-stateists ought to extend their view to include realism about impossible worlds as well.

In the space I have available, I have tried to select those issues, arguments and objections that have received substantial attention in the literature from philosophers working in modal metaphysics. The topic of Chapter 2 is the metaphysics of worlds. I begin with a review of the literature and present some earlier versions of world-stateism. I then review an important objection to these earlier accounts, and outline a response. I conclude the chapter by presenting in detail the metaphysics of worlds which I assume in the remainder of the essay. My account is substantially different, metaphysically speaking, from earlier versions of world-stateism.

In Chapter 3, I draw some important distinctions that cut across most traditional versions of modal realism, and consider a pair of objections which, I argue, my account of the metaphysics of worlds can adequately handle. The first of these objections is well known, and concerns how it is that a given world represents a particular possibility for a given individual. The second objection is more recent, and concerns the metaphysical character of the actual world, the metaphysical character of each possible world, and the relationship between the two.

In Chapter 4, I turn to a broader set of conceptual and ontological issues that bear directly on the version of world-stateism I endorse. I defend primitivism about properties, and show how these commitments may be put to good use in the analysis of modal truth.

## Chapter 1: Actualist Modal Realism

### 1. *Modal Realism and the Phenomena of Modality:*

Ontology involves the philosophical study of what there *is*, or of what *exists*, in the broadest possible sense. Philosophers often disagree about what exists. For instance, some philosophers think that only concrete, material objects (like tables and chairs, or subatomic particles) exist, while other philosophers think that, in addition to concrete, material objects, the world also contains abstract, immaterial entities (like properties, or numbers, or fictional and mythical characters) as well. These are ontological disputes, since they concern what there is, or what exists.

*Modal realism* is an ontological thesis. Among other things, modal realists hold that in addition to the world in which we exist, there are also many other worlds. These are *possible* worlds. According to modal realists, possible worlds are real, and they exist. This is the fundamental thesis of modal realism.

Although the fundamental thesis of modal realism sounds bizarre, it is actually quite well-motivated. David Lewis argues for the fundamental thesis of modal realism in the following well-known passage:

It is uncontroversially true that things might have been otherwise than they are. I believe and so do you that things could have been different in countless ways. But what does that mean? Ordinary language permits the paraphrase: there are many ways that things could have been, besides the way they actually are. On the face of it, this sentence is an existential quantification. It says that there exist many entities of a certain description, to wit "ways things might have been". I believe things could have been different in countless ways; I believe permissible paraphrases of what I believe; taking the paraphrase at its face value, I therefore believe in the existence of entities that might be called "ways things might have been". I prefer to call them "possible worlds".<sup>1</sup>

Call this *the argument for realism about possible worlds*. We can spell out the argument more carefully as follows. The argument begins with the premise that things (broadly construed to include us and all of our surroundings) might have been different, in many different ways. According to Lewis, this premise is uncontroversial. Patterns of

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<sup>1</sup> Lewis (1973), p. 84.

ordinary language use certainly suggest that it is uncontroversial that things could have been different at least some of the time. Consider the claims made by (1) and (2):

- (1) The weather in Winnipeg on June 1, 2009 could have been pleasant.
- (2) Barack Obama could have lost the 2008 American Presidential election.

(1) and (2) are *modal* claims. They make assertions about what could have been the case. And many speakers would take (1) and (2) to express *truths*. So we should agree that it is uncontroversial that at least some things could have been different from the way that they are.

The second premise of the argument is a conditional: it says that if it is true that things could have been different from the way that they are, then according to a permissible ordinary language paraphrase of this claim, it follows that there are many different ways that things could have been. Since Lewis takes the first premise to be uncontroversial, he takes this inference to establish that there are ways things could have been. But what constitutes a *permissible* paraphrase? In other work, Lewis suggests that a given paraphrase R of a sentence S is acceptable only if it is *not* the case that (a) paraphrasing S as R leads to trouble and (b) paraphrasing S some other way is known not to.<sup>2</sup> But it's not the case, he thinks, that paraphrasing the claim that things could have been different as the claim that there are ways that things could have been leads to trouble, or that taking it some other way is known not to (in fact, he spends much of his *On the Plurality of Worlds* defending this point).<sup>3</sup> I'm inclined to agree (although the view developed and defended in this essay is very different from Lewis's). However, leaving aside the issue of what constitutes a legitimate paraphrase, it is sufficient to note that, if (1) and (2) are true, then so are (1P) and (2P)

- (1P) There is a way that things could have been such that, if things had been that way, the weather in Winnipeg on June 1, 2009 would have been pleasant.

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<sup>2</sup> See Lewis (1986a), esp. at pp. 2-4.

<sup>3</sup> See his (1986a), *passim*.

(2P) There is a way that things could have been such that, if things had been that way, Barack Obama would have lost the election,

respectively. In general, then, we should agree with Lewis that truths about what could have been the case may be understood in terms of alternative ways that things could have been.

The third premise tells us that the claim that there are ways that things could have been involves *existential* quantification. This *is* a controversial premise, which Lewis assumes (here) without argument.<sup>4</sup> The idea is that the locutions “there *are* ways that things could have been” and “there *exist* ways that things could have been” literally mean the same thing. But it is safe to say that Lewis is with the philosophical majority on this issue. An alternative view, Meinongianism, will be briefly discussed below in connection with different formulations of the thesis of actualist modal realism. Although I don’t argue for this here, I think that Lewis is right to think that whatever there is, exists. (So, I assume that Meinongianism is false for the remainder of this essay).

The fourth premise (another conditional) says that, since the claim that there *are* ways that things could have been involves existential quantification over ways that things could have been, it follows that there *exist* many ways that things could have been (this is the argument’s second sub-conclusion). In the fifth premise, Lewis identifies each way that things could have been with a possible world (in other words, possible worlds are simply identical to ways that things could have been, for Lewis). Since (by the second sub-conclusion) these ways that things could have been exist, it follows (from premise five) that *possible worlds exist*.

Although the argument for realism about possible worlds is compelling, we can bolster it by considering some additional phenomena that are importantly connected to the fact that things could have been different from the way that they are. Consider *propositions*. A proposition is a truth-apt, truth-evaluable, shareable object of propositional attitudes (attitudes like belief, doubt, and knowledge); it is also the semantic content (or *meaning*) of a declarative sentence.<sup>5</sup> Our uncontroversial modal claims (1) and (2) above *encode* propositions, and an assertive utterance (or inscription) of either

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<sup>4</sup> Although he does argue for it in other places. See Lewis (1990), for discussion.

<sup>5</sup> Perhaps relative to a context of utterance or inscription. I ignore this complication in what follows.

*expresses* a proposition. Propositions are *truth-apt* and *truth-evaluable* because propositions are representational: they represent the world as being a certain way, and are therefore capable of being true or false (intuitively, a proposition is true just in case it represents the world the way the world is, and false otherwise). And to say that a proposition *P* is a *shareable object of a propositional attitude* is just to say that it is possible for two agents *a* and *b* to bear the same propositional attitude (like belief, etc.) to *P*.<sup>6</sup>

The important thing to note is that there are different ways that propositions can be true or false. A given proposition can be true or false *contingently*, or *necessarily*. Contingency and necessity are *modes* of truth and falsity for propositions. To illustrate, for the case of truth, consider (the propositions encoded by) (3) and (4):

(3) Socrates was the teacher of Plato.

(4) If Saul Kripke exists, then Saul Kripke is identical to Saul Kripke.

(3) and (4) each express a true proposition. But (3) is contingently true (it could have been false) while (4) is necessarily true (it could not have been false). Since we can draw analogous distinctions in the case of false propositions, it follows that there are at least four distinct modal profiles that a proposition may take.<sup>7</sup>

It seems plausible to think that the existence of alternative ways that things could have been can help us understand the phenomenon of contingent and necessary truth. Since a necessary proposition is a proposition that could not have been false, it will be true according to every way that things could have been. And since a contingently true

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<sup>6</sup> Here, “*P*” is used as a schematic letter. For discussion, see Cartwright (1968), Plantinga (1987). It is not my intention here to provide necessary and sufficient conditions for being a proposition; in fact, the above rough definition arguably fails to provide either. For example, it seems conceivable that there be a proposition that is too complex for any human agent to ever bear a propositional attitude towards it. This formulation is also explicitly neutral between competing *metaphysical* accounts of what propositional entities *are*. For instance, I take no stand here on whether propositions are structured abstract entities of some sort, or whether they ought to be identified with functions from circumstances to truth values (or simply with sets of such circumstances), although I am sympathetic to the former view.

<sup>7</sup> I say “at least” instead of “exactly” or “at most” because some philosophers hold that there are further truth values for propositions. I ignore this complication in what follows; for discussion, see Priest (1995), (2001).

proposition could have been false, there is a way that things could have been such that, had things been that way, it would have been false.

The existence of ways that things could have been helps us to understand other modal phenomena as well. Consider properties. Properties, roughly, include the qualitative attributes and features of things, like the property of *having mass* or the property of *being red in color*. Most realists about properties hold that individuals instantiate, or exemplify, properties, and many hold that more than one individual may instantiate the very same property.<sup>8</sup> Now, just as there are different modes of truth and falsity for propositions, there are also modes in which a given individual can exemplify a property: some properties are *accidental*, and others are *essential*. Socrates, for example, has the properties of *being a philosopher* and *being snub-nosed* accidentally, since he could have easily failed to exemplify either. In general, a property  $\phi$  is accidental for an object  $o$  if (i)  $o$  instantiates or exemplifies  $\phi$  and (ii)  $o$  could have failed to instantiate  $\phi$ , (while still existing).<sup>9</sup>

Characterizing essential properties is more difficult. A popular conception of an essential property (of an object  $o$ ) is that of a *necessary* property of  $o$ , or a property that  $o$  could not have failed to instantiate, while still existing. But this conception of an essential property faces some counterintuitive consequences, since not all necessary properties seem essential. Consider Socrates and his singleton set, {Socrates}. It is necessarily true that (i) {Socrates} exists if Socrates exists, and (ii) that if Socrates exists then Socrates is the sole member of {Socrates}. It is therefore necessary that Socrates be the sole member of {Socrates} if he exists, and it turns out, on this conception of essential properties, that it is an essential property of Socrates to belong to {Socrates}. But intuitively it is no part of the *essence* of Socrates to belong to any set. Considerations such as these prompt many philosophers to identify essential properties instead with properties instantiated in virtue of an object's *nature*. For instance, we might think that being human is part of the nature of Socrates, and that he therefore has the property of *being human* essentially, in virtue of

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<sup>8</sup> For discussion, see Swoyer, (2000), (2008).

<sup>9</sup> Here,  $\lceil \phi \rceil$  and  $\lceil o \rceil$  are being used schematically for any property and any object, respectively.

what he is. If so, then *being human* would count as one of Socrates's essential properties.<sup>10</sup>

The existence of ways that things could have been can help us understand the phenomena of accident and essence as follows. We might think that, just as a proposition is contingently true if there exists a way that things might have been such that, had things been that way, the proposition would have been false, a property is accidental for an individual if there is a way things could be such that, had things been that way, the individual in question would have lacked the relevant property. Similarly, just as a necessarily true proposition is a proposition that could not have been false, no matter which way things turned out to be, a necessary property of an object *o* is a property *o* would have according to every way that things might have been. And, given the intuitive distinction between a necessary property (like the property of *being a member of one's singleton set*) and an essential property (like the property of *being human*), we might think that essential properties are just necessary properties of a certain special sort, namely, properties that an object has in virtue of its nature, or in virtue of what it is. So it turns out that an essential property can be thought of as a property an object has according to every way that things could have been, in virtue of its nature.

Since it seems plausible to think that there really *are* such things as contingent and necessary propositions, and accidental and essential properties, and since being a realist about ways that things could have been helps us to understand what it is for a proposition to be necessarily or contingently true, and for a property to be accidental, necessary, or essential, these considerations further support the argument for realism about possible worlds. On the assumption that possible worlds just are the ways that things could have been, we should think that there exists a plurality of possible worlds: very roughly, one for each way that things might have been. We should be modal realists.<sup>11</sup>

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<sup>10</sup> For discussion, see Fine (1994), Almog (1991), (1996), and Schaffer (2009).

<sup>11</sup> It is also worth noting that possible worlds have also been employed in the analysis of counterfactual conditionals (Lewis [1973], Stalnaker [1968]), properties (Lewis [1986a], [1986b]), propositions (Lewis [1986a], Stalnaker [1984]), and the semantics of proper names and natural kind terms (Putnam [1975], Kripke [1972]).

1.1. *Possible Worlds and the Semantics for Modal Logic:*

Possible worlds are also important in the study of the logic of necessity and possibility.<sup>12</sup> Some intuitively true English claims, like (1a) and (1b), contain modal locutions, like “possibly” and “necessarily”:

(1a) Possibly, there exist talking chimpanzees.

(1b) Necessarily, all chimpanzees are mammals.

And some English inferences with premises that contain modal expressions appear to be valid. Consider the arguments in (2a) and (2b):

(2a) i. Necessarily, if Obama exists, then Obama is human.  
ii. Therefore, if it is necessary that Obama exists, then it is necessary that Obama is human.

(2b) i. Necessarily, Barack Obama is human.  
ii. Therefore, Barack Obama is human.

However, modal claims and inferences such as those in (1) and (2) cannot be accurately modeled in non-modal logical systems.<sup>13</sup> And modal logical systems that can accurately represent such claims and inferences require commitment to possible worlds. So if we think that some modal claims are true, and that some modal inferences are valid, we are thereby committed to the existence of possible worlds.

To see this, let’s start by taking a look at the simplest modal logic: modal *propositional* logic (MPL). The syntax and semantics of MPL may be set out as follows:

*MPL Primitive Vocabulary:*

1. Sentence letters: A through Z, with or without numerical subscripts.
2. Connectives:  $\sim$ ,  $\rightarrow$ ,  $\&$ ,  $\vee$ ,  $\leftrightarrow$ .

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<sup>12</sup> The discussion in this section draws heavily on Braun (ms.), as well as Bonevac (2003), at pp. 137-156, 249-289, and Garson (2008). See also Barcan-Marcus (1961), (1970), (1985).

<sup>13</sup> One reason for this is that modal locutions are not truth-functional in the manner of the standard non-modal connectives ( $\sim$ ,  $\vee$ ,  $\rightarrow$ , etc.).

3. Parentheses: ( , )
4. Modal Operators:  $\Box, \Diamond$ .<sup>14</sup>
5. Nothing else is an expression of MPL.

*Well-Formed Formulas (wffs) of MPL:*

1. If  $\Phi$  is a sentence letter, then  $\Phi$  is a wff of MPL.
2. If  $\Phi$  is a wff of MPL, then so is  $\sim\Phi$ .
3. If  $\Phi$  and  $\Psi$  are wffs of MPL, then so are  $(\Phi \& \Psi)$ ,  $(\Phi \vee \Psi)$ ,  $(\Phi \rightarrow \Psi)$  and  $(\Phi \leftrightarrow \Psi)$ .
4. If  $\Phi$  is a wff of MPL, then so are  $\Box\Phi$ ,  $\Diamond\Phi$ .
5. Nothing else is a wff of MPL.

*Semantically*, MPL consists of a *model*,  $M = \langle W, R, V \rangle$ , such that

1.  $W$  is a non-empty set of possible worlds.
2.  $R$  is a binary relation of accessibility over worlds in  $W$ .
3.  $V$  is an assignment function from all ordered pairs of wffs of MPL and members of  $W$  onto the set  $\{0,1\}$ .

Where  $M$  is such a model, the valuation function for  $M$ ,  $V_m$ , is that function from wffs of MPL onto  $\{0,1\}$  such that

1. For any sentence letter  $\Phi$ , and any  $w \in W$ ,  $V_m(\Phi, w) = V(\Phi, w)$ .
2. For any wff  $\Phi$  and any  $w \in W$ ,  $V_m(\sim\Phi, w) = 1$  iff  $V_m(\Phi, w) = 0$ .
3. For any wffs  $\Phi$  and  $\Psi$ , and any  $w \in W$ ,  $V_m(\Phi \& \Psi, w) = 1$  iff  $V_m(\Phi, w) = 1$  and  $V_m(\Psi, w) = 1$ .
4. For any wffs  $\Phi$  and  $\Psi$ , and any  $w \in W$ ,  $V_m(\Phi \vee \Psi, w) = 1$  iff either  $V_m(\Phi, w) = 1$  or  $V_m(\Psi, w) = 1$ .
5. For any wffs  $\Phi$  and  $\Psi$ , and any  $w \in W$ ,  $V_m(\Phi \rightarrow \Psi, w) = 1$  iff: if  $V_m(\Phi, w) = 1$ , then  $V_m(\Psi, w) = 1$ .
6. For any wffs  $\Phi$  and  $\Psi$ , and any  $w \in W$ ,  $V_m(\Phi \leftrightarrow \Psi, w) = 1$  iff  $V_m(\Phi, w) = 1$  if and only if  $V_m(\Psi, w) = 1$ .
7. For any wff  $\Phi$  and any  $w \in W$ ,  $V_m(\Diamond\Phi, w) = 1$  iff there is a  $w' \in W$  such that  $wRw'$  and  $V_m(\Phi, w') = 1$ .
8. For any wff  $\Phi$  and any  $w \in W$ ,  $V_m(\Box\Phi, w) = 1$  iff for all  $w' \in W$  such that  $wRw'$ ,  $V_m(\Phi, w') = 1$ .

Under their intended interpretation, the operators  $\Box$  and  $\Diamond$  symbolize “it is necessary that,” and “it is possible that,” respectively.<sup>15</sup> MPL symbolization is most

<sup>14</sup> It's worth noting that, just as in the case of the standard connectives of non-modal propositional logic, we can reduce the number of primitive operators by defining either of the modal operators in terms of the other. For instance, we may define  $\Diamond$  from  $\Box$  and  $\sim$ , by letting  $\Diamond = \sim\Box\sim$ .

appropriate when these operators are given wide scope. Consider again our modal claims in (1) above, and let the sentence letter C represent the sentence “there exist talking chimpanzees,” and M “all chimpanzees are mammals.” In the language of MPL, these modal claims may be represented as follows:

$$(1a_{\text{MPL}}) \Diamond C$$

$$(1b_{\text{MPL}}) \Box M$$

The relevant clauses from the above standard model semantics for MPL are 7 and 8. 7 stipulates that  $(1a_{\text{MPL}})$  is true, at a given world  $w$ , if and only if there exists a world  $w'$ , accessible (under the relation  $R$ ) from  $w$ , such that the sentence “there exists talking chimpanzees” is true at  $w'$ . And clause 8 stipulates that  $(1b_{\text{MPL}})$  is true, at a given world  $w$ , if, for *all* worlds  $w'$  accessible under  $R$  from  $w$ , the sentence “chimpanzees are mammals” is true at  $w'$ .

Likewise, the premises in each of the modal inferences in (2) are best symbolized by letting the modal operators take wide scope. Where  $E$  is “Obama exists” and  $H$  is “Obama is human,” (2a) and (2b) may be symbolized in the language of MPL as follows:

$$(2a_{\text{MPL}}) \begin{array}{ll} \text{i. } \Box(E \rightarrow H) \\ \text{ii. } \therefore (\Box E \rightarrow \Box H) \end{array}$$

$$(2b_{\text{MPL}}) \begin{array}{ll} \text{i. } \Box H \\ \text{ii. } \therefore H \end{array}$$

The above MPL semantic model  $M (= \langle W, R, V \rangle)$  is what logicians call a *standard* model.<sup>16</sup> Validity is defined in MPL with respect to different *classes* of standard models. Classes of standard MPL semantic models differ in terms of the nature of the binary accessibility relation  $R$ . The weakest systems of MPL are constructed by adding to

<sup>15</sup> As well as other cognate modal locutions, such as “necessarily,” “it is necessarily the case that,” “it could have been the case that,” and “possibly, it is the case that,” respectively.

<sup>16</sup> *Leibnizian* models, by contrast, are identical save for the exclusion of the binary accessibility relation  $R$ . I return to this matter below in connection with the various axiom systems that might be adopted in connection with MPL. For discussion, see Braun (ms).

the standard derivation and inference rules of propositional logic<sup>17</sup> the following *Necessitation Rule* and *Distribution Axiom*:

*Necessitation Rule*: If  $\Phi$  is a theorem of K, then so is  $\Box\Phi$ .

*Distribution Axiom*:  $\Box(\Phi \rightarrow \Psi) \rightarrow (\Box\Phi \rightarrow \Box\Psi)$ .

This is the MPL axiom system K. All instances of K are valid in all classes of standard models. Our argument (2a<sub>MPL</sub>) is an instance of K, and is therefore valid in all classes of standard models. To prove this, we need to show that, for all classes of standard models C, (2a<sub>MPL</sub>) is valid with respect to C. So let C be a class of standard models, let M be a model in C, and let w be a world in M. (2a<sub>MPL</sub>) is valid with respect to C if  $\Box(E \rightarrow H) \rightarrow (\Box E \rightarrow \Box H)$  (an instance of the *distribution axiom*) is true in w. By clause 5 of the valuation function V above, what we need to show then is that, if  $\Box(E \rightarrow H)$  is true in w in M, then  $(\Box E \rightarrow \Box H)$  is true in w in M. So assume that  $\Box(E \rightarrow H)$  is true in w in M. We now need to show that  $(\Box E \rightarrow \Box H)$  is true in w in M. To do this, we need to show that, if  $\Box E$  is true in w in M, then  $\Box H$  is true in w in M. So assume that  $\Box E$  is true in w in M. By clause 8 of the semantics for V above,  $\Box(E \rightarrow H)$  is true in w in M iff, for all w' in M such that wRw',  $(E \rightarrow H)$  is true in w' (that is,  $(E \rightarrow H)$  is true in all worlds accessible from w under R). But from our second assumption (that  $\Box E$  is true in w in M), and again by clause 8, we can infer that E is also true in all worlds w' in M. But then both E and  $(E \rightarrow H)$  are true in all worlds accessible from w. But then it follows trivially by *modus ponens* that H is true in all worlds accessible from w. Therefore,  $\Box H$  is true in w in M.<sup>18</sup>

However, it is worth noting that K is too weak to adequately characterize the logical behavior of “it is necessary that” under its intended interpretation, since although axiom M (which states that whatever is necessary is the case) seems intuitive, it is not provable in K:

<sup>17</sup> I.e., *reiteration*, the *introduction* and *elimination* rules for  $\&$ ,  $\sim$ ,  $\rightarrow$ ,  $\&$ ,  $\vee$ ,  $\leftrightarrow$ , and *modus tollens*, *hypothetical syllogism* and *disjunctive syllogism*, together with the familiar rules of replacement of propositional logic.

<sup>18</sup> See Braun (ms), at pp. 102-103.

$$M: \Box\Phi \rightarrow \Phi$$

Therefore, many modal logicians take the slightly stronger system T, which consists of the addition of M to the axioms of K, as their preferred foundation.

Our MPL argument (2a<sub>MPL</sub>) is an instance of T. Any instance of T is valid in all classes of *reflexive* standard models (that is, in standard semantic models M in which the relation R is reflexive in W). Let's say that a relation R is reflexive, among the members of a set A, if and only if every member  $x$  of A bears R to itself:

$$R \text{ is a reflexive relation in } A \text{ iff: } \forall x (x \in A \rightarrow Rxx).$$

(2b<sub>MPL</sub>) is valid in all classes of reflexive models since, if  $\Box H$  is true, at a given world  $w$  in an arbitrary reflexive model M, then, given reflexivity, it follows that  $wRw$  and that  $H$  is true at  $w$  in M as well.<sup>19</sup>

In addition, some philosophers subscribe to even stronger systems of MPL which include axioms governing the *iteration* of modal operators. The system S4, for instance, consists in the strengthening of T via the iteration axiom

$$(4) \Box\Phi \rightarrow \Box\Box\Phi,$$

and S5 strengthens S4 via the inclusion of the mixed iteration axiom (5):

$$(5) \Diamond\Phi \rightarrow \Box\Diamond\Phi.$$

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<sup>19</sup> Note that any instance of T, like (2b<sub>MPL</sub>), will *only* be valid in those models M of MPL in which R is reflexive. For consider a model  $M = \langle W, R, V \rangle$  where  $W = \{w, w'\}$  and  $R = \{ \langle w, w' \rangle \}$  and V is that function from pairs of sentence letters of MPL and  $w \in W$  such that  $V(H, w) = 0$  and  $V(H, w') = 1$ , and for all other sentence letters  $\Phi$  and  $w \in W$ ,  $V(\Phi, w) = 1$ .  $\Box H \rightarrow H$  will be false in  $w$  in M if  $\Box H$  is true in  $w$  but  $H$  is false in  $w$ . By clause 8, we can infer that  $\Box H$  is true in  $w$  iff  $H$  is true in all worlds  $w'$  such that  $Rww'$ . Given the function V in M, this is the case (i.e.,  $H$  is true in  $w'$ ). Thus,  $\Box H$  is true in  $w$ . But  $H$  is false in  $w$ . So  $\Box H \rightarrow H$  is false in  $w$  in M.

These stronger axiom systems are a matter of considerable controversy. For instance, axiom (4) of system S4 imposes the condition of *transitivity* on  $R$ : axiom 4 says that what is necessary is *necessarily* necessary.<sup>20</sup> In the case of S5, not only are matters of necessity themselves necessary, so too are matters of possibility: axiom 5 says that whatever is possible is *necessarily* possible. Thus, axiom (5) of S5 requires that the relation  $R$  be *Euclidean* (i.e., both transitive and *symmetrical*).<sup>21,22</sup>

For now, the crucial thing to note is that, in the metalanguage of MPL, the modal operators  $\Box$  and  $\Diamond$  may be profitably treated as quantifiers over possible worlds. Thus, if we think that MPL claims like (1a<sub>MPL</sub>) and (1b<sub>MPL</sub>) are true, and that MPL inferences like (2a<sub>MPL</sub>) and (2b<sub>MPL</sub>) are valid, then, given the standard MPL semantics outlined above, it turns out that we are *ontologically committed to possible worlds*. So the semantics of QML, properly understood, requires that we be modal realists.

The semantics of other logical systems with expressive resources which outstrip those of MPL also commit us to the existence of possible worlds. Consider first-order modal predicate logic, or *quantified modal logic* (QML). The syntactical component of QML may be specified as follows:

*Primitive vocabulary of QML:*

1. Terms:
  - a. *Variables*:  $x, y, z$ , with or without numerical subscripts.
  - b. *Individual constants*:  $a, b, c$ , with or without numerical subscripts.
2. Predicate Letters:  $F^n-Z^n$ , for every  $n>0$
3. Quantifiers:  $\forall, \exists$ .
4. Connectives:  $\sim, \rightarrow, \&, \vee, \leftrightarrow, =$
5. Parentheses:  $(, )$
6. Modal Operators:  $\Box, \Diamond$
7. Nothing else is an expression of QML.

*Well-Formed Formulas of QML:*

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<sup>20</sup> See Braun (ms).

<sup>21</sup>In section 3 of this chapter, we'll return to these issues when we look at an argument for the conclusion that S4 (and hence S5), are not correct axiom systems for the study of the logic of metaphysical modality.

<sup>22</sup> See the appendix to this essay for formal proofs that all instances of axiom 4 are valid with respect to the class of standard transitive models, and that all instances of axiom 5 are valid with respect to the class of all standard Euclidean models.

1. If  $\pi^n$  is an n-place predicate, and  $\alpha_1, \alpha_2, \dots, \alpha_n$  are terms, then  $\pi^n \alpha_1, \alpha_2, \dots, \alpha_n$  is a wff.
2. If  $\alpha$  and  $\beta$  are terms, then  $(\alpha = \beta)$  is a wff.
3. If  $\Phi$  is a wff of QML, then so is  $\sim\Phi$ .
4. If  $\Phi$  and  $\Psi$  are wff's of QML, then so are  $(\Phi \& \Psi)$ ,  $(\Phi \vee \Psi)$ ,  $(\Phi \rightarrow \Psi)$  and  $(\Phi \leftrightarrow \Psi)$ .
5. If  $\Phi$  is a wff of QML, then so are  $\Box\Phi$ ,  $\Diamond\Phi$ .
6. If  $\alpha$  is a variable, and  $\Phi$  is a wff of QML, then so are  $\forall\alpha, \exists\alpha\Phi$ .
7. Nothing else is a wff of QML.

The semantics of QML is more complicated than the semantics discussed above in connection with MPL. But the crucial thing to note with respect to QML is that, like MPL, its semantics commits us to the existence of a plurality of possible worlds. Again, we specify a model,  $M_{QML}$ <sup>23</sup>, as an ordered n-tuple =  $\langle W, R, D, I \rangle$  such that

1.  $W$  is a non-empty set of possible worlds.
2.  $R$  is a binary relation of accessibility over  $W$ .
3.  $D$  is a non-empty set of individuals.
4.  $I$  is an interpretation function such that:
  - a. If  $\alpha$  is an individual constant, then  $I(\alpha) \in D$ .
  - b. If  $\pi^n$  is an n-place predicate, and  $w \in W$ , then  $I(\pi^n, w)$  is a set of n-tuples of  $D$ .

Here,  $W$  and  $R$  are the same as in our semantic model for MPL. The set  $D$  is the set of individuals over which the quantifiers range, and which serve as the denotations (or extensions) of the individual constants. The interpretation function  $I$  assigns, to each predicate, its extension at a given world in  $W$  in terms of sets of individuals from  $D$ . Intuitively, the extensions of predicates may differ from world to world. However, under the current interpretation, the denotation of the constants (or names) is fixed: in other words, the extension of a name does not vary from world to world.<sup>24</sup> However, the denotation of a variable term may change from world to world, depending on a given *assignment*. In general, we'll say that

<sup>23</sup> In what follows, I'll use ' $M_{QML}$ ' to designate semantic models of QML, in order to disambiguate between models of MPL and models of QML.

<sup>24</sup> This is equivalent to saying that the constants (or proper names) of the language of QML are *rigid designators*, in the sense of Kripke (1972). It's worth noting as well that, *under a particular assignment*, the logical properties of variables are akin to that of the constants or proper names of the language of QML: that is, a given variable under a particular assignment is a paradigmatically rigid designator. See Salmon (1990).

5. Where  $M_{QML}$  is of the form  $\langle W, R, D, I \rangle$ , then  $g$  is an *assignment of the variables for  $M_{QML}$*  iff:  $g$  is a function from the set of variables into the domain of  $M$ .

Thus, where  $\alpha$  is a term,  $M_{QML} = \langle W, R, D, I \rangle$ , and  $g$  an assignment for  $M_{QML}$ , then the *denotation for  $M_{QML}$  under assignment  $g$* ,  $|\alpha|_{M,g}$ , is that function from terms to members of the domain of  $M_{QML}$  such that

- a. If  $\alpha$  is an individual constant, then  $|\alpha|_{M,g} = I(\alpha)$ .
- b. If  $\alpha$  is a variable, then  $|\alpha|_{M,g} = g(\alpha)$ .

The valuation function for  $M_{QML}$  under an assignment  $g$ ,  $V_{M,g}$ , may then be specified as that function from pairs of wffs of the language of QML and worlds in  $M_{QML}$ , onto  $\{0,1\}$  such that:

1. If  $\pi^n$  is an  $n$ -place predicate, and  $\alpha_1, \alpha_2, \dots, \alpha_n$  are terms, then  $V_{M,g}(\pi^n \alpha_1, \alpha_2, \dots, \alpha_n, w) = 1$  iff:  $\langle |\alpha_1|_{M,g}, |\alpha_2|_{M,g}, \dots, |\alpha_n|_{M,g} \rangle \in I(\pi^n, w)$ .
2. If  $\alpha$  and  $\beta$  are terms, then  $V_{M,g}(\alpha = \beta, w) = 1$  iff:  $|\alpha|_{M,g} = |\beta|_{M,g}$ .
3. If  $\Phi$  is a wff, then  $V_{M,g}(\sim \Phi, w) = 1$  iff  $V_{M,g}(\Phi, w) = 0$ .
4. If  $\Phi$  and  $\Psi$  are wff's, then  $V_{M,g}(\Phi \& \Psi, w) = 1$  iff  $V_{M,g}(\Phi, w) = 1$  and  $V_{M,g}(\Psi, w) = 1$ .
5. If  $\Phi$  and  $\Psi$  are wffs, then  $V_{M,g}(\Phi \vee \Psi, w) = 1$  iff either  $V_{M,g}(\Phi, w) = 1$  or  $V_{M,g}(\Psi, w) = 1$ .
6. If  $\Phi$  and  $\Psi$  are wffs, then  $V_{M,g}(\Phi \rightarrow \Psi, w) = 1$  iff if  $V_{M,g}(\Phi, w) = 1$ , then  $V_{M,g}(\Psi, w) = 1$ .
7. If  $\Phi$  and  $\Psi$  are wffs, then  $V_{M,g}(\Phi \leftrightarrow \Psi, w) = 1$  iff  $V_{M,g}(\Phi, w) = 1$  if and only if  $V_{M,g}(\Psi, w) = 1$ .
8. If  $\Phi$  is a wff, then  $V_{M,g}(\Diamond \Phi, w) = 1$  iff there is a  $w' \in W$  such that  $wRw'$  and  $V_{M,g}(\Phi, w') = 1$ .
9. If  $\Phi$  is a wff, then  $V_{M,g}(\Box \Phi, w) = 1$  iff for all  $w' \in W$  such that  $wRw'$ ,  $V_{M,g}(\Phi, w') = 1$ .
10. If  $\alpha$  is a variable and  $\Phi$  is a wff, then  $V_{M,g}(\forall \alpha \Phi, w) = 1$  iff for all  $d \in D$ ,  $V_{M,g[\alpha/d]}(\Phi, w) = 1$ .<sup>25</sup>
11. If  $\alpha$  is a variable and  $\Phi$  is a wff, then  $V_{M,g}(\exists \alpha \Phi, w) = 1$  iff there is at least one  $d \in D$  such that  $V_{M,g[\alpha/d]}(\Phi, w) = 1$ .

Unlike MPL, the language of QML is appropriate for the symbolization of modal claims and arguments in which modal operators are given *narrow* scope. Consider the following:

<sup>25</sup> Here, the assignment function  $V_{M,g[\alpha/d]}$  is that assignment which is just like  $g$  save for the assignment of  $\alpha$  to  $d$ .

- (3a) Someone could have lost the 2008 American Presidential election.  
 (3b) Something exists that is necessarily human.

Under the intended interpretation of  $\Diamond$  and  $\Box$ , and where  $L$  is the predicate of *having lost the election*, and  $H$  the predicate *human*, (3a & b) may be regimented in the language of QML as:

- (3a<sub>QML</sub>)  $\exists x \Diamond Lx$   
 (3b<sub>QML</sub>)  $\exists x \Box Hx$ ,

respectively. Just as in the case of MPL, the modal operators  $\Diamond$  and  $\Box$  may be understood, in the metalanguage and *under their intended interpretation*, as *quantifiers* over possible worlds in  $W$ . For example, consider (3a<sub>QML</sub>). From clause 12 in the above semantics for QML, (3a<sub>QML</sub>) is true if, under some assignment  $g$ , there is some  $d$  in  $D$  such that  $\Diamond Lx$  is true of  $d$  under  $g$ . And from clause 9, we have it that  $\Diamond Lx$  is true of  $d$  under  $g$ , at a world  $w$ , if there *exists* a world  $w'$ , accessible under  $R$  from  $w$ , at which  $d$  is  $L$ .<sup>26</sup>

Modal *inferences* that are best symbolized by letting the modal operators take narrow-scope include:

- (4a) i. Barack Obama could have lost the 2008 American Presidential election.  
       ii. Therefore, something exists that could have lost the American Presidential election.  
  
 (4b) i. Saul Kripke is necessarily human.  
       ii. Therefore, something exists that is necessarily human.

In the language of QML:

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<sup>26</sup> Though the semantics for QML does not specify that the members of a domain of world  $w$  exist as parts of  $w$ , it seems plausible to think that any member of any domain of any world exists at that world, and that existence at a world is best understood in terms of parthood. It follows from this that worlds overlap, and that a given individual can literally be a part of more than one possible world. On an alternative conception, worlds never overlap with respect to individuals; instead, worlds represent that such-and-such is the case by containing representational proxies, surrogates, or *counterparts*. In Chapter 2, I develop a metaphysics of possible worlds which allows for overlap, and in Chapter 3, show how the view avoids traditional worries associated with overlap.

- (4a<sub>QML</sub>) i.  $\Diamond Lb$   
 ii.  $\therefore \exists x \Diamond Lx$

- (4b<sub>QML</sub>) i.  $\Box Hk$   
 ii.  $\therefore \exists x \Box Hx$ <sup>27</sup>

Consider (4a<sub>QML</sub>). (4a<sub>QML</sub>) is valid, given the above semantics for  $M_{QML}$ . Assume that  $\Diamond Lb$  is true. Since the constant  $b$  denotes Obama in every world, it follows (from clause 9) that there is a  $w' \in W$  such that  $wRw'$  and  $Lb$  is true in  $w'$ . The conclusion follows trivially, given clause 12 of the semantics: given that  $Lb$  is true in  $w'$ , there is at least one  $d \in D$  (i.e., Obama) such that  $\Diamond Lx$  is true under an assignment of Obama to  $d$ . And similar considerations hold for (4b<sub>QML</sub>). Again, the crucial thing to note is that if we think that modal claims like (3a & b) are true, and that modal inferences like (4a & b) are valid, and that these modal claims and inferences are best symbolized in the formal language of QML, then, given the semantics as specified by the model  $M_{QML}$ , we are committed to the existence of possible worlds.

It is worth noting that our model  $M_{QML}$  is what logicians refer to as a *common domain* (CD) model. According to CD model semantics, the domains of each world in  $W$  are co-extensive.<sup>28</sup> A noteworthy feature of CD semantics is that they appear to validate both the Barcan Formula (BF):

$$(BF) \quad \Diamond \exists x \Phi x \rightarrow \exists x \Diamond \Phi x,$$

which says that, if it is possible that there exists something that is  $\Phi$ , then there exists something that is possibly  $\Phi$ , as well as its converse:

$$(CBF) \quad \exists x \Diamond \Phi x \rightarrow \Diamond \exists x \Phi x.$$

<sup>27</sup> Here, 'b' and 'k' are constants which (rigidly) denote Obama and Kripke, respectively.

<sup>28</sup> As in Barcan-Marcus (1961).

Here's a brief, informal sketch of how BF is valid in all classes of CD models for QML.<sup>29</sup> Suppose that we assume that BF is false in some world  $w$  in some model  $M$ . Then (i):

$$(i) \quad \sim \Diamond [(\Diamond \exists x \Phi x) \ \& \ \sim (\exists x \Diamond \Phi x)]$$

will be false in  $w$  in  $M$ . So (ii):

$$(ii) \quad \Diamond [(\Diamond \exists x \Phi x) \ \& \ \sim (\exists x \Diamond \Phi x)]$$

is true at  $w$  in  $M$ . Given the semantic clause governing  $\Diamond$  in the above CD model semantics, it follows from (ii) that there will be some world  $w'$  such that  $wRw'$  at which (iii):

$$(iii) \quad \Diamond \exists x \Phi x \ \& \ \sim \exists x \Diamond \Phi x$$

is true. But then from conjunction elimination, both (iv) and (v):

$$(iv) \quad \Diamond \exists x \Phi x$$

$$(v) \quad \sim \exists x \Diamond \Phi x$$

are also true in  $w'$ . But then from (iv), and the semantic clause for  $\Diamond$ ,

$$(vi) \quad \exists x \Phi x$$

is true at some world  $w''$  such that  $w'Rw''$ . From semantic clause 12, this is the case only if there is some  $d$  in  $D$  such that:

$$(vii) \quad \Phi d$$

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<sup>29</sup> This informal sketch draws on the conclusion of Barcan-Marcus (1961). For a more formal proof of the universally quantified versions of BF and CBF in all classes of CD models, see the appendix to this essay.

is true in  $w''$  (under an assignment of  $d$  to  $x$ ). However, from (v),

$$(viii) \quad \exists x \Diamond \Phi x$$

is false in  $w'$ . So (again from clause 12) there is no  $d$  in  $D$  such that:

$$(ix) \Diamond \Phi d$$

is true in  $w'$ . But then (again, given the relevant semantic clause for  $\Diamond$ ), it is *not the case* that there exists a world  $w''$  such that  $w'Rw''$  in which  $\Phi d$  is true (under the relevant assignment). Since this contradicts (vii), our initial assumption is false: BF is valid with respect to every CD model semantics for QML.

BF and CBF are controversial. Although I won't enter here into a formal discussion of the reasons why many logicians and philosophers reject CB and CBF, the basic objection, in the case of BF, is fairly straightforward. Although I don't actually have a brother, it seems that I could have had a brother. But from BF, if it is possible that I have a brother, then there *exists* something that is possibly my brother. And intuitively, it is not the case that there exists something that is possibly my brother. Considerations such as these motivate many logicians to adopt instead what is called a *variable-domain* (VD) semantics for QML, according to which each world  $w$  in  $W$  is assigned a set of objects that constitute its domain such that the domains of different worlds may overlap, but may also be disjoint (intuitively, on a variable-domain semantics for QML, the domains of different worlds may fail to be co-extensive with the domain of the actual world).<sup>30</sup>

Although I won't present a proof of this here, it turns out that BF and its converse are false when evaluated with respect to some VD models for QML. The reason for this has to do with the relationship between the quantifiers and the (variable) domains in such models. In CD models, the quantifiers are interpreted as ranging over the domain of each world in  $W$ . In VD models, by contrast, quantification is restricted to the domain of a

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<sup>30</sup> A Kripke-style model theoretic semantics for QML is a variable-domain semantics. See Kripke (1963).

given world. And since the domains of different worlds may be disjoint, it doesn't follow that, where the antecedent of BF is true with respect to a given world  $w$ , that the consequent is also true *in*  $w$ . Thus some VD models invalidate BF and its converse. And since some logicians and philosophers think that BF and CBF are intuitively false, this makes VD semantic models an attractive alternative to CD models.<sup>31</sup>

An important issue remains: how should we *interpret* the set of worlds  $W$ ? As a technical device in the semantics for MPL and QML, the worlds in  $W$  might be anything at all, provided there are enough of them. And the argument for realism about possible worlds certainly doesn't tell us anything about the *nature* of the possible worlds, other than that they can be thought of as being ways that things could have been. An answer to the question of interpretation will be an explanation of what, exactly, possible worlds *are*, and what they are like. These are metaphysical issues. In the next chapter, I develop a metaphysical picture of possible worlds that answers the question of interpretation. The remainder of this chapter will be primarily concerned with laying out some further issues that lie in the background.

## 2. *Actualist and Possibilist Modal Realism:*

An important issue in the metaphysics and ontology of modality is a debate between *actualist* and *possibilist* modal realists. There are at least two ways of characterizing the thesis of actualism. First, according to philosophers like David Armstrong and Ben Caplan, the debate between actualists and possibilists concerns the existential status of merely possible objects, including possible worlds themselves.<sup>32</sup> Consider talking chimpanzees. Since there aren't actually any talking chimpanzees, but there could have been, talking chimpanzees are merely possible. According to Caplan's construal of the debate, possibilists hold that merely possible objects (like talking

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<sup>31</sup> I think that there are good reasons for adopting a CD semantics for QML. However, the metaphysics of worlds developed in the next chapter is in principle compatible with both CD and VD semantic models.

<sup>32</sup> See Caplan (2002), Armstrong (1989). A non-Meinongian version of actualism is defended in Armstrong (1997). Of course, the actual world is a possible world. By "merely possible," I mean to describe those worlds that represent *alternative* possibilities for the actual world (as well as the individuals that are parts of such worlds). In what follows, I focus on Caplan's characterization of actualism.

chimps) exist and are just as real as actual objects (like you and I), and actualists hold that merely possible objects *don't exist*, and aren't real at all.<sup>33</sup>

Thinking about the debate in this way leads to some puzzling issues for actualists. This is because it seems that we are able to think and talk about merely possible objects, and, more generally, it seems possible for such objects to actually instantiate properties and stand in relations. For example, it seems that such objects (actually) have the property of *being merely possible*, and that we often refer to, and think about, merely possible objects. So it seems that merely possible objects enter into relations with actual referrers and actual thinkers. But it is difficult to see how this could be, if merely possible objects don't exist, and aren't real at all.

Following Caplan, we might attempt to resolve these worries by endorsing *non-serious* actualism:

*Non-Serious Actualism:* Objects can have properties and enter into relations in worlds in which they do not exist.

If non-serious actualism is true, then merely possible objects can have properties and enter into relations at worlds in which they do not exist. Alexius Meinong famously argued that some objects do not exist (and that they don't have any other sort of being, either). But he also held that some nonexistent objects instantiate properties and stand in relations.<sup>34</sup> If actualism is the thesis that merely possible objects don't exist, and non-serious actualism is the view that merely possible objects can actually instantiate properties and enter into relations with things that actually exist, then non-serious actualism amounts to a version of Meinongianism.

An alternative to non-serious actualism is *serious* actualism:

*Serious Actualism:* Objects can have properties and enter into relations only in worlds in which they exist.

If serious actualism is true, then merely possible objects can have properties and enter into relations only in worlds in which they exist. And since merely possible objects do

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<sup>33</sup> Caplan (2002), p. 23.

<sup>34</sup> Meinong (1960).

not exist (on Caplan's characterization of the thesis of actualism), it follows that if serious actualism is true, then merely possible objects cannot actually have properties or enter into relations at all. So, if serious actualism is true, we can't refer to, or think about, merely possible objects (because there aren't any).<sup>35</sup>

So, if actualism is the thesis that merely possible objects do not exist and aren't real at all, then Meinongianism/non-serious actualism would at least allow one to say that thought and talk about merely possible objects is legitimate (Caplan endorses non-serious actualism for basically these reasons). Now, Meinongianism is a notoriously controversial ontological thesis.<sup>36</sup> And while I don't intend to argue for or against it here, I think that if a version of actualism is available that doesn't require commitment to Meinongianism (but still counts thought and talk about mere possibilities as legitimate), then that version of actualism should be given serious consideration.

Here is a characterization of actualism that satisfies this constraint. The dispute between actualists and possibilists should not be seen as a dispute over the existential status of merely possible objects, but instead as a dispute over their *actual* existential status. Consider absolutely everything.<sup>37</sup> Actualists and possibilists can agree that whatever there is, in any sense, exists; furthermore, *each* may hold that claims of absolute possibility and necessity amount to existential quantification over possibilia. But here's the crucial difference: for the actualist, whatever there is, or whatever exists, *is also actual* (and vice-versa). The possibilist disagrees. According to the possibilist, some

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<sup>35</sup> On this characterization of actualism, then, serious actualism amounts to a serious version of anti-realism about modality.

<sup>36</sup> For arguments against, see Lewis (1990), van Inwagen (1977); for arguments in favor, see Routley (1980), Priest (2005).

<sup>37</sup> It is a matter of some controversy whether or not absolutely unrestricted quantification is even possible, that is, whether it is ever possible to quantify unrestrictedly *over absolutely everything*. For discussion, see the essays in Rayo and Uzquiano (2007). Perhaps quantification is always implicitly restricted. If so, then we might wish to say that whatever there is, with respect to any (contextually or otherwise) restricted domain exists. At any rate, in what follows I assume that absolutely unrestricted quantification is possible. Indeed, there are good reasons for thinking that metaphysics itself is only possible if unrestricted quantification is legitimate. The reasons for this are straightforward: metaphysicians, typically, are in the business of describing the fundamental features of reality. Now, take any paradigmatically metaphysical thesis, such as "everything is concrete," "there are no abstract objects," or "everything is spirit." Surely, philosophers who advance such theses do not intend them to hold for some limited corner of reality; instead, they are (typically) intended to hold true for any object whatsoever. Thus, typically, metaphysics requires that absolutely unrestricted quantification be legitimate.

things that exist are *not actual*. Such entities are merely possible (but they exist nonetheless).<sup>38</sup>

To see the difference, consider the modal sentence “Possibly, there exist talking chimpanzees.” Since (as we saw above) modal operators may be profitably treated as quantifiers over worlds, we might formalize this sentence in the language of first-order predicate logic by letting the predicate *P* symbolize “is a part of,” and *C* “is a talking chimpanzee.” Quantifying directly over worlds, we have:

$$(1) \exists x \exists w (Pxw \ \& \ Cx).$$

Now, the possibilist will interpret the quantifiers in (1) as ranging over *non-actual* worlds and individuals; therefore, if the possibilist reading is the correct metalinguistic interpretation, then there (unrestrictedly) exists a non-actual possible world having, as a part, a non-actual individual which is a talking chimpanzee. The actualist, by contrast, is committed to the thesis that existence just is *actual* existence.<sup>39</sup> So what the actualist should say is that the possible worlds and individuals quantified over in (1) are just more of what there actually is, since the actualist takes her quantifiers to range over only actual entities. On this construal, the actualist can accept the fundamental thesis of modal realism (that possible worlds exist), and actualist modal realism may be characterized as the conjunction of theses (A1)-(A3):

- (A1) There exists a plurality of possible worlds.
- (A2) Each possible world actually exists.
- (A3) (Absolutely) everything that exists is actual.<sup>40</sup>

And possibilist modal realism may be characterized as the *acceptance* of (A1), and the *denial* of (A2) and (A3). In other words, possibilists accept that there exists a plurality of

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<sup>38</sup> See Lewis (1986a), pp. 101-108, Yagisawa (2005).

<sup>39</sup> More carefully, actualists are committed to the unrestricted biconditional: whatever exists is actual, and whatever is actual exists.

<sup>40</sup> Here, I follow the exposition given by Divers (2002). See also Menzel (2003).

possible worlds, but deny that each possible world actually exists, and (therefore) also deny that absolutely everything that exists is actual.<sup>41</sup>

### 2.1. *Varieties of Actualist Modal Realism:*

The metaphysical account of possible worlds that I develop in the next chapter, in response to the question of interpretation raised above at the end of Section 1, is a version of actualist modal realism, understood in terms of A1-A3. But it's worth noting here that the actualist literature in the metaphysics of possible worlds has traditionally been dominated by at least four distinct conceptions of what type of actually existing objects possible worlds are. First, according to the *sententialist*, a possible world *w* is identical to a set of sentences *T* such that *T* is *maximal* (that is, for any sentence *S*, either *S* is a member of *T* or *S* fails to be a member of *T*) and *consistent* (that is, it is possible for every member of *T* to be true together).<sup>42</sup> According to the *propositionalist*, a possible world *w* is identical to a proposition, *P*, such that *P* is *maximal* (that is, for any proposition *P'* ( $\neq P$ ), if it were the case that *P* were true, then either *P'* or its complement,  $\sim P'$ , would be true) and *possible* (that is, *P* is possibly true).<sup>43</sup> According to the *combinatorialist*, a possible world *w* is identical to a maximal, possible state of affairs. A state of affairs *S* is *possible* if it is possible for *S* to obtain. And a state of affairs *S* is *maximal* if, for any state of affairs *S'*, either *S* includes *S'* or *S* precludes *S'*.<sup>44</sup>

The version of actualist modal realism developed and defended in this essay is what I call *world-stateism*. Although it is sometimes unclear which actualist philosophers qualify as world-stateists, the view is suggested in some early remarks of Saul Kripke's, and versions of it are explicitly endorsed by Robert Stalnaker, Peter Forrest, John Bigelow, Robert Pargetter, and more recently by Scott Soames and Jeffrey C. King.<sup>45</sup> It is

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<sup>41</sup> One might wonder what connection, if any, obtains between the possible worlds to which the actualist modal realist is committed, and the myriad "quantum worlds" posited by certain "multiple worlds" interpretations (MWI) of quantum phenomena. It seems to me that the two issues are largely orthogonal, thus, I omit discussion of the matter here. However, I briefly address the question in section 4 of the technical appendix. Thanks to Thomas Kucera for bringing the matter to my attention.

<sup>42</sup> Robert Adams is the chief proponent of sententialism. See Adams (1974).

<sup>43</sup> Alvin Plantinga is a propositionalist. See Plantinga (1976).

<sup>44</sup> David Armstrong defends a combinatorial conception of possible worlds in his (1989), (1997), and (2004).

<sup>45</sup> See Kripke (1972); Stalnaker (1976), (1996); Forrest (1986a), (1986b); Bigelow (1986), (1988); Bigelow and Pargetter (1989); Soames (2003), (2007); King (2007a), (2007b).

also consistent with comments made by Nathan Salmon.<sup>46</sup> According to the world-stateist, a possible world  $w$  is identical to a *property*,  $\phi$ , such that  $\phi$  is *maximal* and  $\phi$  is *possibly instantiated*. In Chapter 2, we'll look more closely at different ways that the notion of a maximal, possibly instantiated property might be developed.

### 3. *Extended Actualist Modal Realism:*

Following Takashi Yagisawa, let's call modal realists who hold that, in addition to possible worlds and individuals, there also exist *impossible* worlds and individuals, *extended modal realists*.<sup>47</sup> In the remainder of this chapter, I argue that world-stateists should be extended modal realists.

I'll begin with an argument, from Nathan Salmon, for the conclusion that there exist *metaphysically* impossible worlds. Central to Salmon's argument is the following principle governing the possible range of variation in constitutive matter for material artifacts. Call this the *Variation Principle* (VP):

(VP) If a given artifact  $x$  is originally constructed from a hunk of matter  $y$ , then  $x$  could have been originally constructed from a hunk of matter  $z$  which is sufficiently similar to, and substantially overlaps,  $y$ ; but  $x$  could not have been originally constructed from any hunk of matter  $z'$  which is not sufficiently similar to, and does not substantially overlap,  $y$ .<sup>48</sup>

VP allows that a given material artifact, like a table, could have been constructed from a hunk of matter that varies *slightly* in its constitution from the hunk of matter it in fact is actually originally constructed from. The idea behind the argument is that small variations in constitutive matter, while possible, *add up*, and it turns out that there exist worlds where a given material artifact is not constituted by the same matter it is actually originally constructed from. These are metaphysically impossible worlds.

To illustrate, consider the following *Ship of Theseus* style example. Suppose there is a ship,  $S$ , that is made up of some planks of wood. It seems possible that  $S$  could have

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<sup>46</sup> Salmon (1984), (1989).

<sup>47</sup> Yagisawa (1988).

<sup>48</sup> Salmon (1984).

been made up out of exactly the same planks save for having one plank removed and exchanged with a completely different plank. But then consider S after having one original plank exchanged for another. Clearly, S could have also been made with one different plank (that is, with two different planks from those that actually originally made up S). Continuing along these lines, it seems plausible to say that it is possible that it is possible that it is possible (repeat  $n$  times) that S be made up out of  $n$  different planks, where  $n$  is the number of planks out of which S was originally made up. But intuitively, it is not possible *simpliciter* that S is made up of  $n$  different planks. Thus, any world at which S is wholly constructed from different planks will be a metaphysically impossible world, relative to the actual world.<sup>49</sup>

The argument generalizes for any material artifact whatsoever. Here is a slightly more technical version. The argument itself proceeds indirectly, through an argument that neither S4 nor S5 modal logic represents a correct system of reasoning about the logic of *metaphysical* possibility and necessity. We will focus here on the case against S4.<sup>50</sup> Recall that the characteristic axiom of the system S4 is the iteration axiom (4):

$$(4) \quad \Box\Phi \rightarrow \Box\Box\Phi$$

Call the actual world “@.” Consider some artifact  $x$  at @ such that  $x$  is originally constituted by a hunk of material  $y$ . Now consider some distinct hunks of material  $z$  and  $z'$  such that (i)  $z$  contains some of the molecules of  $y$ , (ii)  $z$  substantially overlaps  $y$ , (iii)  $z'$  contains some of the molecules of  $z$ , and (iv)  $z'$  substantially overlaps  $z$  (but not  $y$ ). Next, assume that VP is necessarily true. Given the necessity of VP, it follows that *necessarily*,  $x$  is not constituted by  $z'$ . Now, if S4 represents a correct system of reasoning about possibility and necessity, then it *ought* to follow (by axiom 4) that it is *necessary that it is necessary* that  $x$  is not constituted by  $z'$ . But it does not. Note that, by VP,  $x$  *could have been* constituted by  $z$ ; therefore, there is a world  $w$ , accessible from @, at which  $x$  is originally constituted by  $z$ . Now, given VP and our descriptions of  $z$  and  $z'$ , *if*  $x$  had been constituted by  $z$ , then *it would have been* the case that  $x$  *could have been* constituted by  $z'$ .

<sup>49</sup> Braun (ms). Note though that the ship will be metaphysically possible relative to some worlds. More on this below.

<sup>50</sup> It is worth noting that, since the axioms of S4 are derivable from S5, then, if the argument against S4 succeeds, a parallel argument against S5 will be straightforward.

So, there is a world  $w'$ , *accessible from*  $w$ , at which  $x$  is originally constituted by  $z'$ .  $w'$  is therefore *possibly* possible, from the perspective of  $@$ . So, it follows that it is *not* necessarily necessary, at  $@$ , that  $x$  is not constituted by  $z'$ . Since it follows from this that the relation of accessibility  $R$ , on the set of worlds  $W$ , is *not* transitive, and since S4 requires this in order for instances of its characteristic axiom schema (4) to be valid, it follows that (S4) does not represent a correct system of reasoning about the logic of metaphysical modality.<sup>51</sup> Given the fact that, at  $@$ ,  $x$  is necessarily not originally constituted by  $z'$ , it follows that any world in which  $x$  is constituted by  $z'$  is metaphysically inaccessible from  $@$ . And  $w'$  is such a world. So,  $w'$  is *metaphysically impossible*, from the perspective of  $@$ . Since we should think that worlds like  $w'$  exist, we should be extended modal realists. Or so Salmon argues.

The most vocal opponent of extended modal realism is David Lewis. Although Lewis's objection is complex<sup>52</sup>, it is ultimately motivated by a rejection of VP. Lewis is a Humean. Hume famously held that there simply are no absolutely necessary connections between distinct existences, and that any talk of such absolutely necessary connections is unintelligible. Some philosophers call this thesis *Hume's Dictum* (HD).<sup>53</sup> Lewis subscribes to HD, and also to the following variant of HD, the principle of *Unrestricted Recombination* (UR):

UR: Recombining parts of different possible worlds always yields a possible world.<sup>54</sup>

Given HD, Lewis thinks that there is no sense in speaking of an absolutely necessary connection between any material artifact and its original constitutive matter. Given UR, Lewis thinks that a world at which a given material object is constituted by a hunk of matter wholly distinct from the hunk of matter it is in fact originally constituted from is a legitimate possible world. We have a material artifact,  $m$ , in one possible world  $w$ . We have a hunk of matter  $y$  in another. Let  $y$  be wholly distinct from the matter  $x$  that constituted  $m$  in  $w$ . From UR, there exists a possible world  $w'$  where  $y$  constitutes  $m$ .

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<sup>51</sup> Salmon (1984). See the appendix for a proof of the characteristic axiom schemas S4 and S5, in their respective classes of standard models.

<sup>52</sup> See his (1986a), at pp. 221-248.

<sup>53</sup> For discussion, see Wilson (forthcoming).

<sup>54</sup> Lewis (1986a), pp. 86-88. Elsewhere, Lewis calls this the "principle of plenitude."

*Pace* Salmon, *w'* is not metaphysically impossible at all. There are no metaphysically impossible worlds, for Lewis (instead, *w'* is just more of what there is: another possible world).

In endorsing UR, Lewis denies VP. So the question of whether or not *w'* is metaphysically impossible depends on whether or not VP is necessarily true. And, since VP is plainly a non-trivial *essentialist* principle governing the modal relation between a given material artifact and the matter from which it is originally constituted, the Lewis-Salmon debate over metaphysical impossibility is a debate over non-trivial essentialism.

It's worth noting that, while Salmon's argument requires only the truth of VP, there are additional, intuitively plausible essentialist principles from which an argument structurally similar to Salmon's might be derived. In addition to VP, philosophers have posited essentialist principles governing the relation between natural chemical kinds (like gold) and their atomic number; between members of biological species kinds (like tigers) and certain biological class properties (like the property of *being a mammal*); or between instances of natural substance kinds (like water) and facts about their underlying chemical microstructure. Philosophers who accept UR in full generality are committed to denying these essentialist principles.<sup>55</sup> Consider the property of *being a tiger*, and the biological class property of *being an amphibian*. From UR, there is a *possible* world where these properties are co-instantiated. Thus, if UR is accepted in full generality, then it will turn out to be *possible* that a tiger has the property of *being an amphibian*. This seems highly counterintuitive to many philosophers.<sup>56</sup>

Of course, one may still consistently reject VP in favor UR. *World-stateists*, however, have an even stronger argument for the conclusion that there exist metaphysically impossible worlds. The argument has the additional advantage of not relying on any controversial essentialist principles. As we noted above, the world-stateist identifies the *possible* worlds with suitably complex properties that might have been

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<sup>55</sup> For discussion, see Salmon (1981), Mackie (2006), and Robertson (2008).

<sup>56</sup> Salmon (1981), pp. 214-219. One reason for this is that these non-trivial essentialist principles provide an intuitive *principle of cross-world identification*. In the case of VP, it seems plausible to think that it is the essential relation that holds between a material artifact *x* and its constitutive matter that allows us to legitimately talk about alternative ways that *x could be*. Such talk requires that we are able to identify, in some sense, the very same artifact *x* in the total space of possibilities, or possible worlds. And we should agree, with Salmon, that something like VP constitutes just such a principle of cross-world identification.

instantiated. Suppose the world-stateist holds that such properties are structured, and literally have, as proper parts, simpler properties and relations. Now, just as there are complex, structured properties that could have been instantiated, there are also complex, structured properties that *couldn't* be instantiated. Among these are *logically impossible* properties. Consider the relatively simple properties of *being red all over* and *not being red all over*. And suppose that conjunction is one way for a complex property to be composed out of simpler properties.<sup>57</sup> If so, then there exists the complex, conjunctive property, *being red all over and not being red all over*, which has these simpler properties as proper constituents. Furthermore, there is no reason in principle why this property could not itself be a constituent of some larger *world sized* structured property that corresponds to a world. However, since it contains the property of *being red all over and not being red all over* as a part, it will be logically impossible for this world-property to be instantiated. So, this world-property represents a logically impossible world. Furthermore, since any logical impossibility is also a metaphysical impossibility, the world-stateist can conclude that there exist both logically and metaphysically impossible worlds. Since this argument for impossible worlds does not require any controversial assumptions about essence, it is immune to the Lewis objection. World-stateists, therefore, should be extended modal realists.<sup>58</sup>

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<sup>57</sup> Later, we'll look at more sophisticated accounts of how simpler properties can be combined to form complex structured properties. But the argument for extended modal realism will apply to those accounts as well, so it's best to keep things simple at this point.

<sup>58</sup> King (2007) gives a similar argument. Unlike King's, however, the above argument for logically impossible worlds does not require that we subscribe to any non-trivial essentialist principles. Lewis finds the notion of a logically impossible world "incomprehensible." He argues as follows: assume that there exists a logically impossible world where the law of excluded middle fails, and for any world  $w$ , let the sentential operator 'at- $w$ ' restrict the domain of quantification to the domain of  $w$ . And let's say that 'at- $w$ ,  $\Phi$ ' is true if and only if  $\Phi$  is true at  $w$ . By assumption, some world  $w$  exists such that, at- $w$ ,  $\Phi$  &  $\sim\Phi$ . Now, since linguistic operators that restrict a quantifier to a given domain (like 'at') have no effect on the interpretations that we give to the logical connectives, the phrase 'at- $w$ ,  $\Phi$  &  $\sim\Phi$ ' expresses a proposition equivalent to 'at- $w$ ,  $\Phi$  & not: at- $w$ ,  $\Phi$ .' If that's right, then for us to speak truthfully *about*  $w$ , at the actual world, requires the contradiction 'at- $w$ ,  $\Phi$  & not: at- $w$ ,  $\Phi$ ' to be true at the actual world. But this is incoherent, according to Lewis, since "there is no subject matter, however marvelous, about which you can tell the truth by contradicting yourself." Therefore, there exists no such world as  $w$ .

Here's what the defender of extended modal realism ought to say in response. A logically impossible proposition is a proposition that cannot *possibly* be true. All this shows is that one cannot tell the truth about anything *possible* by asserting a logically impossible proposition. However, Lewis's argument gives us no reason to think that one cannot tell the truth about *impossibilia* by asserting a logically impossible proposition. So his conclusion does not follow. See Yagisawa (1988) for further arguments for extended modal realism. For a reply, see Lewis (1986a), p. 7, fn. 3, and Stalnaker (1996).

The main business of this chapter has been to motivate modal realism: the thesis that there exists a plurality of possible worlds that correspond, in some sense, to total ways that things could have been. Roughly, I drew on two sources of motivation for this thesis. First, the existence of a plurality of worlds helps us to understand modal phenomena like contingent and necessary truth, accident, necessity, and essence. And second, possible worlds are an indispensable element in the semantics of MPL and QML. Furthermore, in addition to realism about possible worlds, we saw above that world-stateists in particular have good reasons to believe in the existence of impossible worlds as well. In the remainder of this essay, I assume that actualist, extended modal realism is true. More specifically, I endorse world-stateism: the view that possible (and impossible) worlds are identical to actually existing properties. The main business of the next chapter will be providing a more thorough metaphysical account of these properties. After considering some earlier versions of the view, and an important objection, I close the chapter by presenting a novel version of world-stateism, modeled on recent work in the metaphysics of composition. In Chapter 3, I further refine the version of world-stateism I endorse in order to deal with some additional objections that might be raised.

## Chapter 2: World-Stateism and Structured Properties

### 1. *An Answer to the Question of Interpretation:*

In Chapter 1, we characterized actualist modal realism as the conjunction of theses (A1-A3):

- (A1) There exists a plurality of possible worlds.
- (A2) Each possible world actually exists.
- (A3) (Absolutely) everything that exists is actual.

We also left unanswered the question of interpretation. Seen from the perspective of the actualist, the question of interpretation amounts to this: given theses (A1-A3), what is a plausible metaphysical account of the members of *W* (the set of worlds that appears in the semantic component of QML)? Alternatively, what is a plausible metaphysics of possible worlds that satisfies (A2), the thesis that each possible world actually exists?

The answer I defend here is that possible worlds (or equivalently, the ways that things might have been) are *properties*.<sup>1</sup> Properties, roughly, include qualitative attributes: those qualities, features, or characteristics that things exemplify.<sup>2</sup> Different sorts of things exemplify different sorts of properties. For instance, first-order properties are qualitative attributes of ordinary, concrete individuals. Examples include the properties of *being wise*, *being snub-nosed*, and *being the philosopher who taught Plato*, all of which are exemplified by Socrates. But there are also second-order properties, like the properties of *being a set* (exemplified by every set), *being a property* (exemplified by all properties) or the property of *being someone's favorite property*, perhaps exemplified by *goodness*.

The above are examples of *monadic* properties, properties that are in principle instantiable by a single thing. *Polyadic* and *multigrade* properties are really *relations* that hold *between* one or more things.<sup>3</sup> Examples include the first-order relation of *being*

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<sup>1</sup> I use “property” where others use “universal.” Some philosophers have used “concept,” or “predicable,” in roughly the sense in which I use ‘property.’

<sup>2</sup> In addition, some philosophers have posited non-qualitative properties, such as identity properties, essences, or “haecceities.” I omit this complication in what follows since, in presenting the thesis of world-stateism I will be concerned primarily with qualitative properties.

<sup>3</sup> There is a standard definition of “relation” in set theory according to which a relation is identical to a set of *n*-tuples of objects. This is not how I am using “relation” here. Though such identifications may have

taller than, the relation of *being identical with* (a relation that everything bears to itself, and nothing else), and the second-order properties of *being a symmetrical relation* and *being a more abundant property than*. On the conception of properties employed in this essay, properties are *immanent*, or wholly located wherever they are instantiated.<sup>4</sup> In general, properties are distinguished from individuals in that they are capable of (repeatable) instantiation or exemplification, and because one property can be instantiated at the same time in different spatial locations.<sup>5</sup> Obama and Sarkozy, for instance, each (now) exemplify the property of *being a President*, and the members of the ordered pairs <Plato, Aristotle> and <Quine, Lewis> each stand in the *being a teacher of* relation.<sup>6</sup> In each of these cases, we have one property (or relation) that is exemplified, and hence wholly located in, more than one spatiotemporal region.

World-stateists hold that possible worlds are identical to certain suitably complex, *structured* properties that could have been instantiated. As we will see below, proponents of the view offer very different explanations of what it is for a property to be structured. However, given the actualist thesis (A3) above, these properties *actually exist*, and are for the most part uninstantiated.

World-stateism isn't a new view.<sup>7</sup> But modern interest stems from the work of Saul Kripke and Robert Stalnaker. Kripke, for instance, in the preface to *Naming and Necessity*, writes that instead of identifying a possible world with some sort of concrete, physical object, we should instead identify it with a "possible state (or history) of the world, or 'counterfactual situation'."<sup>8</sup> And Stalnaker, outlining the version of actualism he favors, writes that "the moderate modal realist [read: actualist] believes that the only

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technical value, I take properties and relations to be metaphysically primitive entities, irreducible to set theoretic notions. For discussion, see Chapter 4.

<sup>4</sup>For discussion, see Lewis (1983); Armstrong (1981), (1989), Williams (1953), (1986). This is not the only way of thinking about properties. For example, some philosophers think that properties are "transcendent," and that a property is never wholly located wherever it is instantiated. If properties are immanent, then it turns out that uninstantiated properties that could have been instantiated are wholly unlocated, but possibly wholly located.

<sup>5</sup> There may be exceptions. For example, though the property of *being red* might be instantiable at the same time in different spatial locations, we might think that the property of *being identical with Obama* is not.

<sup>6</sup> These examples might be problematic, if you think that the members of these ordered pairs no longer exist and that individuals can only enter into relations (and exemplify properties) at times at which they exist. If you think that some things can have properties and enter into relations even at times at which they exist, or if you think that everything exists at every time, then this complication may be ignored.

<sup>7</sup> Apparently, both Leibniz and Husserl held versions of it. See Leibniz (1952) and Husserl (1975a).

<sup>8</sup> Kripke (1972), at pp. 15-20.

possible worlds there are — ways things might have been — are (like everything that exists at all) elements of our actual world. They obviously are not concrete objects or situations, but abstract objects whose existence is inferred or abstracted from the activities of rational agents.”<sup>9</sup>

However, neither Kripke nor Stalnaker give an account of the metaphysics of those properties that ought to be identified with possible worlds. This came later, primarily through the work of Peter Forrest, John Bigelow and Robert Pargetter.<sup>10</sup> In the next section of this chapter, I present the versions of world-stateism developed by these philosophers. First, I present Peter Forrest’s version of world-stateism. I then turn to Bigelow and Pargetter.

In the third section of the chapter, I defend the metaphysical coherence of structured properties. I then present an argument (due to David Lewis) for the conclusion that we shouldn’t believe in structured properties at all. Since world-stateists hold that worlds are identical to a certain sort of structured property, world-stateism is in serious trouble if Lewis is right. I argue that while Lewis’s argument raises difficulties for the conception of structured properties defended by Bigelow and Pargetter, Forrest’s theory can be defended from Lewis. I conclude, in section 4, by presenting an *alternative* account of structured properties, modeled after Kit Fine’s recent work in the metaphysics of composition. Like Forrest’s, this conception of structured properties can be defended from Lewis’s objection. However, the metaphysics of structured properties I defend differs from Forrest’s in important ways and, in the next chapter, I show how the view succeeds in avoiding an objection targeted at versions of world-stateism like his.

## 2. *Theories of Structured Properties:*

It will be helpful to begin by briefly describing a relatively simple structured property, since those identified with entire possible worlds will differ not in kind, but only in complexity. The stock example from the literature is *methane*.<sup>11</sup> *Methane* is

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<sup>9</sup> Stalnaker (1976), p. 32.

<sup>10</sup> Forrest (1986a), (1986b); Bigelow (1986a), (1988); Bigelow and Pargetter (1989). Armstrong too was sympathetic to the project. See his (1986) reply to Lewis.

<sup>11</sup> Or perhaps less colloquially, *being methane* or even *being a methane molecule*. I omit this complication in what follows, since italics will serve to disambiguate between reference to a particular or the *property* it instantiates.

instantiated by methane molecules, each of which consists of five spatial parts. One, a carbon atom, instantiates *carbon*; the other four are hydrogen atoms and instantiate *hydrogen*.<sup>12</sup> Wherever *methane* is instantiated, it is wholly present.<sup>13</sup> Since each hydrogen atom is bonded to the single carbon atom, each of a methane molecule's four (ordered) carbon-hydrogen atom pairs stands in the relation of *being bonded to*. This is the intrinsic nature of a methane molecule.

*Methane* is a structured property for two reasons. First, its instantiation in some sense *involves* the instantiation of the simpler properties *carbon*, *hydrogen* and *bonded*. And second, there is a complex pattern of entailment between the instantiation of *methane*, on the one hand, and the instantiation of the simpler *hydrogen*, *carbon*, and *bonded*, on the other. *Involvement* is a neutral term that describes whatever relationship it is that obtains between a structured property and those corresponding simpler properties and relations to which it is related. Where  $\lceil\varphi\rceil$  and  $\lceil\psi\rceil$  are schematic expressions standing for properties, and P denotes the *parthood* relation, we may (allowing for second-order quantification over properties) define involvement more carefully as (INV):

$$(INV) \quad \forall x \forall \varphi \forall \psi \{[(\varphi \text{ involves } \psi) \leftrightarrow [P\psi\varphi \vee [\sim P\psi\varphi \ \& \ \Box(\varphi x \rightarrow \psi x)]]\}$$

It follows trivially from (INV) that every property involves itself. It also follows, from the right-hand side of (INV), that one way a given property  $\varphi$  can involve another property  $\psi$  is for  $\varphi$  to have  $\psi$  a *part*. Thus, involvement is either parthood, or it isn't. If it isn't, then some other relation must obtain between a structured property and the simpler properties to which it is related. We return to these issues below.

We begin with Peter Forrest. Forrest's theory is the first systematic articulation of the thesis that possible worlds are identical to structured properties.<sup>14</sup> His main contribution is to define three operations on properties which compose structured properties out of simpler properties. These are what he calls the "product," "contraction,"

<sup>12</sup> See the appendix to this essay for a diagram of a methane molecule.

<sup>13</sup> This is a consequence of an immanent, as opposed to transcendent, conception of properties. See Swoyer (2000) for discussion of the distinction.

<sup>14</sup> Forrest (1986a).

and “projection” operations.<sup>15</sup> Since, on this account, structured properties are *literally composed* out of simpler properties and relations, it follows from INV that the involvement relation, for Forrest, is best understood as the *parthood* relation.

Forrest gives the following example of the product operation on simpler properties. Consider two color properties G and H, such that G is the property of *being some determinate shade of green* and H *being some determinate shade of blue*. According to Forrest, the product of G and H, (G x H), will be that (determinate) relation of color contrast which holds of two individuals *x* and *y* iff G*x* and H*y*. Generalizing, the product operation takes as argument any two properties (or relations) R and S, where R is *m*-adic and S is *n*-adic, and yields the (*m* + *n*)-adic property or relation holding between each of *x*<sub>1</sub>, ..., *x*<sub>*m*</sub>, and *y*<sub>1</sub>, ..., *y*<sub>*n*</sub> iff R*x*<sub>1</sub>, ..., *x*<sub>*m*</sub> and S*y*<sub>1</sub>, ..., *y*<sub>*n*</sub>.<sup>16</sup>

Here’s how Forrest’s contraction operation works. Consider the two-place relation, *being to the left of*, and any *x* and *y* such that *x* stands in the *being to the left of* relation to *y*. Applying contraction to (this particular instance of) the *being to the left of* relation yields two monadic properties, one for each of the relata. These are the monadic properties of *being to the left of y* (instantiated by *x*) and *being such that x is to the left* (instantiated by *y*). More generally, contraction takes as argument any (*n*+1)-adic relation R, and yields an *n*-place property or relation S exemplified by any of the remaining *n* relata of R.

Finally, projection operates on simpler properties and relations as follows. Consider the property of *being a former President*, which many individuals instantiate. Next, consider the mereological *sum*, or fusion, of all the individuals that instantiate this property.<sup>17</sup> According to Forrest, their mereological sum instantiates the (projected) property of *being the sum of parts related under the property of being a former President*. Generalizing, we may think of projection as operating on the argument-places of properties. For any property F such that  $\exists x_1, \dots, x_n, Fx_1, \dots, x_n$ , projection yields a new,

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<sup>15</sup> I say “simpler” instead of “simple” for two reasons. First, many structured properties will be composed or constructed out of constituent properties that are themselves structured (and hence, non-simple). And second, I take it to be a legitimate, empirical possibility that there in fact are no ultimately atomic, or irreducibly simple, properties.

<sup>16</sup> Forrest (1986a), p. 17.

<sup>17</sup> The mereological sum of a group of *n* objects is that whole which consists of all *n* objects, regardless of the spatial or temporal distance that obtains between any of the *n* members.

monadic property *F*, instantiated by the *sum* of  $(x_1 + x_2 + \dots x_n)$ . This is the property of *being-the-sum-of-the-parts-related-by-R*.

Let's return to the stock example. Intuitively, *methane* is going to be something like the complex property, instantiated by methane molecules, of *being a molecule composed of a carbon atom bonded to four hydrogen atoms*. One way to derive this property consistent with Forrest's account would be to build in the simpler properties of *carbon* and *hydrogen*, by replacing talk of atoms instantiating *carbon* and *hydrogen* with talk of carbon and hydrogen atoms, and applying the projection operation on the relation of *being bonded to*.<sup>18</sup> Consider a given methane molecule *M*. As a methane *molecule*, *M* is the fusion of five spatial parts, *c*, *h*<sub>1</sub>, *h*<sub>2</sub>, *h*<sub>3</sub>, *h*<sub>4</sub>, such that *c* is a carbon atom (i.e., instantiates *carbon*) and each of the *h*s is a hydrogen atom (i.e., instantiates *hydrogen*). Let '*B*' denote the *being bonded to* relation. Since, in *M*, the carbon atom is bonded to each of the hydrogen atoms, we have  $cBh_1, h_2, h_3, h_4$ .<sup>19</sup> This instance of *being bonded to* has a projection: the property of *being the sum of five atomic parts, one of which is a carbon atom and the other four of which are hydrogen atoms, related under the property of being bonded to*. Since any molecule that instantiates this property will be a methane molecule, we might identify *methane* with this property.

On Forrest's view, possible worlds are *maximal* structured properties. A maximal structured property is a structured property (a property generated by the application of one or all of his three compositional operations on simpler properties) that instantiates a higher-order *completion* property: the property of *having no further properties*. According to Forrest, the concrete world (or what we might think of as the universe, or the concrete cosmos, or the fusion of us and all of our surroundings) instantiates one of these maximal structured properties. And each of the possible worlds are identical to actually existing, *uninstantiated* maximal structured properties that the cosmos could have instantiated. For obvious reasons, Forrest doesn't attempt to derive the maximal

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<sup>18</sup> Forrest doesn't say anything about the standard case, let alone about more complex properties. Presumably, *methane* could be derived by application of his three property-forming operations in a way that explicitly includes the properties of *hydrogen* and *carbon*; I make the simplifying assumption above in the interest of brevity.

<sup>19</sup> Although this is a non-standard way of denoting a relation, I employ this notation in order to make it intuitively clear that, in this case, *c* stands in the *bonded* relation to each of the *h*s, but that no member of the *h*s stands in this relation to any other member of the *h*s.

structured property that he thinks is actually instantiated (this would probably take a while). However, he holds that the product, contraction and projection operations, together with the completion property of *having no further properties*, are *in principle* sufficient to generate a suitably complex, maximal structured property corresponding to each way that things might have been, including the way that things are. He calls these properties “world-natures.”<sup>20</sup>

### 2.1. Bigelow and Pargetter: An Alternative Account of Structured Properties:

John Bigelow and Robert Pargetter argue for an alternative picture. Unlike Forrest, they hold that simpler properties do not literally compose more complex properties. In fact, all properties in their ontology are atomic, and have no (proper) parts at all. However, Bigelow and Pargetter hold that some (atomic) properties are *structured* in virtue of standing in certain brute, metaphysically necessary patterns of entailment towards other (atomic) properties. They suggest that *methane* is structured in this sense. Its instantiation (by a particular molecule M) entails that proper parts of M instantiate the properties of *carbon* and *hydrogen*, and that proper parts of M stand in the *being bonded to* relation to one-another. This means that for Bigelow and Pargetter, the involvement relation is best understood in terms of the relation of *necessary entailment*, and not as parthood.

Bigelow and Pargetter distinguish the following three ontological levels:

*Level One:* Particular individuals; e.g., atoms and molecules.

*Level Two:* Properties and relations of individuals from level one; e.g., *hydrogen*, *carbon*, and *being bonded to*.

*Level Three:* Higher-order properties and relations of *proportion* that hold among the properties and relations at level two; e.g., *being co-instantiated with*, *having the same number of instances as*, *having twice as many instances as*, and *being a property*.<sup>21</sup>

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<sup>20</sup> Forrest (1986a), p. 21.

<sup>21</sup> Elsewhere, Bigelow and Pargetter call this a ‘three level theory of quantities.’ See their (1991) for discussion, at pp. 38-62.

And they apply this three-level ontology in order to provide a characterization of the property *methane* that (in their view) accounts for the following set of facts:<sup>22</sup>

- (i) Any molecule that instantiates *methane* necessarily has proper parts that instantiate *hydrogen* and *carbon*.
- (ii) Any methane molecule is such that it has four times as many proper parts that instantiate *hydrogen* than it does proper parts that instantiate *carbon*.
- (iii) Any methane molecule is such that each carbon-hydrogen atom pair that composes it stands in the *being bonded to* relation, while no hydrogen-hydrogen atom pair that composes it stands in this relation.

Their proposal, with respect to *methane*, proceeds via three distinct stages.<sup>23</sup>

*Stage 1.* *Methane* is an atomic Level Two property of molecules. It is part of the intrinsic nature of *methane* that any molecule that instantiates it is composed of exactly five atomic spatial parts (this may be thought of as an essential, Level Three property of *methane*). Furthermore, *methane* is related to the atomic Level Two properties of *carbon* and *hydrogen* under the Level Three relation of *being co-instantiated with*. According to Bigelow and Pargetter, this is a matter of certain metaphysically necessary facts about *methane*.<sup>24</sup> It follows from this that, wherever *methane* is instantiated, so are *carbon* and *hydrogen*. They take it that Stage 1 in their account satisfies (i) above.

*Stage 2* concerns further metaphysically necessary features of *carbon* and *hydrogen*. According to Bigelow and Pargetter, whenever *carbon* and *hydrogen* are co-instantiated with *methane* (as they are guaranteed to by Stage 1), it is a metaphysically necessary fact about each that the latter stand in the Level Three proportional relation of *having four times as many instances as* to the former. In this way, they appear to take fact (ii) above to be explained since, (by Stage 1) whenever *methane* is instantiated, so are *carbon* and *hydrogen*, and (by Stage 2) whenever *carbon* and *hydrogen* are co-instantiated with *methane*, there are four times as many instances of the latter as there are of the former.

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<sup>22</sup> Bigelow and Pargetter (1989), pp. 6-7.

<sup>23</sup> Actually, Bigelow and Pargetter don't offer a unique proposal for the metaphysics of *methane*. What follows is consistent with their general account of "quantities."

<sup>24</sup> Bigelow and Pargetter (1989), p. 6.

Stage 3 again concerns metaphysically necessary facts about *methane*. First, Bigelow and Pargetter take it to be guaranteed (by the conjunction of Stages 1 and 2) that any molecule that instantiates *methane* has an atomic part that instantiates *carbon* and four atomic parts that instantiate *hydrogen*. Next, they suggest that (again as a matter of strict metaphysical necessity), any molecule M that instantiates *methane* is such that each (ordered) carbon-hydrogen atom pair that composes it stands in the Level Two relation of *being bonded to*. Therefore, fact (iii) is explained.

Like Forrest, Bigelow and Pargetter say little to indicate how this picture is to be extended to cases in which structured properties are world-sized. That is, they say little about how we ought to think about those structured properties that correspond to *total* ways that things might have been, i.e., total possible worlds. However, we should keep in mind that the primary intention of each of these authors is not to explicitly derive those properties that correspond to total ways that things might have been (including the way that things are), but rather to defend the more modest claim that realism about structured properties is metaphysically coherent. Presumably, like Forrest, Bigelow and Pargetter take possible worlds to be *maximal* structured properties that fit their particular conception of structure (perhaps by holding that those properties that correspond to entire possible worlds are necessarily related to a Level Three completion property, like the property of *entailing the instantiation of no further properties*). And presumably, again like Forrest, they take it that (a) in principle, a structured property corresponding to each (total) way things might have been exists and that (b) one of these properties is instantiated by the concrete cosmos, while the others actually exist and are uninstantiated.

### 3. *Lewis Against Structured Properties:*

We have two distinct theories of the metaphysics of structured properties. Each employs a distinct conception of involvement, or structure. For Forrest, involvement is parthood: structured properties literally have, as proper parts, those simpler properties and relations that his three compositional operations take as argument. According to Bigelow and Pargetter, properties are not composed at all out of simpler properties and relations. Instead, they are atomic, but some stand in certain metaphysically necessary patterns of entailment towards the instantiation of distinct properties. It is in this sense

that they think one property may involve another. And they appear to hold that, in a certain loose sense, such properties may be thought of as structured.

In his “Against Structural Universals,” David Lewis argues for the conclusion that neither of these conceptions of *structure* can be right, and that, therefore, we should not believe in the existence of structured properties at all.<sup>25</sup> If Lewis is right, this is a big problem for world-stateism. Accordingly, in this section, I present Lewis’s objection, and present a response.

Lewis’s argument is best reconstructed as a dilemma.<sup>26</sup> The argument, roughly, is this: we should believe in the existence of structured properties only if there is some theory *T*, such that *T* provides an adequate metaphysics of such properties. A metaphysics of structured properties is adequate only if it (i) can give a satisfying explanation of involvement, *and* (ii) can give a satisfying explanation of the complex patterns of entailment that hold among such properties (such as those patterns of entailment noted above in connection with *methane*). According to Lewis, theories like Forrest’s fail to explain the metaphysics of involvement, and (ii) theories like Bigelow and Pargetter’s cannot give a satisfying explanation of entailment; therefore we shouldn’t believe in the existence of structured properties at all.

Before presenting the argument in detail, let’s introduce some terminology. *Mereology*, roughly, is the philosophical study of the parthood relation. Lewis assumes that, if the involvement relation just is the parthood relation (as it is for Forrest), then involvement is mereological.<sup>27</sup> In presenting his argument, I follow Lewis in this respect. To fully appreciate Lewis’s argument, it is crucial to note the conception of mereology that he endorses. Lewis presupposes that something like *classical mereological monism* is true: there is only one fundamental parthood relation, and the logic of this relation is captured by the axioms of classical, first-order extensional mereology.<sup>28</sup> The basic axioms of classical extensional mereology include *transitivity* (if one thing *x* is a part of some second thing *y*, which is in turn a part of some third thing *z*, then *x* is a part of *z*), *uniqueness* (any things composed of exactly the same parts are identical) and *unrestricted*

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<sup>25</sup> Lewis (1986b).

<sup>26</sup> Lewis (1986b).

<sup>27</sup> Forrest disagrees. See his (1986a). I return to this point below.

<sup>28</sup> Roughly, the logic of first-order part-hood developed in Leonard and Goodman (1940). See also Varzi (2009).

*composition* (any things compose a distinct thing). As we shall see shortly, classical mereological monism is central to Lewis's argument against structured properties.

Here is the argument in detail. The first horn targets the mereological conception of involvement, according to which one property involves another if it has it as a part. According to Lewis, mereological involvement may be understood as *isomorphic* or as *non-isomorphic*. Let's say that mereological involvement is isomorphic if the compositional structure of a property mirrors the compositional structure of the concrete particulars that exemplify it. Returning to our stock example, this amounts to the view that, just as a methane molecule has five proper spatial parts, one of which is bonded to each of the others, *methane* will also be divisible into five proper property parts (one *carbon*, and four *hydrogen*) and four relation parts, each corresponding to an instance of the *being-bonded to* relation.<sup>29</sup>

Now, suppose mereological involvement is isomorphic. According to Lewis, the problem with isomorphic involvement is that it is inconsistent with the metaphysics of properties. Properties occur repeatedly, and are instantiated by different particulars at different spatiotemporal locations. And crucially, properties are *wholly present* wherever they are instantiated. If so, then the structured property *methane* cannot have four proper parts which are identical to *hydrogen*, since there is only one *hydrogen* (likewise for *being bonded to*, etc.).<sup>30</sup>

A related point might help clarify what Lewis thinks is wrong with the isomorphic variant of mereological involvement. Consider a case where some things, *x* and *y*, compose some further thing, *z*. Suppose we need to answer the question "how many (proper) parts does *z* have?" Intuitively, a natural answer would be "two: *x* and *y*". An unnatural answer would be "four: *x*, *y*, and *x* and *y*." Similarly, what Lewis apparently has in mind here is that the isomorphic variant of mereological involvement forces us to give an unnatural answer to the question "how many proper parts does *methane* have?", by

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<sup>29</sup> Lewis (1986b), pp. 90-91.

<sup>30</sup> Note that it is not inconsistent with the metaphysics of properties to suppose that an individual methane molecule has four atomic spatial parts that instantiate *hydrogen*, since each of these will be a distinct atomic spatial part (of the molecule). The problem, for Lewis, lies in supposing that *methane* itself is isomorphic to this molecular structure, since there is only one (and not four) of the property, *hydrogen*, and only one (and not four) of the relation *being bonded to*.

counting the same two things (*hydrogen* and *being bonded to*, respectively) more than once.

However, ultimately what Lewis is arguing here is that the isomorphic conception of involvement violates the classical mereological axiom of *uniqueness*: any two entities entirely composed of the same parts are identical (alternatively, for any group of things, if those things compose some further thing (without remainder), then they compose at most one thing). To see this, assume for *reductio* that involvement is isomorphic and that *methane* has *hydrogen* as a part four times. Now consider *butane*. A butane molecule consists of not one but four linked carbon atoms, with hydrogen atoms bonded to each: three bonded to each of the end carbon atoms, and two to each of the middle ones.<sup>31</sup> If involvement is isomorphic, then butane will also have *carbon*, *hydrogen* and *bonded* as parts (although the configuration of these parts will differ to appropriately mirror the structure of a butane molecule). But, as Lewis points out, there is only one *carbon*, one *hydrogen*, and one *bonded*. From the axiom of uniqueness, it follows that *methane* and *butane* are identical. Since this is absurd, involvement is not isomorphic.

So suppose instead that mereological involvement is non-isomorphic. What this means, in the case of a structured property like *methane*, is that *carbon*, *hydrogen*, and *being bonded to* enter into it only once as proper parts. Again, Lewis's complaint is that this violates the *uniqueness* axiom of classical mereology. Actually, it is even clearer how this is the case for non-isomorphic involvement. Again, assume for *reductio* that involvement is non-isomorphic. Since *butane* involves *carbon*, *hydrogen* and *bonded* (as, we are supposing, proper parts), and since *butane* involves no further properties, *carbon*, *hydrogen* and *bonded* are all and only the proper parts of both *methane* and *butane*. We thus have two distinct properties composed of identical parts. From *uniqueness*, it follows that *methane* and *butane* are identical. This is absurd, so involvement cannot be non-isomorphic. Therefore, neither variant of the mereological conception can give a satisfying account of the metaphysics of involvement. We may display the first horn of the dilemma more formally as follows:

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<sup>31</sup> See appendix for a diagram.

- (1) We should believe in the existence of structured properties only if we can provide an adequate metaphysical theory of such properties, T, such that T:
  - (i) Explains *involvement*; and
  - (ii) Explains *entailment*.
- (2) Involvement is either *mereological* or *unmereological*.
- (3) If involvement is mereological, then it is either:
  - (i) *Isomorphic* or
  - (ii) *Non-isomorphic*.
- (4) Isomorphic and non-isomorphic conceptions of involvement violate the axiom of *uniqueness*.
- (5) No mereological relation can violate the axiom of *uniqueness*.
- (6) If (4 & 5), then, if (3), then (7)
- (7) *If involvement is mereological, then it is not the case that we can give a satisfying account of the metaphysics of involvement.*

The second horn targets those accounts (like Bigelow and Pargetter's) which postulate certain brute, metaphysically necessary connections between the instantiation of wholly distinct, atomic properties. For Bigelow and Pargetter, involvement is *unmereological*. According to Lewis, this is the problem. Recall, from Chapter 1, that Lewis subscribes to Hume's Dictum, according to which any absolutely necessary connection between wholly distinct existences is unintelligible (his principle of Unrestricted Recombination, according to which anything from one world can coexist with anything from another world, is a variant of this Humean doctrine). If *methane* is entirely distinct from *hydrogen*, *carbon* and *bonded*, as it is on the unmereological variant, then, given Hume's dictum, Lewis holds that any metaphysically necessary connection holding between these properties is unintelligible and that, therefore, unmereological involvement cannot provide a satisfying explanation of entailment. Since involvement is either mereological or it isn't, and since endorsing either option results in a failure to satisfy one or the other of Lewis's constraints on adequacy (where adequacy requires satisfying not one or the other, but *both*), Lewis's conclusion follows. This second horn of the argument, more formally, looks like this:

- (8) If involvement is unmereological, then structured properties are *mereologically atomic*.
  - (8.1.) If structured properties are mereologically atomic, then *entailment* is a matter of necessary connections between distinct atomic properties.
  - (8.2.) If entailment is a matter of necessary connections between distinct atomic properties, then we cannot explain entailment.

(8.3.) *So, if involvement is unmereological, then we cannot explain entailment.*

(9) So, either we cannot give a satisfying explanation of the metaphysics of involvement, or we cannot give a satisfying explanation of entailment.

(10) So, we shouldn't believe in the existence of structured properties.

### 3.1. *A Defense of Structured Properties:*

There are a couple of responses to Lewis's argument available to the world-stateist. First, a proponent of the unmereological conception of structured properties could deny (8.2). In Chapter 1, we noted that a realist about essential properties may plausibly deny versions of Hume's Dictum in certain special cases (like those which concern a material artifact and its constitutive matter, or an instance of a natural kind and some underlying microstructural feature). Since Bigelow and Pargetter's approach requires that some properties *of* properties are essential, this move is always open to them. And since (8.2) is required for the sub-conclusion in (8.3), this might be a promising move.<sup>32</sup>

A second set of points is more relevant to Lewis's overall dialectical strategy. First, Lewis thinks that explaining entailment wouldn't be a problem if a mereological account could be had that avoided his worries about the metaphysics of involvement. This seems plausible. If involvement were mereological, and could be understood in terms of the relation of part to whole, then entailment facts would simply supervene on the mereological facts: whenever some structured property has some distinct property as a proper part, the instantiation of the former would (intelligibly!) explain the instantiation of the latter.<sup>33</sup> And second, Bigelow and Pargetter motivate their view as a *response* to Lewis's argument (which they accept) against the mereological conception.<sup>34</sup> For these reasons, in what follows I'll focus on the first horn of Lewis's argument, and what Forrest (and other world-stateists who hold that involvement is mereological) should say in response.

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<sup>32</sup> This is basically their response. See their (1989), esp. at pp. 8-11. However, it's worth noting that the unmereological conception will require (potentially infinitely) many essential properties, at least one for each structured property that there is. This in itself might count against the proposal.

<sup>33</sup> Lewis (1986b), p. 101.

<sup>34</sup> See their (1989), esp. pp. 2-4 under the heading 'Not Mereology, and No Magic Please.'

It's worth noting first what he *shouldn't* say. He shouldn't say that the structured properties that the *product*, *contraction* and *projection* operations generate are (i) properties that literally have other, simpler properties as proper parts, but that (ii) these parts are somehow fundamentally unmereological in nature.<sup>35</sup> This is because composition just is mereological composition, and mereology just is the philosophical study of the part-whole relation. We should agree with philosophers who hold that the notion of unmereological composition is unintelligible.<sup>36</sup> If Forrest's simpler properties are literally parts of the more complex properties they compose, then they had better be mereological parts.

What Forrest *should* do is deny premise (5) in Lewis's argument:

(5) No mereological relation can violate the axiom of *uniqueness*.

There are two ways he could go about this. First, he could argue that (i) the logic of the parthood relation that governs the composition of structured properties is not reducible to, and does not satisfy all the axioms of, classical extensional mereology, and that (ii) because of this, Lewis's classical mereological *monism* is false. Instead, Forrest could endorse some form of mereological *pluralism*, according to which there is more than one fundamental, part-whole relation. For instance, the mereological pluralist might hold that the part-whole relation that holds for material objects is distinct from the part-whole relation that holds for paradigmatically abstract objects like properties, propositions, and the like.<sup>37</sup> In particular, the mereological pluralist could deny (5) by holding that the classical mereological axiom of uniqueness does not govern composition in the case of properties. Provided axioms governing the part-whole relation for abstract objects can be given a satisfying specification, this would give Forrest a straightforward way to avoid Lewis's objection.

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<sup>35</sup> He does say this, unfortunately. See his (1986b) reply to Lewis. However, this is largely due to his acceptance of Lewis's classical mereological monism.

<sup>36</sup> See Lewis (1986b), at p. 91.

<sup>37</sup> For arguments and discussion, see McDaniel (2004), (2006), and (2009). This move is compatible with the arguments Forrest gives in his (1986b).

Alternatively, Forrest could hold on to mereological monism (the view that there is only *one* fundamental parthood relation), but deny that *classical* mereological monism is true. One reason to go this way is that we might think mereology is topic-neutral, in the sense that the axioms of mereology which govern the parthood relation are intended to hold in full generality, regardless of what sorts of entities are the relata. In the remainder of this section, I'll explore this strategy.<sup>38</sup>

Ultimately, Lewis's complaint against both the isomorphic and non-isomorphic conceptions of involvement is that they violate the classical mereological axiom of *uniqueness*, according to which any two things composed of exactly the same parts are identical. The principle of uniqueness has clear counterexamples in cases of composition involving paradigmatically abstract objects. Consider singular propositions and states of affairs. For some non-symmetrical relation  $R$ , and two particulars  $a$  and  $b$ , the state of affairs of  $a$  standing in  $R$  to  $b$  ( $aRb$ ) is clearly different from the state of affairs of  $b$  standing in  $R$  to  $a$  ( $bRa$ ). Yet  $aRb$  and  $bRa$  are arguably composed of exactly the same parts.<sup>39</sup> And the propositions encoded by (1) and (2),

(6) Frege admired Russell.

(7) Russell admired Frege.

though clearly different, have the same proper parts<sup>40</sup>; namely, Russell, Frege, and the *admiring* relation. So if there exist singular propositions and states of affairs, and if propositions and states of affairs literally have parts, then these are counterexamples to the classical mereological axiom of *uniqueness*. And we should think that there *are* singular propositions and states of affairs, and that these sorts of things do have parts. So, we should think that uniqueness of composition does not hold in full generality. But if mereology is topic neutral, and is intended to hold in full generality regardless of which entities serve as the relata of the parthood relation, then uniqueness cannot be an axiom of mereology. First-order, classical extensional mereology therefore gives a false theory of

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<sup>38</sup> Although it is worth noting that the arguments of this section are compatible with the first strategy mentioned above as well. Thanks to Chris Tillman on this point.

<sup>39</sup> Armstrong (1986), and Forrest (1986b).

<sup>40</sup> At least on some accounts of structured propositions. For an alternative, see King (2007).

parthood, and premise (5) in Lewis's argument against structured properties is false. These considerations vindicate the mereological conception of involvement. World-stateists like Forrest who hold that possible worlds are identical to complex structured properties, are free to hold that such properties are literally composed out of simpler properties and relations.<sup>41</sup>

#### 4. *An Alternative Theory of Structured Properties:*

In this section I defend an alternative conception of structured properties, based on some recent work in the metaphysics of composition. Kit Fine argues for a theory of composition that he calls a theory of *rigid embodiments*.<sup>42</sup> Fine motivates his view by arguing that aggregation and compounding (the most common forms of classical composition) fail to explain certain puzzling issues tied to the part-whole relation. For Fine, a rigid embodiment is a sort of material object. He gives the example of a ham sandwich. Suppose a given ham sandwich is composed out of two pieces of bread and a slice of ham. While the bread and the ham are proper parts of the ham sandwich, according to Fine they do not exhaust all of its parts. This is because the sandwich also has, as a *part*, a relation holding between the ham and the bread: the relation of *being arranged ham sandwich-wise*.<sup>43</sup>

More generally, for any material objects  $x_1, x_2, \dots, x_n$  and some relation  $R$ , *the xs standing in R* is a rigid embodiment. Following Fine, we let 'the xs/R' denote such a rigid embodiment. The xs/R is a composite object that has the xs and  $R$  as proper parts. The xs are what Fine calls its *material parts*, and the relation  $R$  is its *formal part*, or what Fine calls its *principle* of rigid embodiment. Crucially, the mode of composition characteristic of rigid embodiments cannot be reduced to that of classical mereological aggregation or summation, because this would be to overlook what Fine calls the "predicative role" played by  $R$ , "which somehow serves to modify or qualify the components [of the rigid

<sup>41</sup> Given the nature of his compositional operations, it seems likely that Forrest would favor the non-isomorphic conception of mereological involvement. However, nothing in the above response turns on this.

<sup>42</sup> Fine (1999). See also his (1994) for discussion of these two forms of classical mereological composition. And for a more recent discussion, see Caplan, Tillman and Reader (ms).

<sup>43</sup> Fine (1999).

embodiment].”<sup>44</sup> The key thing to take from Fine’s theory is the special role played by *R*, in the composite the *xs/R*. Intuitively, *R* specifies the way that the material parts of the composite are arranged, or *how* the material parts of the composite are with respect to each other.

My own view is that Fine’s theory of rigid embodiments can be adapted to provide an intuitive and simple account of the metaphysics of a structured property, provided we allow properties to play the role that material parts play in such composites. In order to see how this might go in the case of our simple example of *methane*, we need to introduce some new terminology. Let’s say that, for any properties  $\phi_1, \phi_2, \dots, \phi_n$  and some (higher-order) relation *R* holding between  $\phi_1, \phi_2, \dots, \phi_n$ , that the  $\phi$ s standing in *R* is a rigid *property-embodiment*. Following Fine, let *the  $\phi$ s/R* denote the  $\phi$ s standing in *R*. The  $\phi$ s and *R* are all proper constituents of *the  $\phi$ s/R*. Call the  $\phi$ s the *encoded parts* of *the  $\phi$ s/R*, and call *R* the *encoding part* of *the  $\phi$ s/R*. Just as the principle of rigid embodiment specifies the way that the material parts of a rigid embodiment are arranged, we can think of the encoding part of a rigid property-embodiment as specifying the way that its encoded (i.e., property) parts stand to one another.

With this terminology in place, we might identify *methane* with the following complex, conjunctive rigid property-embodiment. Where the properties of *having a proper part that exemplifies carbon* and *having a proper part that exemplifies hydrogen* are encoded parts, and the higher-order relation of *having four-times as many instances as* is an encoding part, the resulting rigid property-embodiment, *methane*, is a structured property instantiated by all and only methane molecules. *Methane*, on this view, is going to be the (conjunctive) property of *being a molecule with five proper atomic parts such that any atomic part that exemplifies hydrogen is bonded to any proper part that exemplifies carbon, and being such that the property of having a proper part that exemplifies hydrogen has four-times as many instances as the property of having a proper part that exemplifies carbon*. Its encoding part, *having four-times as many instances as*, may be thought of as specifying the unique set of relations that hold

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<sup>44</sup> Fine (1999), p. 65. Consider the mereological sum, or fusion, of the bread and the ham. It exists even when the bread and the ham are in distinct, non-overlapping regions. Thus, the ham sandwich cannot be identical to the mereological sum of the bread and the ham.

between the properties of *having a proper part that exemplifies carbon* and *having a proper part that exemplifies hydrogen*, whenever these properties are instantiated by proper parts of a methane molecule.

On this view, structured properties are just rigid embodiments of a certain special sort: namely, rigid embodiments that contain *properties* as non-formal parts. It's worth noting two things about this account of the structured property *methane*. First, on this account, *methane* is going to be non-isomorphic, in Lewis's sense, to a methane molecule, since each of its proper constituents will enter into it only once. Second, the account easily avoids Lewis's worry about compositional uniqueness, since the rigid property-embodiments we identify with *methane* and *butane* will have completely different encoding parts. However, since it seems likely that some (distinct) rigid property embodiments will involve identical parts (consider iterations of some such construction under the relation of *being a property*), we still ought to hold that classical, extensional mereology gives a false theory of the parthood relation.<sup>45</sup>

One advantage the view enjoys over the accounts surveyed at the beginning of this chapter is that extending it to show how entire worlds might be identified with structured properties is fairly straightforward. Again, we introduce some terminology. For any world  $w$  in  $W$ , let  $D_w$  denote the domain of  $w$ . Intuitively, the members of  $D_w$  will be the set of individuals that exist at  $w$ .<sup>46</sup> Next, for any  $w$  and individual  $i$  in  $D_w$ , we introduce the world-relativized notion of  $i$ 's *maximal singular property* at- $w$ , and let  $w_i$  denote such a property. The idea here is that, just as entire worlds represent different *total* ways for things to be, less-than-maximal (proper) parts of worlds represent particular ways *for* individuals to be.<sup>47</sup> Maximal singular properties like  $w_i$  serve as these less-than-maximal proper parts of worlds.

Maximal singular properties are structured properties that essentially involve individuals and properties as proper constituents. We can think of them as a special sort of rigid embodiment. They are neither rigid embodiments *simpliciter* (of the sort Fine

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<sup>45</sup> See Caplan, Tillman and Reader (ms).

<sup>46</sup> Since the view is actualist, the members of any  $D_w$  will actually exist, since every  $w$  actually exists. Although I think that there are good reasons for actualists to favor a CD semantics, according to which the domains of every world are coextensive, the above presentation is intended to be compatible with either CD or VD semantic models.

<sup>47</sup> As in Lewis (1983).

discusses in connection with ham sandwiches) nor rigid property-embodiments (of the sort discussed above in connection with *methane*). Instead, a singular property is a *mixed* rigid embodiment containing both material parts (individuals from some  $D_w$ ) and encoded parts (various properties and relations) as proper constituents, in addition to an encoding part, which specifies the way that these constituents are related.

A natural thought is that the *encoded* parts of a singular property  $w_i$  will include an individual  $i$  together with those properties  $i$  is represented as exemplifying at, or with respect to,  $w$ . The *encoding* part of a singular property, on this view, is the relation of *exemplification*. With these matters in place, we can say that for any individual  $i$ , world  $w$  and properties  $F$ ,  $G$  and  $H$  such that  $i$  is represented as exemplifying  $F$ ,  $G$  and  $H$  at, or with respect to,  $w$ ,  $i$ 's singular property at- $w$ ,  $w_i$ , is the mixed rigid embodiment denoted by " *$i$ ,  $F$ ,  $G$ ,  $H$ /exemplification*."<sup>48</sup> This singular property,  $w_i$ , is in effect a property which encodes a certain subset of  $i$ 's properties at  $w$  under the relation of *exemplification*. More simply:  $w_i$  represents  $i$  as having  $F$ ,  $G$  and  $H$  at  $w$ , and may be thought of as the property of *being such that  $i$  has  $F$ ,  $G$  and  $H$* .

For arbitrary world  $w$  and individual  $i$  such that  $i$  is a member of  $D_w$ , we may say that  $w_i$  is *maximal* if an inventory of its encoded parts exhaustively characterizes the qualities  $i$  is represented as exemplifying at  $w$ . Where  $w_i$  is such a property,  $w_i$  in effect encodes the *totality* of  $i$ 's properties at  $w$  under the relation of *exemplification*. Thus, for arbitrary  $i$ , and where " $@$ " denotes the actual world,  $i$ 's maximal singular property,  $@_i$ , represents the total way that  $i$  *actually* is, provided  $i$  is a member of  $D_@$ . And (again for arbitrary  $i$  and worlds  $@, w^1, w^2, \dots, w^n \in W$ , the corresponding *set* of  $i$ 's maximal singular properties,  $\{@_i, w_i^1, w_i^2, \dots, w_i^n\}$ , is the set of total possibilities for  $i$  (with respect to worlds  $@, w^1, w^2, \dots, w^n$ ).

A *total world*, on this conception, is a totality of ways for individuals to be, for all individuals that exist at that world. A world is a special sort of structured property. It is a *maximal* rigid property-embodiment. The encoded parts of a maximal rigid property-embodiment (i.e., a world) will be all and only maximal singular properties of the sort

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<sup>48</sup> I say "represented as exemplifying" at a world instead of "exemplifies" at a world because I think that individuals don't literally exemplify properties at any world other than the instantiated one. I return to this topic in detail in the next chapter, in connection with overlap and the issue of accidental, intrinsic properties.

discussed above. This element of the view captures the fact that proper parts of worlds represent ways for particular individuals to be. Thus, for arbitrary world  $w$ , and individuals  $i_1, i_2, \dots, i_n$  such that  $i_1, i_2, \dots, i_n$  are in  $D_w$ , the maximal singular properties  $w_{i1}, w_{i2}, \dots, w_{in}$  are the encoded parts of the structured property which is, on this view, identical with  $w$ .

The encoding part of a world (*qua* maximal rigid property-embodiment) may be thought of as the relation of *actualization*. This captures the fact that each world ‘represents itself’ as being the way that things *are*, or, equivalently, as being the way that things *actually are*. Thus, for arbitrary world  $w$ , and individuals  $i_1, i_2, \dots, i_n$  in  $D_w$ , we may formally identify  $w$  with the rigid property-embodiment denoted by “ $w_{i1}, w_{i2}, \dots, w_{in}$ /actualization.”  $w$  is, in effect, a structured property that represents its encoded parts as being co-instantiated under the relation of *actualization*, and may be thought of as the property of *being such that  $w_{i1}, w_{i2}, \dots, w_{in}$  are actualized*.

The actual world, @, is on this conception *also* a maximal rigid property-embodiment. It is the maximal rigid property-embodiment that is *instantiated*. All other possible worlds correspond to maximal rigid property-embodiments that are *uninstantiated*, but which could have been instantiated. However, recall from Chapter 1 that world-stateists ought to think that in addition to the possible worlds, there are also impossible worlds, i.e., worlds that could not have been instantiated. Following Scott Soames, let’s say that each world that exists is *epistemically possible*: it can coherently be supposed to be instantiated, and cannot be known *a priori* not to be instantiated. Depending on which world *is* instantiated, however, some worlds will be such that it is not metaphysically possible that they be instantiated. These are metaphysically impossible worlds. The rest of the epistemically possible worlds are the metaphysically possible worlds. These represent total ways that things *could* have been, given the way that things are.<sup>49</sup>

The primary business of this chapter has been to provide an answer to the question of interpretation posed in Chapter 1. According to the answer I have given, each world is identical to a maximal structured property that actually exists. Our discussion of

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<sup>49</sup> Here, I follow Soames (2003). We could draw further distinctions here as well among the worlds that are metaphysically possible given the way that things are. For instance, some metaphysically possible worlds will be physically impossible, given the way that things happen to be.

Lewis's objection to structured properties showed that the notion of a structured property is metaphysically coherent, provided we see the axioms of classical extensional mereology as giving a false theory of the parthood relation. Taking a page from Kit Fine's theory of rigid embodiment allows for a straightforward account of how those properties that are to be identified with total worlds are literally composed out of individuals, simpler properties, and relations. This is the theory of worlds that I assume in the remainder of the essay.

In what follows, I consider some objections to the account. In Chapter 3, I consider two main issues. The first concerns how it is that worlds represent, *de re*, of a particular individual *i* that such and such is possible for *i*. On the account I defend, worlds represent *de re* by *overlapping*: individuals are literally parts of more than one possible world. I then defend overlap from a well-known objection. In the second half of Chapter 3, I draw some distinctions that cut across all versions of world-stateism that we have considered so far. Here, my primary concern is to distinguish the version of world-stateism I endorse from Forrest's account (and others like it). I argue that Forrest's account is vulnerable to a strong objection that my own view avoids, and that this counts as a point in favor of my account of possible worlds.

### Chapter 3: Abstract Issues

#### 1. Representation De Re:

The concern of this chapter is with two broad issues that bear directly on any version of actualist modal realism, including the version of world-stateism I developed at the end of the last chapter.<sup>1</sup> In this section, I consider the issue of how a world *w* represents, de re, of some individual *i* that such-and-such is true of *i*, at or with respect to *w*. Here, I distinguish between modal realism with *overlap* and modal realism *without overlap*. Actualists who believe in overlap face what David Lewis has called *the argument from accidental intrinsics*. I present Lewis's argument, and consider some different ways that the world-stateist might respond. In section 2, I distinguish between *genuine* and *ersatz* modal realism, and present an argument for the conclusion that any version of world-stateism ought to be genuine.<sup>2</sup> Since Forrest's world-stateism, discussed at the beginning of Chapter 2, is a species of ersatz modal realism, while the view I developed is not, the argument in section 2 will demonstrate certain advantages my account enjoys over Forrest's.

Let's say that two worlds, *w* and *w'*, *non-trivially overlap* only if at least one individual is a part of each. Admitting higher-order quantification over worlds themselves, we may express the idea more formally as follows:

*Non-Trivial Overlap*:  $\forall w \forall w' [(w \text{ overlaps } w') \leftrightarrow \exists x (Pxw \ \& \ Pxw')]$ <sup>3</sup>

Suppose we characterize modal realists who believe in (non-trivially) overlapping worlds as holding that our everyday de re modal claims about possibility and necessity ought to be analyzed along the following lines:

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<sup>1</sup> Strictly speaking, all of the issues considered in this chapter cut across both actualist and possibilist versions of modal realism. Since I am concerned with defending actualism, in what follows I largely ignore the corresponding debates as they bear on possibilist modal realism.

<sup>2</sup> The terminology is Lewis's. See his (1986a), at pp. 136-174.

<sup>3</sup> I say "non trivial" because *all* modal realists ought to hold that some entities, like certain properties, (trans-world) fusions of individuals, sets and (de dicto) propositions, can literally be parts of more than one world. The controversial cases of overlap are those in which a given individual exists at more than one possible world.

$$(\Diamond_{\text{de re}}) \Diamond Fa \leftrightarrow \exists w [Paw \ \& \ (at\text{-}w, Fa)]$$

$$(\Box_{\text{de re}}) \Box Fa \leftrightarrow \forall w [Paw \rightarrow (at\text{-}w, Fa)]^4$$

$(\Diamond_{\text{de re}})$  says that some individual  $a$  is possibly  $F$  only if there exists a world that has  $a$  as a part and at which  $a$  is  $F$ . And  $(\Box_{\text{de re}})$  says that some individual  $a$  is necessarily  $F$  only if  $a$  is  $F$  at every world at which it exists as a part. The crucial thing to note is that, according to modal realism with overlap, a given individual can exist as a literal part of more than one possible world.

Modal realism *without overlap* is the thesis that this is never the case. According to modal realism without overlap, ordinary individuals are *world-bound*: they never exist at more than one possible world. Lewis's modal realism is perhaps the most well-known example of this view. According to Lewis, de re modal claims of the form  $\Diamond Fa$  and  $\Box Fa$  are not analyzed in terms of worlds containing  $a$  as a part.<sup>5</sup> Instead, such claims are analyzed in terms of worlds containing qualitatively similar *counterparts* of  $a$ , where a counterpart of  $a$  is just another world-bound individual that is similar, in certain contextually determined respects, to  $a$ . On this view, the de re modal claim expressed at the actual world by (1a) is analyzed in terms of (1b),

(1a) John McCain could have won the 2008 Presidential election.

(1b)  $\exists x \exists w (Pxw \ \& \ Cxm \ \& \ Ex)$ ,

or, more colloquially, in terms of the existence of a world  $w$  having, as a part, a victorious counterpart of McCain (that is, a victorious individual who is *not* identical to McCain but is similar, in certain contextually salient respects, to McCain).

<sup>4</sup> Strictly speaking, each of these principles would need to be modified in order to reflect the fact that what is (metaphysically) possible/necessary at a given world is always a matter of which worlds are metaphysically *accessible* from it. I omit this formal complication here since it doesn't bear on the present discussion. However, each of these principles, and their universally quantified variants below, ought to be read as implicitly asserting the existence of an *accessible* world where such-and-such is the case. For discussion, see the section on the semantics of modal logics in Chapter 1, and the appendix.

<sup>5</sup> Aside from the trivial case where  $\Diamond Fa$  is true at a world  $w$  such that  $a$  exists at  $w$  and is  $F$  at  $w$ .

### 1.1. Overlap and the Problem of Accidental Intrinsic Properties:

The version of actualist modal realism I presented at the end of Chapter 2 is committed to overlap, since ordinary individuals (things like you and I, Socrates, Obama, Australia, and the Eiffel Tower) are literally parts of different possible worlds (this is a consequence of the fact that individuals are constituents of the maximal singular properties that go together in composing entire worlds).<sup>6</sup> As such, the view faces the following argument from accidental intrinsic properties.<sup>7</sup> In presenting the argument, I assume the version of world-stateism I presented in the last chapter, according to which possible worlds are maximal, uninstantiated structured properties that actually exist and have individuals and properties as proper parts.

Here is the argument. Suppose the world-stateist endorses the following *naïve principle of overlap* (OP) as the appropriate analysis of de re possibility claims:

*Naïve Overlap Principle* (OP): For any individual  $x$ , and property  $F$ , it is possible that  $x$  exemplify  $F$  only if there exists a world  $w$  such that (i)  $x$  is a part of  $w$  and (ii) *at-w*,  $x$  exemplifies  $F$ .

(OP) represents the universally quantified version of the above principle of de re possibility, ( $\Diamond_{\text{de re}}$ ).<sup>8</sup> It says that a de re possibility claim of the form  $\Diamond Fa$  is true only if there exists a world  $w$  such that  $a$  is a part of  $w$  and *at-w*,  $a$  exemplifies  $F$ . And suppose that in addition to (OP) we assume the following intuitively plausible principle governing *intrinsic* property instantiation at-a-world:

*Intrinsic Exemplification* (IE): For any individual  $x$ , world  $w$ , and *intrinsic* property  $F$ ,  $x$  exemplifies  $F$  at- $w$  only if (i)  $x$  exists at  $w$  and (ii)  $x$  has  $F$  *simpliciter*.

Very roughly, a property is *intrinsic* to an individual  $a$  if its instantiation is wholly a matter of internal facts about  $a$ , and not a matter of any external relations  $a$  stands in to

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<sup>6</sup> It's worth noting that overlap is, in principle compatible with both actualist and possibilist versions of modal realism. For a version of genuine modal realism that is both similar in spirit to Lewis's own view, and also holds that worlds literally overlap in this non-trivial sense, see Kris McDaniel's (2004) and (2006).

<sup>7</sup> Lewis (1986a) at pp. 198-202.

<sup>8</sup> I omit the corresponding universally quantified principle of analysis for de re necessity/essentiality, since we are here concerned only with *accidental* intrinsic properties.

other individuals.<sup>9</sup> For instance, *being wise*, *being snub-nosed*, and *being a philosopher* are (arguably) intrinsic properties of Socrates. A less controversial example might be the property of *having a singular self-referential thought*. Extrinsic properties do depend on matters of fact external to the exemplifier. *Being the teacher of Plato*, *being taller than Xanthippe*, and *being thought about in 2009* are some of Socrates's extrinsic properties, since he exemplifies them partly in virtue of how things stand with other individuals.

The idea behind (IE) is that, when F is an *intrinsic* property, its exemplification by an individual *a* *at-a-world* w is analyzable in terms of (i) *a* existing at w and (ii) *a* exemplifying F *simpliciter*. Alternatively, whenever F is intrinsic, the *exemplification* of F by an individual *a* is never a matter of *a* standing in a relation to anything else. This is intuitive, given what it takes for a property to be intrinsic. Now, although (OP) and (IE) are both plausible, Lewis's argument is intended to show that they cannot be jointly true. For suppose that the conjunction of (OP) and (IE),

(1) (OP & IE)

is true, and that Fa, for some individual *a* and *intrinsic, accidental* property F.

(2) Fa

Since F is accidental to *a*, we also have (3):

(3)  $\Diamond \sim Fa$

But from (3), and the first conjunct of (1), (OP), it follows that there exists a world w such that *a* is a part of w and *at-w*,  $\sim Fa$ . Since F is intrinsic, it follows from this and the second conjunct of (1), (IE), that *a* exists at w, and that  $\sim Fa$ .

(4)  $\exists w [Paw \ \& \ (at-w, \sim Fa)]$

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<sup>9</sup> Not much turns on the specifics of the distinction here, and I presume that some trouble-free account is possible. For discussion, see Kim (1982), Lewis (1983), and Lewis and Langton (1998).

(5)  $[(a \text{ exists at } w) \ \& \ \sim Fa]$

This leads straightforwardly to contradiction: from the second conjunct of (5) we have it that

(6)  $\sim Fa$

is also true. But then (from (2)) both  $Fa$  and  $\sim Fa$ . Since this is impossible, one of our initial assumptions must be false. According to Lewis, since (IE) captures what it is for a property to be intrinsic for an individual at a given world, the only option is to deny the principle of de re representation in terms of overlap (OP). So modal realism with overlap is false.

### 1.2. Responses to the Argument:

Lewis's own solution is to replace (OP) with a counterpart-theoretic treatment of de re possibility, according to which (i) (ordinary) individuals are never a part of more than one possible world, and (ii) de re modal claims about (world-bound) individuals are understood as claims about their modal counterparts at different possible worlds. Given the structure of the argument, an alternative would be to hold (OP) fixed as the analysis of de re possibility claims, and to deny (IE). Suppose we do this by endorsing the view that property exemplification is always *world-indexed*:

*w-Indexed Exemplification:* For any individual  $x$ , property  $F$  and world  $w$ ,  $x$  exemplifies  $F$  at  $w$  only if (i)  $x$  exists at  $w$  and (ii)  $Fx$ -at- $w$ .

Substituting this principle for (IE) entails that property exemplification is *always* a matter of a relation holding between an individual *and a world*. This move is sufficient to block the argument, since it no longer follows from the fact that, for some world  $w$ , intuitively intrinsic property  $F$  and individual  $a$  such that at- $w$ ,  $Fa$ , that  $a$  exists at  $w$  *and*  $a$  is  $F$  *simpliciter*. However, this seems bad. (IE) was meant to be a fully general principle governing the exemplification of *intrinsic* properties. But if exemplification is always  $w$ -

indexed, then it turns out there are no *actually* intrinsic properties. And it seems false to hold that no individual actually instantiates an intrinsic property: your actual shape and size, for instance, seem (arguably) to be examples of perfectly intrinsic properties of yours, and not a matter of a *relation* holding between you, your shape or size, *and* the actual world. Furthermore, the approach would rule out the metaphysical *possibility* of intrinsic properties. If you share either the intuition that, at least some of the time, some things actually instantiate intrinsic properties, or that intrinsic properties are at least metaphysically possible, then you should think that this response to the argument from accidental intrinsics involves costs that are too high to pay.

A second move might be to supplement the above principle of *w-indexed exemplification* with an additional principle governing the exemplification of intrinsic properties at *the actual world*, @.<sup>10</sup>

*@-intrinsic Exemplification:* For any individual *x* and intrinsic property *F*, if *x* exemplifies *F* at-@, then (i) *x* exists at @ and (ii) *Fx*.

Thus, we might think that the above principle of *w-indexed exemplification* holds only for the exemplification of properties at worlds other than the actual world, but that, whenever an individual *a* *actually* exemplifies an (intuitively intrinsic) property *F*, this is a matter of *a* exemplifying *F simpliciter*, and not a matter of *a* exemplifying *F at-@*. We thereby satisfy the intuition that some actually instantiated properties are intrinsic, and avoid the worry raised above in connection with the first proposal. Furthermore, we can still block the contradiction generated at premise (6) in the argument from accidental intrinsics.

Consider a concrete case. Socrates is actually wise, but only contingently so. Since *wisdom* is intuitively an intrinsic property, and since Socrates actually has this property, *@-intrinsic exemplification* comes into play and we may say that Socrates exemplifies *wisdom*. Since Socrates is only contingently wise, it follows (from (OP)) that Socrates has the property of *being unwise* at some possible world *w*. Since *w* is not the actual world, *w-indexed exemplification* comes into play, and we avoid contradiction by saying that Socrates exemplifies *being-unwise-at-w*.

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<sup>10</sup> Here, and in what follows, I let “@” denote the actual world.

However, there is (at least) one significant problem with this approach. Suppose we adopt an *indexical* account of actuality, according to which the content, or meaning, of a proposition expressed by a sentence containing “actual,” or cognate locutions like “actually” and “the actual world” is a matter which varies from world to world. According to the indexical account of “actual” and its cognates, the sentence “Actually, Saul Kripke is a philosopher,” when used by anyone at the actual world, @, expresses the proposition that Saul Kripke is a philosopher at @, while the same sentence, used by a speaker at a world  $w$  ( $\neq @$ ) expresses the proposition that Saul Kripke is a philosopher at  $w$ .<sup>11</sup>

The indexical account of actuality fits well with the intuition that every possible world, including the actual world, *represents* itself as being actual; alternatively, every possible world represents itself as being the way things are, actually. But suppose we adopt the present proposal, and that we wish to know the truth values of the sentences “Actually, Socrates is wise,” when evaluated at @, and “Actually, Socrates is unwise,” when evaluated at  $w$ . Since  $w$  represents Socrates as being unwise, and since (according to the indexical account of actuality) (i)  $w$  represents itself as being actual, and (ii) “actually,” at  $w$ , refers to the way things are at  $w$ , @-intrinsic exemplification is called into play. It then turns out that, from the perspective of  $w$ , Socrates exemplifies *being unwise*, while at @, he exemplifies *being wise*. But then, speaking unrestrictedly, it follows that Socrates has the property of *being wise* and the property of *being unwise*: a contradiction. Thus, given plausible semantic assumptions about “actual” and cognate locutions, and about the evaluation of propositions expressed by sentences containing these indexical terms at contexts of use that range across distinct possible worlds, it turns out that the problem raised by the argument from accidental intrinsics is not avoided on this approach.<sup>12</sup>

<sup>11</sup> See Soames (2007), Lewis (1986a), van Inwagen (1980).

<sup>12</sup> A modified proposal fares even more badly. Suppose that, in addition to an indexical theory of actuality, we also endorse the view that only one world is *absolutely actual*. On this view, each world continues to represent itself as being actual; propositions expressed by sentences containing “actual” and its cognates continue to refer to the world of the context; but property exemplification at any world that is not the *absolutely actual* world is always world-indexed, while property exemplification at the *absolutely actual* world is un-indexed. On this view, properties exemplified at worlds that are not *absolutely actual* are world-indexed, but some of these are properties that *would* be intrinsic, were it the case that  $w$  were instantiated (i.e., *absolutely actual*). This bizarre view inherits all the problems with the above proposal,

I think that what these considerations show is that philosophers who wish to hold onto an analysis of de re modal predication in terms of overlapping worlds ought to reject the *naïve overlap principle* (OP). In its place, we might substitute the following general modal principle governing the possible exemplification of any property, intrinsic or otherwise. Call this the *modal overlap principle*:

*Modal Overlap Principle:* For any individual  $x$  and property  $F$ , it is possible that  $x$  exemplify  $F$  only if (i) there exists a world  $w$  such that  $x$  is a part of  $w$  and (ii) *if  $w$  were instantiated*, then  $x$  would have  $F$ .<sup>13</sup>

The idea behind the modal overlap principle is that speaking of the *extension* of a property  $F$ , at a world  $w$ , is elliptical, and ought to be understood in terms of the extension that  $F$  *would* have, *were  $w$  instantiated*. Strictly speaking, on this view, individuals only exemplify properties (intrinsic or otherwise) at, or with respect to, the world that is *in fact* instantiated, and are therefore only *literally* in the extension of those properties that the instantiated world represents them as having.

This proposal does not require that we no longer think of a possible world  $w$  as *representing* that certain individuals are in the extension of properties at  $w$ . A possible world  $w$  represents properties that the individuals who exist at it would have had, had  $w$  been instantiated. But the modal overlap principle does preclude us from equating the fact that a world  $w$  represents that some individual is in the extension of a property  $F$  with that individual literally being *in* the extension of  $F$  *at  $w$* .<sup>14</sup> This is a significant departure from theories of truth at-a-world that treat the extension of any predicate, at any world  $w$ , as a matter of simply reading-off the extensions of corresponding properties at  $w$ .<sup>15</sup>

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and adds to these the fact that we are forced to say that some properties (the intuitively intrinsic properties) are such that their exemplification is a matter that can 'shift' from being  $w$ -indexed to being unindexed. But surely whether or not a property is intrinsic is not a matter that can shift in this way.

<sup>13</sup> A corresponding principle for the analysis of de re necessity/essentiality would say that for any world  $w$ , were it the case that  $w$  were instantiated,  $x$  would have the relevant property. Again, I assume that, where the modality in question is metaphysical, these principles ought to be read as implicitly asserting the existence of metaphysically *accessible* worlds.

<sup>14</sup> The proposal is formally similar to one suggested by Plantinga (1973). See also Stalnaker (1986), and van Inwagen (1985).

<sup>15</sup> This is a common treatment of the semantics of predicates, and of their extensions, across possible worlds. See, for example, King (2007), at pp. 80-86.

Returning to our concrete example, consider how this proposal would have us evaluate the proposition expressed by “Socrates is unwise,” with respect to some arbitrary, uninstantiated world  $w$ . We want it to be the case that  $w$  represents that Socrates is unwise. What the world-stateist ought to say is that this is a matter of (i) Socrates existing at  $w$ , by being a part of  $w$ , and (ii)  $w$  representing, of Socrates, that he has the (arguably intrinsic) property of *being unwise*. (i) is straightforward, and follows from the version of world-stateism I presented at the end of the last chapter: Socrates exists at  $w$ , as a part, in virtue of being a constituent of a singular, structured property,  $w_{\text{socrates}}$ , that is itself a constituent of the rigid property-embodiment identified with  $w$ . (ii) is a matter of (a)  $w_{\text{socrates}}$  encoding Socrates and the property of *being unwise* (perhaps among other properties and relations) under the relation of *exemplification* and (b)  $w$  being such that, were it instantiated, Socrates *would have been unwise*.

This proposal doesn’t run afoul of the indexical account of actuality. “Actually, Socrates is unwise,” when evaluated at any world  $w$ , comes out true if  $w$  *represents* Socrates as being in the extension of *being unwise* at  $w$ . But this is not a matter of Socrates standing in the ( $w$ -indexed or un-indexed) relation of exemplification to *being unwise* at  $w$ . He doesn’t *literally* exemplify the property at all, at or with respect to  $w$ , on this view. But he would, if (and only if) it *were* the case that  $w$  were instantiated. This is because, on this proposal, saying that “Socrates is unwise at  $w$ ” is true is elliptical and ought to be understood as saying that Socrates *would be* unwise, if  $w$  were instantiated.

And the proposal respects the intuition that some properties are intrinsic, and that their exemplification is not a matter of a relation holding between an individual, property, and world. Given that the actual world  $@$  is a property that represents Socrates as being wise, and given that this property is instantiated, Socrates is literally in the extension of the intrinsic property *wisdom*.

Adopting the modal principle of overlap avoids contradiction by precluding the move from (4) to (5) in the argument from accidental intrinsics. So world-stateists who are (i) committed to overlap, but are (ii) uncomfortable with denying that anyone (or anything) ever actually instantiates (or could instantiate) an intrinsic property, and (iii) wish to hold on to the intuitively plausible indexical analysis of “actual” and its cognates, ought to consider this solution to the problem of accidental intrinsics.

### 1.3. Modal Realism and Primitive Modality:

The above response to the argument from accidental intrinsics requires drawing an irreducible, primitive modal distinction between the maximal structured property that is instantiated and each of the uninstantiated maximal structured properties that correspond to (merely) possible worlds. Indeed, what it *is* for an individual *a* to possibly have a property *F* is for *a* to be part of a world *w* such that, were *w* instantiated, *a* would have *F*. Instantiation makes *all* the difference between something being *merely represented* as being in the extension of a property (as is the case with uninstantiated worlds), and something *literally being in* the extension of a property by exemplifying it (as is the case with the actually instantiated world-property).

Some philosophers (most notably Lewis) find the notion of primitive, irreducible modality somehow problematic.<sup>16</sup> These philosophers think an analysis of modal phenomena like contingency and necessity, accident and essence, ought to somehow reduce the modal to the non-modal.<sup>17</sup>

All other things being equal, I think that the claim that the modal ought to reduce to the non-modal ought to be taken seriously. After all, it seems like we ought to prefer that theory of reality that explains so called “hypothetical facts,” like modal facts, in terms of some more fundamental, “categorical,” or non-modal, reality. However, I don’t think a commitment to primitive modality is somehow inherently problematic, because I don’t think that all other things really *are* equal. For instance, it seems obvious to many philosophers that a counterpart-theoretic analysis of *de re* modality, according to which hypothetical modal facts about an individual are analyzed in terms of non-modal, categorical facts about that individual’s counterparts, just gets the facts wrong about modality. It entails, for instance, that every world-bound individual has each of its properties as a matter of utter necessity. But, *clearly*, you could have lacked some of the properties you currently have; you could have lacked the property of *reading this essay*, for example. Since this is literally false, on a reductionist analysis in terms of counterparts, I think that the natural response should be to abandon counterpart theory.

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<sup>16</sup> But see also McDaniel (2004), and Bricker (2006), (2008).

<sup>17</sup> It is surprising that modal realism has come to be associated with this reductionist approach. Instead, it seems more appropriate to call philosophers who take this approach “modal reductionists” instead of “modal realists.” See Plantinga (1987) for an excellent discussion on the matter.

Thus, I think that world-stateists who are committed to overlap shouldn't worry that the response to the argument from accidental intrinsics outlined above commits them to primitive modality.<sup>18</sup>

## 2. *Genuine vs. Ersatz Modal Realism:*

In this section, we turn to the distinction between what David Lewis calls *genuine* and *ersatz* modal realism.<sup>19</sup> According to Lewis, the genuine modal realist is one who holds that there is no fundamental metaphysical or categorical difference between any of the worlds, including the actual world. Leaving open for the moment what counts as a *fundamental metaphysical category*, genuine modal realism may be characterized as the following thesis:

*Genuine Realism:*  $\forall w[w \neq @ \rightarrow (w \text{ belongs to the same fundamental metaphysical category as } @)]$

Lewis's own version of modal realism is genuine, as he makes clear in the following passage from *Counterfactuals*:

When I profess realism about possible worlds, I mean to be taken literally. Possible worlds are what they are, and not some other thing. If asked what sort of thing they are, I cannot give the kind of reply my questioner probably expects: that is, a proposal to reduce possible worlds to something else. I can only ask him to admit that he knows what sort of thing our actual world is, and then explain that other worlds are more things of that sort, *differing not in kind but only in what goes on at them*. Our actual world is *only one world among others*.<sup>20</sup>

Although Lewis has reservations about employing the terms "concrete" and "abstract," he often characterizes his version of genuine modal realism as the view that, like the actual world, all possible worlds are concrete.<sup>21</sup> But we can do better by simply noting that the actual world, for Lewis, is a *maximally spatiotemporally interrelated individual*, and not

<sup>18</sup> This is an abbreviated discussion of a very important issue. For arguments on either side of the debate, see Sider (2003), Plantinga (1987), Divers (2002), pp. 41-164, Lewis (1986a), pp. 136-174, (1986b).

<sup>19</sup> Lewis (1986a), pp. 1-92, 136-174.

<sup>20</sup> Lewis (1973), p. 85, my emphasis.

<sup>21</sup> See esp. Lewis (1986a) at pp. 81-86. The main problem with this terminology is that there doesn't seem to be any way of marking the distinction that is free of counterexamples. Lewis is reluctant to employ the term 'concrete' to characterize his version of genuine modal realism for these reasons.

a property, state of affairs, proposition, or set of such things. For simplicity, let's call any such individual a *Lewisian World*:

*Lewisian World*: an individual  $y$  is a *Lewisian World* only if (i) there are some  $x$ s such that each one of the  $x$ s is spatiotemporally related to each of the  $x$ s, (ii) none of the  $x$ s is spatiotemporally related to any object that is not one of the  $x$ s, and (iii)  $y$  is the fusion of the  $x$ s.<sup>22</sup>

From the passage cited above and the identification of the actual world with a *Lewisian World*, it follows that Lewis identifies every world with a *Lewisian World*. In this sense, Lewis is a genuine modal realist.

The ersatz modal realist disagrees. Ersatzers typically hold that there *is* a fundamental metaphysical or categorical difference between the actual world and each of the possible worlds, which is often expressed as the view that the actual world is concrete, while each of the possible worlds is (in some sense) abstract. Again, we can do better by simply noting that typically this amounts to the view that (i) the actual world is a *Lewisian World*, and (ii) no (merely) possible world is a *Lewisian World*:

*Ersatz Realism*:  $@$  is a *Lewisian World* &  $\forall w[w \neq @ \rightarrow \sim(w \text{ is a } \textit{Lewisian World})]$

Peter van Inwagen, in his "Two Concepts of Possible Worlds", does a nice job of characterizing ersatz modal realism.<sup>23</sup> According to van Inwagen, the actual world,  $@$ , is a concrete, *Lewisian World*, while each of the possible worlds is identified with a maximal abstract entity (such as a maximal consistent set of sentences or propositions, a maximal compossible state of affairs, or a maximal property).<sup>24</sup> According to ersatzism,  $@$  is unique in being a *Lewisian World*, and exactly one of these maximal abstract entities stands in a special, primitive relation  $R$  to  $@$ , where the nature of  $R$  will depend on what type of entity is identified with the possible worlds. Since we are concerned in this essay with world-stateism, let  $R$  be *instantiates*, and let the possible worlds be

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<sup>22</sup> The formal definition of a *Lewisian World* given here is modeled after McDaniel (2004), p. 142. For Lewis's own (extended) discussion of what a world is, see his (1986a), at pp. 69-86.

<sup>23</sup> Van Inwagen (1986). See also his (1980).

<sup>24</sup> Van Inwagen makes the distinction in terms of what he calls "C-Worlds" and "A-Worlds." This is merely a terminological difference, and need not detain us here.

structured properties.<sup>25</sup> According to the ersatz world-stateist, the unique structured property that @ instantiates, @<sub>w</sub>, represents the way that @ is. It does this because of the way that @'s parts are arranged, the properties these parts instantiate, and the relations they stand in. If any part of @ were arranged any differently, or instantiated a different property, or stood in different relations, then an entirely distinct structured property would be instantiated. On this view, uninstantiated maximal structured properties represent different ways that @, the unique Lewisian World, could have been.<sup>26</sup> These are the possible worlds. So characterized, we may represent ersatz world-stateism as characterized by van Inwagen as the conjunction of the following four theses:

(Ews1) The actual world, @, is the unique Lewisian World.

(Ews2) @<sub>w</sub> is the maximal, structured property that @ instantiates.

(Ews3) Possible worlds are maximal, structured properties that @ could have instantiated.

(Ews4) No maximal structured property is possibly a Lewisian World.

It should be clear that Forrest's theory is best characterized as a version of ersatz world-stateism.<sup>27</sup> For Forrest, the "way things are" is a structured property that @ instantiates (Ews2). Forrest calls this property the 'nature' of @. And possible worlds are uninstantiated properties that @ could have instantiated (Ews3). Alternatively, for Forrest possible worlds are different "natures" that @ could have instantiated. Since Forrest also (presumably) identifies @ with a concrete, maximally spatiotemporally interrelated individual, he also subscribes to Ews1. And, given that the difference between @ and each of Forrest's world-natures is categorical (the former is Lewisian World, while the latter are properties), Forrest also subscribes to Ews4. So Forrest is an ersatz world-stateist.

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<sup>25</sup> Depending on which version of actualist modal realism one endorses, we might substitute for R the relation of *being made true by* (in the case of maximal sets of sentences and maximal propositions), or *obtaining* (in the case of maximal states of affairs).

<sup>26</sup> Van Inwagen (1986) pp. 230-233.

<sup>27</sup> This is true of Bigelow and Pargetter as well. However, I am here concerned primarily with motivating my own account over Forrest's.

Questions about the metaphysics of structured properties aside, this is the most important different between Forrest's account and the alternative account outlined at the end of chapter 2. That view *is* genuine: like each of the possible worlds, the actual world, @, is a property, and *not* a Lewisian World. @ is the uniquely instantiated, maximally specific property that contains, as parts, each of the individuals that exist in D@, and specifies the properties these individuals actually instantiate and the relations they actually stand in. Possible worlds that are metaphysically accessible from @ are uninstantiated maximally specific properties that specify alternative ways that each of the individuals that actually exist could have been. Since it follows from this that the distinction between @ and each of the possible worlds is not categorical, the view is a species of genuine modal realism.

### *2.1. Against Ersatz World-Stateism:*

Kit Fine gives an argument which may be interpreted as giving indirect motivation for genuine modal realism, and the remainder of this chapter will be spent looking at Fine's argument. Fine is concerned with actualism – the view that whatever exists is actual – and the problem of how, given only the resources of the actual world, the actualist is able to find entities suitable to play the role of possible worlds and individuals. While Fine's argument is quite general, and may be read as targeting any of the traditional versions of actualism surveyed in Chapter 1, I focus here only on Fine's argument as it pertains to the world-stateist conception of possible worlds as structured properties. Roughly, Fine may be read as arguing that the ersatz world-stateist's commitment to a categorical distinction between @ and each of the possible worlds leads (surprisingly) to the conclusion that no ersatz world can really *be* a possible world.<sup>28</sup> A natural way to avoid this conclusion is to endorse genuine world-stateism (the view that all worlds, including the actual world, are properties). If I'm right, then although Fine himself doesn't put the matter this way, the fact that genuine world-stateism avoids his objection counts as a strong point in its favor.

The gist of Fine's argument is given in the following passage:

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<sup>28</sup> Fine (2003).

[Some philosophers] have suggested that we might think of a possible world as a way the world might have been [i.e., as a property]. But a possible world is possibly the world, just as a possible person is possibly a person, yet no way the world might have been [no property] is possibly the world, just as no way I might have been is possibly me. Thus...no possible world is [a property].<sup>29</sup>

This needs some unpacking. Although Fine doesn't put the matter this way, the passage just cited makes sense only if we assume that the view he is targeting here is ersatz world-stateism. Suppose ersatz world-stateism is true. Then the actual world, @, is a Lewisian World, and each of the possible worlds is identical to some maximal structured property that the (unique) Lewisian world could have instantiated. Thus interpreted, we ought to think of 'the world,' as it appears in the passage's first sentence, as (rigidly) denoting the unique Lewisian World, @. The second sentence tells us that "a possible world is possibly the world." Obviously, Fine cannot intend 'the world,' as it occurs in the second sentence, to be understood rigidly, i.e., in the same way as it occurs in the first sentence, and as referring to the unique Lewisian World, @. For if he did, then the second sentence of the passage would be equivalent to the claim that 'a possible world is possibly identical to @, but no property is possibly identical to @'. Surely, nothing other than @ itself possibly has the property of *being identical* to the world, where 'the world' is understood as rigidly denoting @.<sup>30</sup> So, perhaps we ought to read 'the world', as it occurs in the second sentence, as denoting some indexical property that @ exemplifies, like the property of *being actualized*. Interpreted in this way, the passage's second sentence makes the claim that a possible world is something that possibly instantiates the indexical world property of *being actualized*, but that no maximal structured property (no "way that things might have been") possibly instantiates this property. The conclusion of the passage then follows validly: since there is a property that every possible world has that no property has, it follows by Leibniz's law that properties cannot *be* possible worlds. Provided we assume the reasonable corollary principle ( $\lambda$ ):

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<sup>29</sup> Fine (2003), p. 163.

<sup>30</sup> To see this, consider any two distinct possible worlds,  $w$  and  $w'$ . Given the necessity of identity,  $w$  and  $w'$  are necessarily distinct. Now, assume that both  $w$  and  $w'$  had the modal property of *possibly being identical to @*. Then,  $w$  and  $w'$  are possibly identical. But then  $w$  and  $w'$  are both necessarily distinct and possibly identical, which is impossible.

- (λ) If an object *a* has the property of *possibly being*  $\phi$ , then *a* possibly has the property of *being*  $\phi$ ,

Fine's argument may be represented formally as follows:

- (1) Necessarily, a possible world possibly instantiates the indexical property of *being actualized*.
- (2) No property possibly instantiates the indexical property of *being actualized*.
- (3) Therefore, no property is a possible world.

As it stands, the passage provides little motivation for the argument's (crucial) second premise. But a plausible reading of the passage takes Fine's argument from (1-3) to be enthymematic, and that the implicit supporting argument for (2) might be given as follows. Assuming ersatz world-stateism, it will be true that:

- (2<sub>a</sub>) Necessarily, anything that has the property of *being actualized* is a Lewisian World.
- (2<sub>b</sub>) No ersatz possible world (i.e., no property) is possibly a Lewisian World.
- (2<sub>c</sub>) Therefore, no ersatz possible world (i.e., no property) possibly has the property of *being actualized*.

Premise (2) in the original argument from Fine follows immediately from (2<sub>c</sub>). (2<sub>b</sub>) is simply a restatement of *Ews4*. The idea is that, since the ersatz world-stateist takes the distinction between @ and each of the possible worlds to be categorical, presumably it is true as a matter of necessity that nothing from the second category could ever belong to the first. Putting the point in terms of the distinction between concrete and abstract objects, (2<sub>b</sub>) might be read instead as the claim that no abstract object is possibly a concrete object, which seems plausible enough. And (2<sub>a</sub>) is also plausible, when considered from the perspective of the ersatz world-stateist. By definition, the ersatz world-stateist thinks that @ exists, and is a Lewisian World. And it plausible to think that if @ exists, then it instantiates this property *in virtue* of being a concrete Lewisian World.

We'll return to (2<sub>a</sub>) below, when we consider some possible responses to Fine's argument. On the revocable assumption that (2<sub>a</sub>) is true, it follows from (3) and the trivial (4):

- (4) If ersatz world-stateism is true, then possible worlds are identical to properties,

that

- (5) It is not the case that ersatz world-stateism is true.<sup>31</sup>

Peter van Inwagen gives what might be thought of as the *standard ersatzist response* to arguments of this sort in his "Two Concepts of Possible Worlds." When modified to capture the theoretical commitments of the ersatz world-stateist, the response amounts to denying premise (1) in Fine's original argument:

- (1) Necessarily, a possible world possibly instantiates the indexical world property of *being actualized*.<sup>32</sup>

According to the van Inwagen move, ersatz world-stateists ought to accept that the unique Lewisian World, @, instantiates the property of *being actualized*. But by denying (1), they deny that possible worlds need be the sort of thing that possibly instantiate *this* property.<sup>33</sup> Instead, according to the standard response, a possible world is a maximal structured property that possibly stands in the *instantiation* relation to @.<sup>34</sup> So were Forrest to take the van Inwagen route, he could say that, while it is true that the unique Lewisian World, @, instantiates the property of *being actualized*, no possible world

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<sup>31</sup> Formally similar arguments against various versions of ersatzism appear in Bricker (2009), Divers (2002), pp. 21-22, Lewis (1986a), pp. 81-86, Melia (2009), Stalnaker (1976), and van Inwagen (1986).

<sup>32</sup> Van Inwagen (1986). Divers endorses the standard response in his (2002), at pp. 228-231.

<sup>33</sup> Of course, the supporter of the van Inwagen move might point out that, in virtue of standing in the obtaining relation to our concrete world, one A-world (or property) instantiates a unique property that other A-worlds could have instantiated. And this seems true- perhaps one of the properties this unique A-world instantiates is the complex property of *standing-in-the-obtaining-relation-to-the-concrete-world*. And it's true that *this* is a unique, indexical property that other A-worlds possibly instantiate. However, this line of thought is wide of the mark, for the reasons I discuss below.

<sup>34</sup> This does not mean that a maximal structured property is itself possibly a Lewisian World. Indeed, this is impossible, given (2<sub>b</sub>) in the reconstruction of Fine's supporting argument above.

possibly instantiates this property, and every possible world is such that it is possibly instantiated by @.

The supporter of Fine's argument would likely respond to this by bolstering support for (1). They might do this by pointing out that there are at least two necessary conditions that an entity would have to satisfy in order to qualify as being a possible world. The first of these is a *representational* condition. The entity in question (in this case, a maximal structured property) needs to be such that it is capable of representing, in some way, a possibility for the unique, concrete Lewisian World @.<sup>35</sup> And it is arguable that the ersatz world-stateist's possible worlds satisfy the representational condition: after all, according to the ersatz world-stateist conception of possible worlds, they represent different ways that @ could have been. But the second condition is more stringent. According to Fine, whatever else a possible world is, it is the sort of entity that possibly instantiates the indexical world property of *being actualized*. Something like the following is likely operating behind the scenes here: Ersatz world-stateists believe in the existence of a unique, concrete Lewisian World, @. Consider @. Whatever else is true, of @, it is at least true that:

(1<sub>a</sub>) @ is a world.

(1<sub>b</sub>) @ exists.

(1<sub>c</sub>) @ instantiates the property of *being actualized*.

From (1<sub>a</sub>-1<sub>c</sub>), it follows that

(1<sub>d</sub>) @ is a world and @ instantiates the property of *being actualized*.

Given (1<sub>d</sub>), surely any *possible* world ought to be something that at least *possibly* instantiates this property. Since the standard ersatz response from van Inwagen doesn't

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<sup>35</sup> These possibilities might be rather coarse-grained, and correspond in some sense to total ways that the concrete actual world could have been. Or, perhaps they are more fine-grained, and correspond to ways that individual parts of @ could have been. At any rate, whatever a possible world is, it must be such that it is at least capable of representing possibilities for both individuals and for the concrete actual world as a whole.

address what appears to be motivating (1), the standard ersatz response fails to block the argument's conclusion.

The only other controversial premise in the argument is (2<sub>a</sub>):

(2<sub>a</sub>) Necessarily, anything that has the property of *being actualized* is a Lewisian World.

What would denying this amount to, for the ersatzer? Let "the world" *non-rigidly* designate whatever actually existing, maximal entity it is that has each and every one of us, and all of our surroundings, as parts, and which instantiates the property of *being actualized*. From the perspective of the ersatz world-stateist, denying (2<sub>a</sub>) amounts to the bizarre view that, while "the world" actually denotes @ (a concrete Lewisian World), and while @ instantiates the property of *being actualized*, "the world" could have denoted some other thing (presumably, a maximal structured property) that is *not* a Lewisian World, and which *could have* instantiated the property of *being actualized*. But surely it is not a contingent matter, for the ersatz world-stateist, that the actually existing, maximal entity that has us and all of our surroundings as parts is a concrete Lewisian World. So it appears that denying (2<sub>a</sub>) is off the table for the ersatz world-stateist as well. Fine's conclusion ought to be endorsed. Ersatz world-stateism is false.

The genuine world-stateist has the advantage of being able to plausibly deny (2<sub>a</sub>). This is because the genuine world-stateist denies the ersatz thesis

(Ews1) The actual world, @, is the unique Lewisian World,

and replaces it with

((@) The actual world, @, is the unique, maximal structured property that is instantiated.

Ews2 is then trivially false, and in place of Ews3, the genuine world-stateist endorses (W):

(*W*) Possible worlds are maximal, structured properties that could have been instantiated.<sup>36</sup>

Since the genuine world-stateist is not committed to the claim that @ is identical to a Lewisian World, (2<sub>a</sub>) may be consistently denied. And since (2<sub>a</sub>) is crucial in the enthymematic argument for (2),

(2) No property possibly instantiates the indexical property of *being actualized*,

the latter is false as well, from the perspective of the genuine world-stateist. Indeed, nothing at all in Fine's argument should make us think that the genuine world-stateist cannot consistently hold that the actual world, @, is (a) the instantiated maximal structured property, that (b) @ instantiates the indexical property of *being actualized* and that (c) a possible world *w* is a maximal structured property such that, were *w* instantiated, *w* *would* instantiate the indexical property of *being actualized*. Thus, the genuine world-stateist can accept that a possible world is something that possibly instantiates this property, while blocking the (sub) argument's conclusion, (3). That this line of response is open to genuine, but not ersatz, world-stateism, counts as a strong point in favor of the former. World-stateists should be genuine about it.

The primary concern of this chapter has been to defend the version of world-stateism that I developed in Chapter 2 from the argument from accidental intrinsics, and to demonstrate an advantage the view holds over other, more traditional, versions of world-stateism. I take the above considerations to show that world-stateists who endorse an account of de re modality in terms of overlap have a plausible strategy for avoiding the argument from accidental intrinsics. Furthermore, the discussion of Fine's argument against ersatz modal realism shows that genuine world-stateism is a more attractive version of the theory. In the following, final chapter, I defend primitivism about properties, and show how ontological commitment to possible worlds can help provide a theory of truthmakers for modal truths.

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<sup>36</sup> The ersatzer's *Ews4*, according to which no maximal structured property is possibly a Lewisian World, is trivially true, and not detain us.

## Chapter 4: Conceptual and Ontological Issues:

### 1. *World-Stateism and Ontological Identification:*

The world-stateist's ontological commitments include, among other things, various "intension-like" entities, like properties and propositions. In this final chapter, I begin by considering an objection that targets the account's potential for providing a philosophically satisfying range of ontological identification. Roughly, the argument is this: one thing a theory of modality might provide is a means of identifying the various intension-like entities to which it is committed (like properties, propositions, and states of affairs, etc.) with extensional entities of some sort (like individuals, or set-theoretic constructions out of individuals). The motivations for such identifications tend to be Quinean: on the whole, we should prefer that theory which achieves the best balance of ontological economy, theoretical unity, and explanatory power.<sup>37</sup> More simply: if one can, unproblematically, get by with less, ontologically, then one ought to. Some theories of modality, most notably Lewis's possibilist modal realism, boast an *exhaustive* reduction of intension-like entities to the extensional. But there is at least one category of entity (the properties), for which such an ontological reduction/identification is impossible, on pain of circularity, for world-stateists. That is, if properties are identified with set-theoretic constructions out of, say, their actual and possible instances, then worlds themselves cannot be identified with properties. But then, since the world-stateist is ontologically committed to a class of primitive intension-like entities, while rival views are not, this counts as a point against the account. I respond to the argument by challenging the assumption that, when it comes to properties, one *can* get by with less. I then argue that, once we accept properties as ontologically primitive, commitment to other intension-like entities, like propositions, is unproblematic.

In the second section of this chapter, I turn to the issue of modal truth and the question of whether possible worlds, or proper parts of possible worlds, are needed in order to give a satisfying account of the truthmakers for such truths. I argue that they are.

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<sup>37</sup> Quine (1948).

The upshot of this section, therefore, is that there is at least one area that the world-stateist's commitment to properties as primitive may be put to good use.

At the beginning of his *On the Plurality of Worlds*, Lewis gives the following argument for his version of possibilist modal realism (PMR). Call this *the argument from utility*:<sup>38</sup>

- (i) For any ontological thesis T, *if* T allows us to (a) reduce the diversity of notions that we must accept as ontologically primitive, and (b) improve the unity and economy of our total theory to a greater extent than rival ontological theses, then we have good (but not conclusive) reason to believe in the truth of T.
- (ii) PMR is an ontological thesis that allows us to (a) reduce the diversity of notions that we must accept as ontologically primitive, and (b) improve the unity and economy of our total theory to a greater extent than rival ontological theses.
- (iii) So, we have good (but not conclusive) reason to believe in the truth of PMR.

Premise (i) is simply a restatement, in the form of a universally quantified conditional, of the Quinean motivations mentioned above: we have good reason to accept as true that ontological thesis that satisfies these conditions to a greater degree than do its rivals.

Premise (ii) attributes to Lewisian possibilism the virtue of satisfying these conditions to a greater degree than its rivals. PMR satisfies (a), according to Lewis, since, in terms of ontological primitives, it is committed only to individuals, set-theoretic constructions out of individuals, and a family of primitive relations (mereological, spatiotemporal, etc.) holding over individuals. On Lewis's theory, each category of intension is identified with one or another of these ontological primitives: abundant properties are each identified with *subsets* of the set of actual and possible individuals, propositions and states-of-affairs are identified with sets of possible worlds,<sup>39</sup> and worlds themselves are identified with maximal sums of individuals that are spatiotemporally related, i.e., Lewisian Worlds. Since there is no unanalyzed or unidentified intensional

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<sup>38</sup> Lewis (1986a) pp. 3-5. See also Divers (2002), pp. 196-201.

<sup>39</sup> Or, if more fine-grained distinctions are needed among propositions (in order to account for puzzles arising from attitude ascriptions in belief contexts), with proper parts of worlds. See Lewis (1979), (1983).

primitive in the PMR ontology, Lewis argues, PMR offers an *exhaustive* and fully *extensional* range of ontological identification.<sup>40</sup> However, world-statists identify each world with a maximal, structured property having, as proper constituents, simpler properties and relations, and take these world-making elements to be ontologically primitive, the range of ontological identification on offer from PMR outstrips that of the world-stateist.

And Lewis thinks PMR satisfies the second condition (b) since Lewisian PMR is a version of genuine modal realism.<sup>41</sup> Here, Lewis clearly has versions of ersatz modal realism in his sights. Since Lewis's PMR is committed to worlds of only one metaphysical category, and one we are already familiar with in virtue of our acquaintance with *our* world, and since ersatzers are committed to at least two, Lewisian possibilism wins out in terms of unity and economy of total theory. Since both of these considerations strongly support premise (ii) in the argument from utility, Lewis thinks we should prefer PMR to world-stateism (and other traditional versions of actualism, for analogous reasons). However, since the version of world-stateism we are considering here is *also* genuine<sup>42</sup>, the real issue for the world-stateist is (a).

Although the principle of ontological economy embodied in (a) of (i) is intuitive, it's open for the world-stateist to complain that it is incomplete, as stated. It may be true that we should prefer that theory that allows us to reduce the number of entities that we must accept as primitive, but any such reduction also ought to be *plausible* on independent grounds: if reducing the *as* to the *bs* is desirable on grounds of economy, so that apparent ontological commitment to *as* turns out to be nothing over and above commitment to *bs*, then we need some reason to think that the *as really are* just the *bs*. After all, Parmenides famously held that all of reality consisted of only one thing.<sup>43</sup> Given Lewis's Quinean reasoning, we should all be Parmenidians. The reason we aren't is that we find the proposed reduction implausible on some grounds.<sup>44</sup> So the crucial question, for the world-stateist, is whether Lewis's identification of properties with

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<sup>40</sup> Lewis himself doesn't put the matter in these terms. But this is the idea.

<sup>41</sup> See Chapter 3, at pp. 52-53.

<sup>42</sup> See Chapter 3.

<sup>43</sup> See Heidegger (1998) for a lengthy discussion of the relevant fragment.

<sup>44</sup> Assuming we think that there is more than one thing.

subsets of the set of actual and possible individuals is plausible. In the remainder of this section, I argue that it is not.

### 1.1. *Against Extensional Identification for Properties:*

Here's an argument. First-order properties include the qualitative attributes of individuals. In virtue of instantiating these qualitative attributes, ordinary, concrete things stand in particular relations of objective similarity and difference to one-another. Furthermore, we might also think that properties ground the causal and dispositional powers that we discern in things (or, on some realist metaphysics of properties, as being *identical* to these causal and dispositional powers).<sup>45</sup> Sets, by contrast, are a sort of aggregate, or collection, of entities; a set is a single entity (somehow) composed (or constructed) out of its members.<sup>46</sup> It is no part of our concept of *set* that sets be the sort of entity that are (or could be) instantiated, and the existence of (or membership in) a particular set seems to have no relevance to an object's particular causal or dispositional properties. Since (some) properties have these features, but no set does, it follows by Leibniz's law that no property is a set.

The trouble with this sort of Leibniz's law reasoning is that it is unlikely to sway a supporter of the sort of identification Lewis has in mind. The argument implicitly assumes that our everyday, pre-theoretical conception of properties and sets is a reliable guide to what these entities ultimately must be like. But Lewis denies this. Instead, he argues that there are various theoretical "roles" that properties and sets are supposed to play. While these roles may be partially captured by our common sense conception of properties and sets, common-sense itself offers us no guidance on what entities (or classes of entities) ultimately fill these roles. Lewis writes:

'Property,' and the rest [like 'proposition,' and 'state-of-affairs'] are names associated in the first instance with roles in our thought. It is a firm commitment of common-sense that there are some entities or other that play the roles and deserve the names, but our practical mastery of uses of the names does not prove that we have much notion what manner of entities those are. That is a question for theorists. I believe in properties. That is, I have my

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<sup>45</sup> Cf. Ellis (2001); Molnar (2003); Shoemaker (1980).

<sup>46</sup> Potter (2004).

candidates for entities to play the role and deserve the name. My principle candidates are sets of possible individuals.<sup>47</sup>

So appealing to the fact that we pre-theoretically believe sets and properties to be distinct does little to undermine the theoretical identification Lewis is proposing. Disagreement with common-sense is perhaps a cost, but it is a cost outweighed by the theoretical advantages (simplicity, economy, etc.) to be gained by the proposed identification. World-stateists need something stronger.

So here's a stronger argument. Instead of exploiting differences between our pre-theoretical conceptions of sets and properties, we point to differences in their established, *theoretical* roles. Consider the following. We have it from set *theory* that there is no *Russell set*; that is, there is no set of all sets (or set of all non self-membered sets, etc.). Now, if Lewis's proposal is correct, then every one of the (abundant) properties is identical to some set or other. But sets have properties. In particular, every set has the property of *being a set*. If properties just are sets of their actual and possible instances, then this property must be identical to the set of all sets. Since there is no such set, Lewis's proposal cannot be ultimately correct.<sup>48</sup>

Here's another. Consider contingent properties of properties. Presumably, Lewis's proposal to identify the properties with sets of individual instances holds also for second-order properties, like the property *being a property* and the property of *being instantiated*. Now, some second-order properties are only contingently instantiated. For consider the second order property of *being Obama's favorite property*. Suppose that the (first-order) property of *being green* has this property. Though *being green* is Obama's favorite property, it need not have been: the property of *being Obama's favorite property* is only contingently a property of the property of *being green*. But, on the assumption that Lewis's proposal is correct, the property of *being Obama's favorite property* is identical to a set. Since Obama could have favored a different property, it follows that at some worlds, a different property instantiates the property of *being Obama's favorite property*. But then *being green* both is, and is not, a member of the set that is identical (on Lewis's proposal) with the property of *being Obama's favorite property*. Since this is a

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<sup>47</sup> Lewis (1986b) p. 189. C.f. Divers (2002), pp.198-200.

<sup>48</sup> Thanks to Chris Tillman for this point. .

contradiction, Lewis's identification of properties with the sets of their instances cannot ultimately be correct.<sup>49</sup>

The best explanation of these results is that the abundant properties simply are not identical to sets of actual and possible individuals. In eschewing the best explanation, Lewis achieves a greater degree of ontological economy than the world-stateist. But this is a small comfort. Once we reformulate the first premise of the argument from utility (by building in the intuitive condition that any proposed ontological identification ought to be independently plausible), the world-stateist has the resources to deny the second premise: it is not the case that Lewisian PMR is able to provide a unified, economical, *and plausible* ontological theory to a greater extent than its rivals. So that fact that the range of ontological identification on offer from PMR outstrips that of the world-stateist is no threat to the overall plausibility of the account.

Once we accept a fundamental ontological commitment to properties (by resisting Lewis's proposed identification), the world-stateist then has two strategies available for dealing with other intension-like entities, like propositions. One strategy is to identify the propositions with sets of possible worlds.<sup>50</sup> On this view, a contingently true proposition is identical to a subset of the possible worlds, all the worlds are identified with structured properties, and necessary and impossible propositions are identified with the set of all worlds, or the empty set, respectively.

The problem with the identification of propositions with sets of worlds is that it conflates intuitively distinct propositions. This is easiest to see in attitude contexts: when Fred believes both that Ted is a married bachelor and that there is a counterexample to Fermat's last theorem, the object of his belief is the same (empty) set of possible worlds. But Fred's beliefs seem distinct (the latter, but not the former, is at least intelligible). By conflating these intuitively distinct propositions, the strategy gets the facts about belief wrong. And since part of a theory of propositions is the explanation of what objects our intentional attitudes range over, the identification of propositions with sets of possible worlds won't work.<sup>51</sup>

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<sup>49</sup> Egan (2004).

<sup>50</sup> Stalnaker (1987).

<sup>51</sup> The world-stateist has *some* room to maneuver here: we might avoid the conflation of distinct propositions by identifying propositions with sets of possible *and impossible* worlds. Doing would at least

But once we allow properties as ontologically primitive, the world-stateist has a further avenue available for dealing with propositions. Consider singular propositions. A wide-spread semantic theory holds that singular propositions are structured, abstract entities that have individuals and properties (the respective semantic values of directly referential terms and predicates) as proper constituents. And for world-stateists, individuals and properties are irreducible, ontologically primitive entities. Given these commitments, it is unclear why commitment to a further class of entities composed *out of* individuals and properties should strike us as ontologically problematic. Similar considerations hold for other categories of intension-like entity, like states of affairs, or facts, since these too are, plausibly, structured abstract entities composed out of individuals, properties and relations. The world-stateist's ontological commitments, therefore, seem unproblematic on the whole.

## 2. *Modality and Truth:*

Above, I argued that commitment to properties as primitive is defensible since an extensional identification (of properties with sets) is implausible. In the remainder of this essay I argue that these commitments may be put to good work. In particular, we may appeal to possible worlds and their parts, which are constructions out of such properties, in order to develop a metaphysics of modal truth. The idea is that those parts of possible worlds that correspond to possibilities for particular individuals may serve as *truthmakers* for everyday modal truths about these individuals.

Not all philosophers agree that this is a worthwhile project. David Armstrong, for instance, argues that we may account for modal truth without appealing to possible worlds, their parts, or modal properties at all. But I think he's wrong about this. After briefly spelling out Armstrong's truthmaking theory, I present a problem for his view, and show that an account that identifies truthmakers for modal truths with constituents of possible worlds (in this case, structured properties) avoids the worry. I then consider a further objection, this time from John Divers. If Divers is right then, given certain facts

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allow us to explain how it is that Fred believes distinct things. (Although consider the intuitive difference between believing the proposition that twice two is four and the proposition that first-order arithmetic is incomplete. Both propositions are necessary, and so, on the Lewis-Stalnaker proposal, identical (to the set of all *possible* worlds). See Soames (2007) for discussion.

about the metaphysics of properties, it turns out that certain characteristic truthmaking theses hold trivially, and are therefore uninteresting. However, I'll point to an interpretation of the project that avoids Divers's complaints as well.

### 2.1. *Armstrong's Theory of Modal Truthmakers:*

The rough idea behind a theory of truthmakers is that a truthmaker is something *actual* that *makes a truth true*. Appeal to truthmakers is sometimes made in the very definition of truth, in the sense that something is true only if it has a truthmaker. Consider the following definition of truth from Armstrong:

(TRUTH) A proposition *p* is true *iff* there exists some *T* such that *T* necessitates that-*p* and *p* is true in virtue of *T*.<sup>52</sup>

Here, *p* denotes some true proposition, and *T* a *truthmaker* for *p*: some actual aspect, element, or portion of reality the existence of which makes *p* true. In what follows, I'll assume that since propositions are the fundamental bearers of truth-values, every truth is a (true) proposition, and every falsehood is a (false) proposition.<sup>53</sup> TRUTH captures the above intuition about truthmakers: whenever some proposition is true, there exists something that makes it true. But insofar as TRUTH is supposed to *define* truth, it's still pretty uninformative, for a couple of reasons. In order to be informative, we'd have to know (i) what kind of entity plausibly serves as the value of *T*, and (ii), the nature of the relation holding between *p* and *T* such that *p* is true in virtue of being a relatum. A metaphysics of truthmakers is an attempt to provide answers to these questions.

It's worth noting that TRUTH is really the conjunction of two distinct theses, each of which Armstrong endorses, and argues for independently.<sup>54</sup> According to *truthmaker maximalism*,

(TM) Every truth has a truthmaker.

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<sup>52</sup> Armstrong (2004), p. 17.

<sup>53</sup> The notion of truth might well be *connected* with various notions other than that of (true) propositions, like assertion, judgment, and belief. But, like Armstrong, I think it is plausible to identify true assertions, judgments and beliefs with assertions *of*, and judgments and beliefs *in*, true propositions.

<sup>54</sup> I won't rehash the arguments here. For discussion, see Armstrong (2004).

Note that truthmaker maximalism does not say that every truth has some *unique* truthmaker, but only that every truth has *at least one*. The idea, roughly, is that every truth is made true by something; there are no “free-floating” truths that aren’t made true by anything at all.<sup>55</sup> And according to the second thesis, *truthmaker necessitarianism*,

(TN) Truths are necessitated by the existence of their truthmakers.

Truthmaker necessitarianism doesn’t say that all truths are necessary truths, but rather that truths and truthmakers are modally covariant. Given that T exists and is a truthmaker for some proposition p, the truth of p supervenes on T; alternatively, once you have all the truths, you (necessarily) have their truthmakers.

Exactly which aspects, elements, or portions of reality ought to be identified with the truthmakers for modal truths is an open issue, because different ontological theses have different candidate aspects, elements or portions of reality to serve as truthmakers.<sup>56</sup> But let’s assume, for the moment, that truthmakers are *Armstrongian*: facts, or states of affairs, consisting of (actually existing) objects and the properties they (actually) instantiate.<sup>57</sup> On Armstrong’s account, the truthmaking relation is a *cross-categorical* relation of *necessitation* holding between a proposition and its (non-propositional) truthmaker(s).<sup>58</sup> The truthmaking relation is cross-categorical because truths and truthmakers belong to distinct ontological categories. Crucially, truthmaking isn’t the entailment relation, for Armstrong; truthmakers do not entail their truths, since entailment is a relation that holds between propositions, and truthmakers are non-propositional.

However, entailment and *necessitation* (the truthmaking relation) are importantly connected, for Armstrong. Armstrong subscribes to what he calls *the entailment principle*: whenever p and q are (true) propositions such that p entails q, and T is a

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<sup>55</sup> Armstrong calls unique truthmakers “minimal”; for discussion, see Armstrong (2004), pp. 19-22.

<sup>56</sup> It’s also an open issue because you might think that there just are no such things as truthmakers, perhaps because you think that truth is just a primitive property of propositions. I ignore this complication in what follows.

<sup>57</sup> See Armstrong (1997), (2004).

<sup>58</sup> Armstrong (2004), p. 5

truthmaker for  $p$ ,  $T$  is thereby *also* a truthmaker for  $q$ .<sup>59</sup> More carefully, where  $[\Phi]$  and  $[\Psi]$  are schematic letters standing for propositions, “ $\rightarrow$ ” denotes the truthmaking relation of necessitation, “*entails*” the relation of entailment holding between propositions, and  $[T]$  is a schematic letter standing for a truthmaker for some  $\Phi$ , Armstrong’s entailment principle (EP) licenses any inference that is of the following form:

- (EP):      i.  $\Phi$   
               ii.  $T \rightarrow \Phi$   
               iii.  $\Phi$  entails  $\Psi$   
                $\therefore$  iv.  $T \rightarrow \Psi$

Armstrong’s main thesis is that one can provide a satisfying account of truthmaking for modal truths by appealing *only* to truthmakers for non-modal truths, together with the entailment principle. The upshot, he argues, is a fully *deflationary* account of truthmaking for modal truths: we can provide a theory of modal truth that does not require any commitment to possible worlds or their constituents.

In fact, Armstrong may be read as endorsing an even stronger claim than this. And it’s important to be clear on what, exactly, Armstrong’s view is with respect to the entailment principle since, as I argue below, the failure of the entailment principle in modal truthmaking contexts creates a problem for his account. Not only is Armstrong arguing that we can have a theory of truthmakers for modal truths that makes no appeal to possible worlds or their parts; he also appears to hold that we can explain modal truths wholly in terms of non-modal properties (in a sense, this latter claim may be seen as a consequence of the former). And according to Armstrong, this ontologically economical aspect of his view does much to recommend it. He writes:

It seems to me very surprising that so many good philosophers consider that huge metaphysical commitments must be made in order to give an account of these [modal] truths. David Lewis (1986) postulated a whole pluriverse: ‘the worlds in all their glory.’ Alvin Plantinga (1974) rejects these other worlds, but adds to this world, our world, an uncountable multitude of sets of propositions, each set a way that the world might have been, but in is in fact not... [m]y thesis is that these philosophers are bringing in giants to

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<sup>59</sup> Armstrong (2004), pp. 10-12.

do a boy's work. 'Possible worlds' are useful fictions, no doubt, but we ought to be looking for quite modest truthmakers, fairly deflationary truthmakers, for these fairly unimportant truths of mere possibility.<sup>60</sup>

Bracketing the question of why Armstrong thinks that modal truths about possibility are "fairly unimportant" (it seems likely, for instance, that McCain cares a great deal about the fact that he could have won, but didn't) the crucial issue to be addressed in the remainder of this section is whether Armstrong is right, and that we need not appeal to possible worlds, their parts, or modal properties at all in order to account for modal truth.

Here is how he argues for this. Consider the case of *de re* modal truths, like (1):

(1) Obama could have lost the election.

Armstrong's strategy is to exploit a close connection that obtains between modal propositions, like (1), and corresponding *non-modal* propositions, like (1a):

(1a) Obama won the election.

Let's call (1a) the *non-modal dual* of (1). Since (1a) is contingently true, it could have been false. And since (1a) could have been false, Armstrong argues, (1a) *entails the (modal) proposition* (1). Presumably, this relation holds between any modal proposition and its non-modal dual. By the entailment principle, any truthmaker for the non-modal (1a) will therefore *also* be a truthmaker for the modal proposition (1). In other words, on Armstrong's theory, the truthmaker for the proposition that Obama could have lost just *is* the truthmaker for the proposition that he won, since the latter is contingently true.

Now suppose, with Armstrong, that we identify the truthmaker for (1a) with the complex state of affairs consisting of Obama instantiating the property of *winning the election*. Since this state of affairs is also (via the entailment principle) a truthmaker for the modal truth (1), we have Armstrong's deflationary account of truthmakers for modal truths. Moreover (and here's where the stronger reading of Armstrong's thesis comes into play), since we can explain the truth of (1) only by appealing to the state of affairs

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<sup>60</sup> Armstrong (2004), pp. 83-84.

consisting of Obama instantiating the property of *winning the election*, and since the property of *winning the election* is a non-modal property, Armstrong appears to hold that we can provide truthmakers for modal truths like (1) *without appealing to any modal properties at all*.

In general then, if Armstrong is right, we may provide a truthmaker for *any* modal proposition of the form  $\Diamond\Psi$  by (i) first identifying its contingent, non-modal dual,  $\Phi$ ; (ii) identifying a truthmaker,  $T$ , *for*  $\Phi$  (where  $T$  involves no commitment to possibilities or modal properties) and then applying the entailment principle to derive the result that  $T$  is *also* a truthmaker for the target modal proposition  $\Diamond\Psi$ . Thus, where “ $\rightarrow$ ” and “*entails*” are as before, Armstrong’s strategy may be represented formally by the argument schema (MT):

- (MT)
- i.  $\Phi$
  - ii.  $T \rightarrow \Phi$
  - iii.  $\Phi \text{ entails } \Diamond\Psi$  from i, and the contingency of  $\Phi$
  - $\therefore$  iv.  $T \rightarrow \Diamond\Psi$  from ii, iii, and (EP)

Thus, given the entailment principle, Armstrong thinks, instances of MT will generate truthmakers for any and all modal truths.<sup>61</sup>

But this can’t be right. Entailment is a relation that holds between two propositions in virtue of facts which are *internal* to each. These facts might be *semantic*; that is, they might be facts about the meaning of propositional constituents. For instance, the proposition that Tom is a bachelor entails the proposition that Tom is an unmarried male, in virtue of the semantics of “Tom,” “bachelor,” and “unmarried male.” Alternatively, one true proposition might entail another in virtue of logical form. For instance, the proposition that Tom is a bachelor entails the proposition that at least one

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<sup>61</sup> For instance, just as any truthmaker for the contingent proposition that Obama won is also (according to Armstrong) a truthmaker for the proposition that he could have lost, any truthmaker for the contingent proposition that there are chimpanzees will also be a truthmaker for the proposition that there could have been none. And although Armstrong doesn’t provide a separate treatment for truths about metaphysical necessity (his account focuses on logical and mathematical necessary truth) it’s not hard to see how the account would go. Presumably, *whatever* makes it true that Obama is human will also, given the entailment principle (and the fact that the proposition that Obama is human is necessary) serve as truthmaker for the proposition that Obama is necessarily human. See Armstrong (2004), especially at pp. 95-111, for the relevant discussion.

thing is a bachelor. But the relation that holds between true modal propositions and their non-modal duals in Armstrong's (MT) is neither logical nor semantic.

To see this, consider (1a), the proposition that Obama won. If this proposition were to entail the modal proposition that Obama could have lost, it would have to be in virtue of internal semantic facts about the former (facts about the semantics of "Obama" and "won") or facts about its logical form. But no such internal semantic relation obtains. And while the proposition that Obama won might (logically) entail the proposition that *someone won*, it doesn't entail the proposition that Obama could have lost.<sup>62</sup>

Instead, it's the *external* fact, *about* the proposition that Obama won, that it has the property of *being contingently true* that is doing the real work here. So the truthmaker for the proposition that Obama could have lost *cannot* be the truthmaker for (1a). Instead, what these considerations show is that the truthmaker for the proposition that Obama could have lost is really just whatever makes (2) true:

(2) The proposition that Obama won is contingently true.

Now suppose, for the moment (with Armstrong), that we need not appeal to possibilities in order to account for modal truths. A natural (Armstrongian) candidate for the truthmaker for (2) will then be the complex fact, or state of affairs, consisting of Obama instantiating *both* the property of *winning the election* and the (modal) property of *possibly losing the election*. Call this state of affairs 'OBAMA+'. Notice that, in addition to being a truthmaker for (2), OBAMA+ will *also* be a (non-minimal) truthmaker for our target (1) and its non-modal dual:

(1) Obama could have lost the election.

(1a) Obama won the election.

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<sup>62</sup> Presumably, it is for precisely these reasons that an inference from  $\Phi$  to  $\Diamond\sim\Phi$  is not a valid and accepted pattern of inference in any system of modal logic. It's worth noting that considerations such as these tell strongly against any attempt to explain the modal profile of a proposition solely in terms of its logical or semantic form, as in Wittgenstein (1921). For discussion, see Scott Soames (2003), at pp. 234-253.

But, crucially, this has nothing to do with any relation (entailment or otherwise) holding between (1a) and (1); nor does it depend at all on the fact that *these* propositions *are* (semantically and logically) entailed by (2). Entailment is not doing *any* work here. It follows that, at least in modal truthmaking contexts like these, any application of the entailment principle is redundant.<sup>63</sup> We need not appeal to anything like it in order to provide an (Armstrongian) account of truthmakers for modal truths like (1).

However, this still leaves Armstrong's stronger thesis—that we can account for the truth of modal propositions like (1) without appealing to possible worlds or their parts—unscathed. In the remainder of this section I argue that he is wrong about this as well.

## 2.2. *Why We Need Possibilia: Partial and Proper Explanation:*

Since the modal property of *possibly losing* is a proper part of OBAMA+, identifying OBAMA+ with the truthmaker for (1) entails commitment to fundamentally modal properties. And, as we have seen, Armstrong ought to identify the truthmaker for (1) with OBAMA+ (or something like it). In a forthcoming paper, Ben Caplan and David Sanson distinguish between what they call *partial* and *proper* explanation.<sup>64</sup> They offer the following example to help bring out the distinction. Imagine someone trying to explain the existence of evil in the world, and suppose that the existence of evil in the world is in fact due to the existence of Satan and his machinations. Here are two competing explanations of the existence of evil in the world:

S1. There is evil in the world because {Satan} exists.

S2. There is evil in the world because Satan exists.

On the assumption that evil exists because Satan exists, S1 and S2 each count as a successful, and correct, explanation of the existence of evil in the world. But they are importantly different, as far as explanations go. This is because S1 provides a *partial* explanation of the existence of evil, while S2 provides a *proper* explanation. Partial

<sup>63</sup> I say “at least in modal truthmaking contexts” because presumably the entailment principle can still do some of the work it is designed to do in other contexts (namely, those in which entailment does apply).

<sup>64</sup> Caplan and Sanson (2009).

explanations are not incorrect, or irrelevant. Instead, they are connected, in important ways, with proper explanations. Since {Satan} exists if and only if Satan exists, it follows that, if {Satan} exists, then Satan exists, and S1 partially explains the existence of evil in the world. But it does this *only* because of the relation that holds between {Satan} and Satan. Suppose (*per impossibile*) that {Satan} existed but Satan didn't. In such a scenario, we surely wouldn't want to say that S1 explained the truth of the proposition that there is evil in the world. However, suppose there were no sets, and that Satan existed. In such a case, it seems like S2 would still count as an explanation of evil. For these reasons, S2 counts as a proper explanation.

Now, suppose we agree that (1) is true because OBAMA+ exists, and that (1) and OBAMA+ stand in the truthmaking relation. Consider the following two *explanations* of the truth of (1):

- E1: (1) is true because OBAMA+ exists. OBAMA+ exists because Obama has the primitive, irreducible modal property of *possibly losing the election*.
- E2: (1) is true because OBAMA+ exists. OBAMA+ exists because there is a metaphysically accessible world at which Obama exists and is represented as being in the extension of *losing*.

Both E1 and E2 have it that (1) is true because OBAMA+ exists. But unlike E1, E2 explains the existence of OBAMA+ in terms of certain categorical facts about modal reality: namely facts about Obama and how things are with him at uninstantiated possible worlds. In virtue of explaining the truth of (1) in categorical terms, E2 constitutes a *proper* explanation of the truth of (1). And at best, E1 constitutes only a partial explanation.

We may bolster the point by noting that the relationship between E1 and E2 mirrors the relationship between S1 and S2. Just as we might think that {Satan} exists in virtue of Satan existing, Obama has the modal properties he does in virtue of being a literal part of different worlds that represent him as being in the extension of different properties. So we should think that Armstrong's stronger thesis (that we can have a satisfying theory of truthmakers for modal truths without commitment to possible worlds and their parts) is also false. Possibilia are needed in order to provide a proper

explanation of the truth of modal truths. Therefore, we need them in a metaphysics of truthmakers.

### 2.3. *The Non-Contingency of Singular Structured Properties:*

In light of these considerations, world-stateists ought to identify the truthmakers for basic truths about metaphysical possibility with parts of possible worlds. A natural candidate for the truthmakers for these truths will be the atomic world-making elements: singular structured properties that have as proper parts individuals and the simpler properties they are represented as exemplifying, and which combine with other similar properties to compose entire worlds. So, for example, given the fact that Socrates is actually wise, but could have been unwise, the world-stateist might identify, as the truthmaker for (3)

(3) Socrates could have been unwise

the complex, structured singular property that has Socrates, the property of *being unwise*, and *instantiation* as proper parts.<sup>65</sup> Although identifying the truthmakers for modal truths with constituents of possible worlds avoids the worries raised above in connection with Armstrong's account, the position still needs some clarification, in light of the following issue.

A natural way to think of the relation that holds between truths and their truthmakers is in terms *supervenience*: indeed, Armstrong often characterizes truthmaking in terms of supervenience. And a supervenience relation is a relation of modal covariance. For example, for any two sets of properties A and B, we may say that the A properties supervene on the B properties if nothing can differ with respect to the exemplification of an A property without also thereby differing with respect to the exemplification of a B property.<sup>66</sup> For instance, one might hold that mental properties supervene on properties of the brain, that moral properties supervene on natural physical

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<sup>65</sup> Of course, given the fact that there are many ways that things could have been according to which Socrates is unwise, this very property will be a constituent of many distinct possible worlds.

<sup>66</sup> McLaughlin and Bennett (2005). C.f. Stalnaker (1996).

properties, or that the aesthetic properties of a physical artwork supervene on the distribution of the work's physical properties.

However, there are problems with thinking of the truthmaking relation in terms of supervenience. These problems are brought out in the following argument from John Divers.<sup>67</sup> According to Divers, any adequate account of truthmaking for modal truths ought to be such that it enables us (at least in principle) to identify, for any true modal proposition *p*, a unique truthmaker *T* for *p* such that the existence of *T* is *modally necessary and sufficient* for the truth of *p*. A truthmaking thesis, Divers argues, must issue in a “suitably discriminating *matching* of truths to their truthmakers.” Divers argues that, properly understood, the world-stateist's structured singular properties cannot be appealed to in order to provide a theory of truthmaking that provides such a suitably discriminating matching of truths to their truthmakers, and is therefore inadequate.

Here is the argument. Suppose that the world-stateist identifies the truthmakers for basic claims of possibility, like (3), with singular properties having individuals and simpler properties as parts. Now consider these properties themselves. A popular view in the metaphysics of properties has it that properties are necessary existents. If world-stateists accept that all properties are necessary existents, then this entails that (i) the world-making elements themselves are necessary existents, and that therefore (ii) the truthmakers for basic modal truths exist necessarily. But if each and every truthmaker exists necessarily, then it follows that things (absolutely) could not have been otherwise with respect to which truthmakers exist and which do not. If this is right, it follows that *any* truthmaker *T* will be modally necessary and sufficient for the truth of *any* modal truth.

Where “SOCRATES” denotes our putative truthmaker for (3), it is easiest to see the problem by considering counterpossible conditionals of the form (4a-c):

(4a) If SOCRATES didn't exist, then it would have been false that Socrates could have been unwise.

(4b) If SOCRATES didn't exist, then it would have been false that Obama could have lost the election.

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<sup>67</sup> Divers (2004), pp. 201-209.

(4c) If SOCRATES didn't exist, then it would have been false that Obama is necessarily human.

(4a) seems intuitive. However, given the impossibility of the antecedent assumption, it turns out that *each* of these conditionals will turn out to be vacuously true. And if this is right, then the existence of any truthmaker whatsoever turns out to be modally necessary and sufficient for the truth of any truth, and the world-stateist's account fails to provide the sort of discriminating correspondence between truth and truthmaker that Divers takes to be intuitively necessary for any adequate theory of truthmaking for modal truth.

I think Divers is correct about all this, but that what his argument really shows is not that the world-stateist's account of truthmaking for modal truths is somehow inadequate, but that the truthmaking relation that holds between a given modal truth and its truthmaker is not best characterized in terms of a supervenience relation. Indeed, as Jonathan Schaffer points out in a recent paper, the supervenience relation has the wrong formal features to be *the* truthmaking relation.<sup>68</sup> For whatever else we may want to say, we want to be able to say that (i) modal truths are *made true* by the existence of their truthmakers, (ii) that it is not the case that certain truthmakers exist in virtue of certain truths being true, and that therefore (iii) the truthmaking relation ought to be characterized in terms of a relation of ontological dependence that holds between truths and their truthmakers. More carefully, we want the truthmaking relation to be a relation that is both *irreflexive* and *asymmetric*. But the supervenience relation, as a relation of mere modal covariation, is neither of these: supervenience *is* reflexive and non-asymmetric. So, while we should accept that truths do supervene on the existence of truthmakers (and that the existence of truthmakers supervenes on the existence of truths), we should refrain from characterizing truthmaking as supervenience. Standard claims about the truthmaking relation will, as Divers puts it, come out trivially true if we try to characterize the truthmaking relation in terms of a relation of mere modal covariation or supervenience.

Taking a page from Schaffer, it seems more appropriate to characterize truthmaking in terms of what he calls the *grounding* relation. Truthmakers *ground* truths. But since grounding, as formally defined by Schaffer, *is* an irreflexive and asymmetric

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<sup>68</sup> Schaffer (2009).

relation, it is not the case that truths ground their truthmakers.<sup>69</sup> We thus have the requisite ontological dependence of truths upon truthmakers. Returning to Divers's objection: truthmaking *is* able to issue in a suitably discriminating matching of truths to truthmakers if the truthmaking relation is characterized in terms of grounding. For what makes it true that Obama could have lost is the fact that he has the property of *possibly losing*. And he has this modal property in virtue of being a constituent of a way things could have been that represents him as losing. This fact about Obama *grounds* the truth that he could have lost (but *not* vice versa, given the formal character of the grounding relation). And obviously the truth that Obama could have lost is not grounded, in the sense of ontological dependence, by the fact that Socrates could have been unwise, although it is the case that the two are modally covariant. So world-stateists ought to characterize the relation that holds between modal truths and their truthmakers in terms of *grounding*, or ontological dependence, and not in terms of supervenience.

In conclusion, the world-stateist's commitment to properties as a class of primitive, irreducible entities is defensible. The acceptance of properties as primitive allows us to see that the existence of further categories of intension-like entities, like singular propositions and states of affairs, is ontologically unproblematic. The second half of this chapter showed that properties can do good work for us, metaphysically speaking. In particular, those singular structured properties that include individuals as parts, and which represent alternative ways for individuals to be, can be appealed to in order to provide a theory of truthmaking for modal truths. The best way to think about the truthmaking relation that holds between such properties and modal truths is in terms of Schaffer's irreflexive and asymmetric grounding relation. Truthmakers (or singular structured properties) *ground* modal truths. The fact that the world-stateist's ontological commitments allow for a metaphysics of modal truth in terms of grounding is an additional advantage of the account.

Although there are certainly other issues and arguments that remain to be addressed in a more thorough defense of world-stateism, I think that those issues and arguments I have dealt with in the previous four chapters are among the most important. Chapter 1 showed that modal realism is a plausible view, and one to which we are

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<sup>69</sup> Schaffer (2009), pp. 363-365.

committed if we believe in modal phenomena like contingency and necessity, accident and essence, at all. In Chapters 2 and 3, I showed that the notion of a structured property is metaphysically coherent, that the analysis of de re modality in terms of overlap is defensible, and that the genuine world-stateism I endorse is an attractive alternative to ersatzism. World-stateism, therefore, is a viable version of actualist modal realism.



## Technical Appendix:

### 1. Proofs of the S4 and S5 axiom systems in MPL.

In this section, we show that the characteristic axioms of systems S4 and S5 are valid in their respective classes of standard MPL models. We begin by noting the following conditions on a *relation*,  $R$ , ranging over the members of a set  $A$ :

- i.  $R$  is a *symmetrical* relation iff:  $\forall x \forall y (Rxy \rightarrow Ryx)$
- ii.  $R$  is a *transitive* relation iff:  $\forall x \forall y \forall z [(Rxy \ \& \ Ryz) \rightarrow Rxz]$
- iii.  $R$  is a *reflexive* relation in a set  $A$  iff:  $\forall x (x \in A \rightarrow Rxx)$
- iv.  $R$  is an *equivalence* relation in  $A$  iff:  $R$  is reflexive in  $A$ , transitive and symmetric.
- v.  $R$  is *serial* in  $A$  iff:  $\forall x [x \in A \rightarrow \exists y (y \in A \ \& \ Rxy)]$
- vi.  $R$  is *total* iff:  $\forall x \forall y [(x \in A \ \& \ y \in A) \rightarrow Rxy]$
- vii.  $R$  is *Euclidean* iff:  $\forall x \forall y \forall z [(Rxy \ \& \ Rxz) \rightarrow Ryz]$ <sup>1</sup>

1.1. Proof that all instances of the characteristic axiom of system S4,  $\Box \Phi \rightarrow \Box \Box \Phi$ , are valid with respect to the class of *transitive* standard models.

We wish to show that all instances of the characteristic axiom of system S4 are valid with respect to the class of all transitive standard models of MPL, that is, those models  $M = \langle W, R, V \rangle$  where  $R$  is transitive among members of the set of worlds  $W$ . Let  $\Box \Phi$  be a wff. Let  $M$  be a model in which  $R$  is transitive, and let  $a$  be a world at which  $\Box \Phi$  is true. We now wish to show that  $\Box \Box \Phi$  is true at  $a$  in  $M$ . This will be the case if, for all worlds  $w$  in  $M$  such that  $aRw$ ,  $\Box \Phi$  is true at  $w$  in  $M$ . Since  $\Box \Phi$  is true at  $a$  in  $M$ ,  $\Phi$  is true at every world  $w$  such that  $aRw$ . Furthermore, since  $R$  is transitive,  $\Phi$  is true at every world  $w'$  such that  $wRw'$ . So for all worlds  $w$  in  $M$  such that  $aRw$ ,  $\Box \Phi$  is true at  $w$  in  $M$ . So  $\Box \Box \Phi$  is true at  $a$  in  $M$ . This is what we set out to show.

1.2. Proof that all instances of the characteristic axiom of system S5,  $\Diamond \Phi \rightarrow \Box \Diamond \Phi$ , are valid with respect to the class of *Euclidean* standard models.

We wish to show that all instances of the characteristic axiom of system S5 are valid with respect to the class of all Euclidean standard models of MPL, that is, those

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<sup>1</sup> Any relation that is both reflexive (in a set  $A$ ) and Euclidean is an equivalence relation.

models  $M = \langle W, R, V \rangle$  where  $R$  is Euclidean among the members of the set of worlds  $W$ . Let  $\Diamond\Phi$  be a wff. Let  $M$  be a model in which  $R$  is Euclidean, and let  $a$  be a world in  $M$  at which  $\Diamond\Phi$  is true. We now wish to show that  $\Box\Diamond\Phi$  is true at  $a$  in  $M$ . Since  $\Diamond\Phi$  is true at  $a$  in  $M$ ,  $\Phi$  is true at some world  $w$  such that  $aRw$ . For all worlds  $w'$  such that  $w'Rw$ ,  $\Diamond\Phi$  is true at  $w'$ . Since  $R$  is Euclidean, it follows that  $\Diamond\Phi$  is true at all worlds accessible from  $a$ . But then  $\Box\Diamond\Phi$  is true at  $a$  in  $M$ , which is what we set out to show.

## 2. Proof that BF and CBF are valid in any class of CD models:

### 2.1. Proof of BF in any class of CD models:

We wish to show that BF is valid in any class of CD models. We will show this for the equivalent, universally quantified version of BF,  $\forall\alpha\Box\Phi \rightarrow \Box\forall\alpha\Phi$ . Let  $\alpha$  be any variable and  $\Phi$  any wff. Let  $C$  be any class of CD models. Let  $M$  be a member of  $C$ . We wish to show that for any assignment  $g$  for  $M$ , and every world  $w$  in  $M$ , that  $\forall\alpha\Box\Phi \rightarrow \Box\forall\alpha\Phi$  is true at  $w$  in  $M$  under  $g$ . So let  $g$  be an arbitrary assignment for  $M$ , and let  $a$  be a world in  $M$ . We now wish to show that  $\forall\alpha\Box\Phi \rightarrow \Box\forall\alpha\Phi$  is true at  $a$  in  $M$  under  $g$ . Assume (i) that the antecedent is true at  $a$  in  $M$  under  $g$ . We now wish to show that the consequent is also true at  $a$  in  $M$  under the same assignment for  $M$ . So, we wish to show that, for all worlds  $w$  such that  $aRw$ ,  $\forall\alpha\Phi$  is true at  $w$  in  $M$  under  $g$ . Assume (ii) that  $b$  is an arbitrary world such that  $aRb$ . We now wish to show that  $\forall\alpha\Phi$  is true at  $b$  in  $M$  under  $g$ , that is, for all  $d \in D$ ,  $\Phi$  is true at  $b$  in  $M$  under  $g[\alpha/d]$ . Assume (iii) that  $d^* \in D$ . We need to show that  $\Phi$  is true at  $b$  in  $M$  under  $g[\alpha/d^*]$ .

From (i)  $\Box\Phi$  is true at  $a$  in  $M$  under  $g[\alpha/d]$ . From (iii),  $d^* \in D$ . But this means that, for all worlds  $w$  such that  $aRw$ ,  $\Phi$  is true at  $w$  in  $M$  under  $g[\alpha/d^*]$ . From (ii),  $\Phi$  is true at  $b$  in  $M$  under  $g[\alpha/d^*]$ . Thus,  $\forall\alpha\Box\Phi \rightarrow \Box\forall\alpha\Phi$  is true at  $a$  in  $M$  under  $g$ , which is what we set out to show.

### 2.2. Proof of CBF in any class of CD models:

We wish to show that CBF is valid in any class of CD models. We will show this for the equivalent, universally quantified version of CBF,  $\Box\forall\alpha\Phi \rightarrow \forall\alpha\Box\Phi$ . Let  $\alpha$  be any variable and  $\Phi$  any wff. Let  $C$  be any class of CD models. Let  $M$  be a member of  $C$ . We wish to show that for any assignment  $g$  for  $M$ , and every world  $w$  in  $M$ , that  $\Box\forall\alpha\Phi \rightarrow \forall\alpha\Box\Phi$  is true at  $w$  in  $M$  under  $g$ . So let  $g$  be an arbitrary assignment for  $M$ , and let  $a$  be a world in  $M$ . We now wish to show that  $\Box\forall\alpha\Phi \rightarrow \forall\alpha\Box\Phi$  is true at  $a$  in  $M$  under  $g$ . Assume (i) that the antecedent,  $\Box\forall\alpha\Phi$ , is true at  $a$  in  $M$  under  $g$ . We now wish to show that  $\forall\alpha\Box\Phi$  is true at  $a$  in  $M$  under the same assignment, that is, for all  $d \in D$ ,  $\Box\Phi$  is true at  $a$  in  $M$  under  $g[\alpha/d]$ . Assume (ii) that  $d^* \in D$ . We need to show that  $\Box\Phi$  is true at  $a$  in  $M$  under  $g[\alpha/d^*]$ .

From (i), for all worlds  $w$  such that  $aRw$ ,  $\forall\alpha\Phi$  is true at  $w$  in  $M$  under  $g$ . Let  $b$  be an arbitrary world such that  $aRb$  and  $\forall\alpha\Phi$  is true at  $b$  in  $M$  under  $g$ . From (ii),  $d^* \in D$ .

Thus,  $\Phi$  is true at  $b$  in  $M$  under  $g[\alpha/d^*]$ . Since the selection of  $b, d^*$  was arbitrary, it follows that  $\Box\Phi$  is true at  $a$  in  $M$  under  $g[\alpha/d]$ , which is what we set out to show.

### 3. Molecular Diagrams:

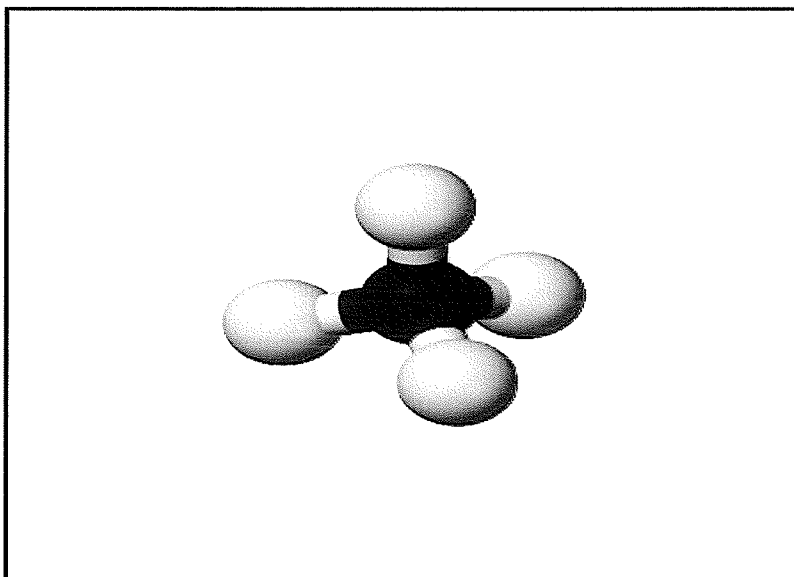


Fig. 1. A Methane Molecule.<sup>2</sup>

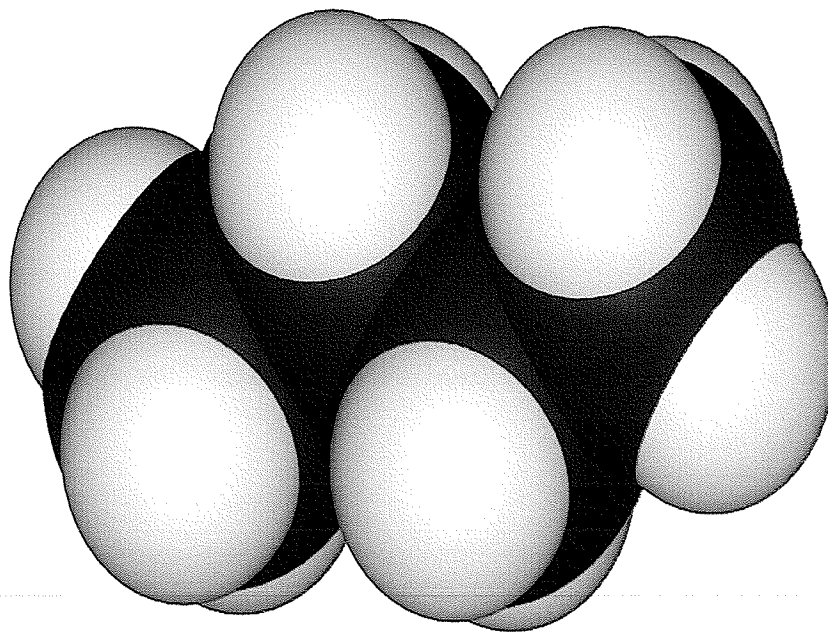


Fig.2. A Butane Molecule.<sup>3</sup>

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<sup>2</sup> <http://en.wikipedia.org/wiki/Methane>

<sup>3</sup> <http://en.wikipedia.org/wiki/Butane>

#### 4. Actualist Modal Realism and the Multiple Worlds Interpretation (MWI) of Quantum Dynamics:

In this section, I consider the relevance of the *multiple worlds* interpretation (MWI) of quantum dynamics to modal realism. *Prima facie*, it would appear that there is a relevant connection between the two theses. The central thesis of modal realism, recall, is that, in addition to the world we inhabit and call “actual,” there exist (potentially infinitely) more worlds that are just as real as our own. According to the MWI, there exist a myriad of quantum worlds in the universe in addition to the world that we are directly aware of; each exists in parallel; each is “actual;” and none is any more real than the rest.<sup>4</sup> I argue that this connection is at best superficial, and stems from an unfortunate coincidence in the employment of the “worlds” terminology. The quantum worlds of the MWI are not *worlds*, in the sense in which the worlds to which the modal realist is committed are *worlds*. Instead, the quantum worlds of the MWI are best thought of as a set of superposed quantum *states*, each of which exists in parallel within the same world. I begin by briefly sketching out a well-known quantum-level experiment, and its apparently paradoxical results. I then briefly survey the motivations for the MWI hypothesis, and its resolution of the paradox. I then give two arguments for the conclusion that the MWI resolution of the paradox presupposes causal interaction between quantum states. On the basis of this conclusion, I demonstrate that the quantum states of the MWI should not be identified with the possible *worlds* of the modal realist. Finally, I show how plausible modal considerations also weigh against such an identification.

##### 4.1. The Quantum Phenomena:

I focus here on a single, well-known case of quantum-level paradox: the results of the *double-slit experiment*, originally performed by Thomas Young in 1803, and which illustrate what physicists have come to call the “wave/particle” duality of light.<sup>5</sup> A light source, *s*, illuminates a solid plate *p* with two slits, of equal size, cut into it. Beyond *p*, a screen is positioned to receive the light from *s* as it passes through the slits cut into *p*. On the screen itself, an interference pattern of light and dark bands is observed, suggesting that the wave nature of light causes the light waves themselves to interfere with one-another as they pass through the two slits cut into *p*. However, at the screen itself, the light from *s* is found to be absorbed as discrete particles, i.e., as *photons*.<sup>6</sup>

The wave/particle nature of light was illustrated even more starkly once *single photon* versions of the experiment became technically possible. In single photon versions of the double-slit experiment, only one photon at a time is fired. Although at any given time, only a single photon is being released from *s*, the interference pattern of light and dark bands is observed on the screen, while at the same time, being absorbed at discrete points. The implication is that something with a *wave-like* nature is *passing through both slits at once*, and yet is being absorbed *as a single photon*.

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<sup>4</sup> As first proposed by Everett (1957).

<sup>5</sup> It is worth noting, however, that in addition the MWI hypothesis has been invoked in order to explain the apparent results of such quantum-level phenomena as the Schrödinger Cat experiment, among others.

<sup>6</sup> Vaidman (2002).

#### 4.2. MWI and the Double-Slit Experiment:

Everett proposed the MWI hypothesis as a result of dissatisfaction with then prevalent explanations of quantum-level paradox.<sup>7</sup> According to the MWI, wave/particle duality is explained in terms of *quantum decoherence*: the universe is composed of a *quantum superposition* of (possibly infinitely) many divergent, parallel quantum states. According to the MWI, the universe ought to be viewed as splitting into an increasingly large number of such states, each resulting from the interaction of the universe's components at the quantum level. According to Everett, each of the branching states in a quantum superposition ought to be regarded as equally real, or actual.<sup>8</sup>

In the single-photon variant of the experiment, the interference pattern observed on the screen is to be explained by (i) the existence of a plurality of superposed quantum states, each of which corresponds to a given, determinate possible position of the single light photon, and (ii) the interaction of the members of this plurality as the photon moves towards the screen. This is taken to explain the wave nature of light. A single photon is in many quantum superposed states at once, and is therefore best thought of, at the quantum level, as a wave. However, (iii), the screen itself records the photon as arriving as a discreet particle since, at any given time, we are only able to perceive the position of the photon on the screen according to one of the superposed quantum states. This is taken to explain the (apparent) particle nature of light. Thus, apparent wave/particle duality is explained in terms of quantum decoherence.

#### 4.4. MWI and Modal Realism:

Here are two arguments for causal interaction among quantum states of a given superposition. First, consider the MWI explanation of the single-photon interference pattern.<sup>9</sup> Since, presumably, the interaction of these superposed quantum states is responsible for the interference pattern observed on the screen, we have what appears to be causal interaction between (a) each of the individual elements of the given quantum superposition, and (b) the quantum superposition itself and the observed interference pattern on the receiving screen. Thus, the explanation of the subjective appearance of something with a wave-like nature passing through both slits of the apparatus at the same time, *and* the explanation of the observed interference pattern, *both* presuppose that elements of a given superposition stand in causal relations to each-other.

Second, consider quantum decoherence. According to quantum decoherence, a measurement interaction (i.e., the interaction of an observer with the experimental apparatus) causes the position of the photon within the experiment to split into various quantum branches; the photon's position in each branch is then identified with a given quantum state of the photon, i.e., a possible determinate position with respect to the

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<sup>7</sup> Among these, the most widely accepted was the *Copenhagen Interpretation* of quantum phenomena (CI). According to the CI, the wave/particle duality exhibited by light in the double-slit experiment is only *apparent*, and is ultimately to be explained by *wave-function collapse*: an indeterminate quantum system (like the apparatus used to conduct the double-slit experiment), *as a result of observation*, collapses down into a single, determinate outcome.

<sup>8</sup> Everett (1957). See also later developments of the MWI hypothesis, in particular DeWitt (1973), and Deutsch (1998).

<sup>9</sup> Deutsch (1998).

outcome of the experiment. But then, each quantum branch must be causally connected, to the observer, at the root node of the branch, and each is therefore properly understood as being causally linked to the activities of a single observer.

By contrast, the possible *worlds* to which actualist and possibilist modal realists are committed are best thought of as being causally *closed*. This is easiest to see in the case of Lewisian possibilism. Lewisians identify worlds with concrete, maximally spatiotemporally interrelated sums of individuals. And causation, at least intuitively, presupposes spatiotemporal interrelation. Thus, for Lewisians, causation is best thought of as a relation that holds only between spatiotemporally related individuals, i.e., between *world-mates*.<sup>10</sup>

And there are good reasons to think that actualists ought to hold that worlds are causally closed as well. Recall the solution proposed in Chapter 3 to the problem of accidental intrinsic properties. On my proposal, individuals never literally exemplify properties with respect to any world except the actual, instantiated world. But any two individuals that were causally related would, presumably, each have the property of *being causally related*. Thus, actualist modal realists should think that the relata of any causal relation are a part of the same world.

Thus, the quantum states postulated by the MWI should not be identified with the worlds of the modal realist. Instead, we ought to view the elements of a given quantum superposition as parts, at the quantum level, of a single metaphysically possible *world*. On this conception, the individual states that combine to form a given superposition exist in parallel within a single world.

Finally, it's worth noting that plausible *modal* considerations tell strongly against any identification of the quantum states of the MWI with the worlds of the modal realist. The MWI is really just one of several *hypotheses* about the nature of quantum-level phenomena. Thus, for all we know, the MWI hypothesis could be true, and it could be false. It follows from the analysis of possibility outlined in this essay that there are metaphysically possible worlds at which the hypothesis is true, and metaphysically possible worlds at which it is false (and, for we know, our world could be either). That is, according to the modal realist analysis of metaphysical possibility, something is possibly the case iff there exists a world at which it is the case. But surely this is inconsistent with the assumption that the quantum states of the MWI just are the possible worlds of modal realism, since, from the perspective of the MWI, this would amount to the claim that there exists a quantum state at which the MWI hypothesis is false. It follows that only the modal realist has the theoretical resources to capture the legitimate possibility that the MWI is false. It is therefore the case that (i) one could be a modal realist without being committed to the truth of the MWI, and (ii) one could not, plausibly, be committed to the truth of the MWI and not to the truth of modal realism.<sup>11</sup> The two theses are therefore best thought of as orthogonal, with any apparent connection between them a result of the employment of the "worlds" idiom.<sup>12</sup>

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<sup>10</sup> For additional arguments that the quantum "worlds" of the MWI are not *worlds*, see Skyrms (1976).

<sup>11</sup> At least if the motivations for modal realism surveyed in Chapter 1 are compelling, which I think they are.

<sup>12</sup> Philosophers working in the metaphysics of modality have long considered the possibility of worlds containing branching times to be metaphysically legitimate. It seems possible, for instance, and is certainly not ruled out a priori, that our world is a world of branching times. Suppose that times are themselves parts

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of possible worlds. Then it seems plausible to think that an entire temporal sequence (that is, a sequence of consecutive times) will itself be part of a possible world. Since branching times seem to be a legitimate metaphysical possibility, we may apply the analysis of de re modal predication outlined in Chapter 4, ( $\Diamond_{de\ re}$ ), to derive the result that there exist possible worlds that contain branching temporal segments. For all we know a priori, our world might be such a world; thus, the possible worlds apparatus discussed and defended in this thesis seems to have the resources to handle the possibility that something like the MWI hypothesis is true. See Lewis (1976) for discussion.

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