How to be a modal realist

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Comments welcome

1 Some puzzles

I'm no modal realist myself, mind, and I don't think you should be either. But it can be important to know how best to do something you have no intention of doing. Modal realism plays a pivotal role in the space of available views about modality: our understanding of that space will be seriously incomplete unless we understand how modal realism can best be made coherent.

You probably think that David Lewis has already made it coherent—*On the Plurality of Worlds* (Lewis 1986: henceforth *OPW*) stands for many of us as an exemplar of the *internal* virtues towards which one might aspire in a systematic metaphysics, whatever we may think about the plausibility of the result. I think this judgment needs refining. The book contains the outlines of a marvellously coherent and elegant (albeit otherwise implausible) account of modality and many other subject matters. But it also contains various bits of doctrine that just don't fit with this picture, including some that might have seemed quite central. My goal in this paper is to track down these aberrant elements and show how the view works once they are eliminated.

Let me begin with some puzzles for Lewis. They are not particularly deep: in fact, the correct solution to all three will probably jump out at you long before I have presented it. But they will help us begin to figure out what is really central to the modal realist's analysis of possibility and necessity.

While the most general statement of this analysis is a bit complicated, its application in some simple cases is supposed to be quite straightforward. For example, we have the following analyses:

(1) It is possible that some swans are blue $\leftrightarrow_{\text{df}}$ there is a Lewis-world such that some swans in it are blue.

(2) It is possible that no swans are blue $\leftrightarrow_{\text{df}}$ there is a Lewis-world such that no swans in it are blue.

Here, a Lewis-world is a cosmos: according to Lewis's final analysis, an object none of whose parts bears any "analogically spatiotemporal" relation to anything disjoint from it, and which is not part of any other such object.

The symbol '$\leftrightarrow_{\text{df}}$' in (1) and (2) is supposed to indicate the giving of an analysis. Perhaps it may be rendered in English as 'For it to be the case that... is for it to be the case that...'. If we have any grip at all on what it means to give an analysis of something, we know that $\ulcorner\phi \leftrightarrow_{\text{df}} \psi\urcorner$ entails $\ulcorner$Necessarily, ϕ iff $\psi\urcorner$. If this is given up, it becomes entirely unclear how the meaning of (1) and (2) go beyond the meaning of the corresponding material biconditionals.[1] So in particular, (1) entails (1′):

[1] Is $\ulcorner\phi \leftrightarrow_{\text{df}} \psi\urcorner$ just *equivalent* to $\ulcorner\Box(\phi \leftrightarrow \psi)\urcorner$? There is pressure for Lewis to answer yes: it wouldn't be so exciting if one could analyse modality, counterfactuals, etc. in nonmodal terms but still had to take '$\leftrightarrow_{\text{df}}$' as a primitive, manifestly non-extensional, operator. If one does answer yes, one will presumably have a *pragmatic* story to tell about why claims like 'For Socrates to be wise is for Socrates to be wise and not to be a round square' sound wrong.

(1′) Necessarily: it is possible that some swans are blue iff there is a Lewis-world such that some swans in it are blue.

Puzzle 1 depends on (1′) alone. Intuitively, it *is* possible that no swans should be blue; this is the kind of intuitive modal judgment that Lewis strove to accept. It seems almost as obvious that it is possible for there to be *contingently* no blue swans—i.e. that it is possible that: no swans are blue even though it is possible that some swans are blue. But given (1′), for this to be possible, it would have to be possible that: no swans are blue even though some swans in some Lewis-world are blue.[2] And this cannot be, since any blue swan that is parts of a Lewis-world is a blue swan. Was Lewis really committed to denying that there could have contingently been no blue swans?

Puzzle 2 depends on the combination of (1′) with (2). As we saw in Puzzle 1, (1′) entails that if it is possible that no swans are blue, it is possible that it is not possible that some swans are blue. Suppose that—as Lewis believed—some Lewis-worlds contain blue swans and others don't. Then by (2), it is possible that no swans are blue, and hence by (1′), it is possible that it is not possible that some swans are blue. But it is possible that some swans are blue, by (1). This combination of claims is inconsistent in the modal logic S5, where what is possibly necessary is simply necessary, and what is possibly impossible is simply impossible. It is thus puzzling to find it seeming to follow so directly from Lewis's commitments. For Lewis generally seems to be friendly towards S5, at least when the modal operators are interpreted as expressing metaphysical necessity and possibility and the sentences we are dealing with are "*de dicto*" or "purely qualitative", as 'there are blue swans' and 'there are no blue swans' are supposed to be.

Puzzle 3 requires us to generalise the pattern of which (1) and (2) are instances. The schema seems straightforward:

(3) It is possible that Q Fs are Gs $\leftrightarrow_{\mathrm{df}}$ there is a Lewis world such that Q Fs in it are Gs.

Here 'Q' is to be replaced with a quantifier like 'some' or 'many' or 'at least two', and 'F' and 'G' with predicates expressing qualitative properties. Since 'Lewis-world' is itself such a predicate, (4) is an instance of (3):

(4) It is possible that at least two things are Lewis-worlds $\leftrightarrow_{\mathrm{df}}$ there is a Lewis-world such that at least two things in it are Lewis-worlds.[3]

But it follows from the definition of 'Lewis-world' that no Lewis-world contains any other Lewis-world. So if we accept (4), we have to say that it is *not* possible that at least two things are Lewis-worlds. This sits strangely, to say the least, with Lewis's further claim that at least two things—infinitely many things, in fact—are Lewis-worlds. Whatever is the case could be the case: this is a version of the modal axiom T, and it is obviously correct.[4] So it looks like (4) must be rejected; but then what principled grounds could there be for holding on to (1) and (2)?.[5]

2 Unrestricted and restricted quantification

A resolution of these puzzles must, I think, involve the familiar idea that quantification is sometimes tacitly restricted. You can say 'there is no beer' and assert nothing false even if there is beer but none of it is in your house, or even if there is beer in your house but only in the form of a puddle of spilt beer on the floor of the fridge. You can say 'there are no blue swans' and assert nothing false even if,

[2]The argument here is of the evidently valid form $\Box(\phi \leftrightarrow \psi), \Diamond(\xi \wedge \phi) \vdash \Diamond(\xi \wedge \psi)$.

[3]There is some direct evidence that Lewis accepted (4): for example, at *OPW* 16 he writes that 'it is not the case that, possibly, two worlds differ in their laws without differing in their distribution of local qualitative character' is equivalent to 'there is no world wherein two worlds differ in their laws without differing in their distribution of local qualitative character'. He goes on to point out that 'That's trivial—there is no world wherein two worlds do anything'.

[4]Hudson (1997) and Parsons (2009) also note the apparent failure of T induced by Lewis's analysis.

[5]It doesn't help to point out that 'Lewis-world' is defined using quantifiers, and to require that these quantifiers should also get restricted. If w is a Lewis-world and x an object in w none of whose parts in w bears any analogically spatiotemporal relation to anything in w disjoint from x, then x must be w: this follows from classical mereology and the premise that one cannot bear an anologically spatiotemporal relation to the fusion of some objects to which one bears no such relations.

as Lewis believed, there are blue swans but none of them is in our Lewis-world.[6]

The natural thing to say about the puzzles is that the analyses in the previous section involve a mixture of restricted and unrestricted quantification. In the analysis-schema

(3) It is possible that Q Fs are Gs $\leftrightarrow_{\text{df}}$ there is a Lewis world such that Q Fs in it are Gs.

the quantifier Q on the left is some kind of restricted quantifier—section 4 will discuss what the restriction might be—while both the quantifiers on the right (Q and 'there is') are unrestricted.

This reading makes the puzzles go away. Let us use the subscript u to indicate unrestricted quantification, and r to indicate the relevant kind of restriction.

Puzzle 1: the intended reading of (1) does not make 'possibly some_r swans are blue' inconsistent with 'no_r swans are blue'. Thus it is consistent with the truth of 'Possibly, there are contingently no_r blue swans'.

Puzzle 2: for the same reason, the intended reading of (2) does not license the inference from 'Possibly, no_r swans are blue' to 'Possibly, it is not possible that some_r swans are blue'. So the inference to the S5-inconsistent 'Possibly there are no blue swans, and possibly, it is not possible for there to be blue swans' (on either interpretation) is blocked.

Puzzle 3: (4) tells us that it is not possible that there be at least two_r Lewis-worlds. It follows by T that there is at most one_r Lewis-world. But this is consistent with Lewis's claim that there are infinitely many_u Lewis-worlds.

So provided we understand the analyses of section 1 as analyses of possibility claims involving restricted quantification, trouble is averted. But this response raises a further question. Given that 'some' in 'some swans are blue' admits of both unrestricted and restricted readings, it follows from a plausible principle of compositionality that 'some' in 'it is possible that some swans are blue' also admits of both kinds of readings. So how should we analyse 'Possibly Q Fs are Gs' when Q is taken as unrestricted? Any general programme for analysing the modal in terms of the non-modal had better have something to say about this.

In the case where Q is 'some', our response to this question is effectively determined: 'possibly some_u Fs are Gs' is necessarily equivalent to 'some_u Fs are Gs'. The right-to-left direction follows from T. As for the left-to-right direction, if we had some workable analysis of 'possibly some_u Fs are Gs' on which it was consistent with 'no_u Fs are Gs', why on earth would we not use the same trick to give an analysis of 'possibly some_r Fs are Gs' on which *it* was consistent with 'no_u Fs are Gs'?

It is not yet completely obvious that the modal realist should regard 'possibly Q_u Fs are G' as equivalent in every case to 'Q_u Fs are Gs'. One could imagine analyses according to which it is possible that no_u swans are blue, even if in fact some swans are blue. For example, we could propose that

(5) Possibly, Q_u Fs are Gs $\leftrightarrow_{\text{df}}$ some_u appropriate part of reality is such that Q_u Fs in it are Gs.

What are the "appropriate" parts of reality? For T to be valid, the whole of reality had better count as an appropriate part. We *could* say that the only other appropriate parts are Lewis-worlds.[7] But this restriction seems arbitrary: if there could be_u many Lewis worlds, and there could be exactly one, what grounds are there for denying that there could be two, or any other intermediate number? The best version of (5) would, I think, at least allow arbitrary fusions of appropriate parts of reality to be themselves appropriate.[8] But any such

[6]The question how, if at all, the phenomenon of quantifier domain restriction fits into compositional semantics is not germane to my purposes. I will write as if it involves a semantic context-sensitivity in the quantifiers; but everything I say should be acceptable, mutatis mutandis, to those (e.g. Stanley and Szabó 2000) who locate the context-sensitivity in the noun, or some silent syntactic element connected to the noun, and to those (e.g. Bach 1994) who regard the phenomenon as pragmatic rather than semantic.

[7]This is the "T-preserving analysis" discussed by Parsons (2009).

[8]Bricker (2001) endorses something like (5) with 'appropriate' interpreted to mean 'fusion of Lewis-worlds', but he does not intend it as an analysis of possibility claims involving *absolutely* unrestricted quantifiers. I will discuss his theory of the relevant kind of restriction in section 4 below.

view still strikes me as pointless. If anything short of reality as a whole counts as "appropriate", we will no longer have an S5 modal logic, even for claims involving just unrestricted quantification and qualitative predicates. For example, if there is an appropriate part that lacks blue swans, then it is possible that no_u swans be blue, and hence possible that it is not possible that some_u swans be blue. Endorsing such a claim for the sake of being able to agree with ordinary people when they claim that it is possible that no_u swans are blue seems like a bad trade. For the modal realist is already committed to rejecting many common-sense modal claims involving unrestricted quantification, e.g. the claim that it is possible that it is contingently the case that no_u swans are blue. It would be perverse to jettison compelling logical principles just in order to slightly decrease the scope of this systematic disagreement.

I conclude that the best option for the modal realist is to hold that 'Possibly, Q_u *F*s are *G*s' is equivalent in every case to 'Q_u *F*s are *G*s'. And if we say this, I can see no grounds for resisting the following obvious generalisation: whenever ϕ is a sentence built up from qualitative predicates, unrestricted quantifiers and truth-functional operators, $\ulcorner$Possibly $\phi\urcorner$ and $\ulcorner$Necessarily $\phi\urcorner$ are both equivalent to ϕ.[9]

One might attempt to avoid this conclusion by giving up the "plausible principle of compositionality" alluded to above, and denying that sentences of the form 'Possibly *Q F*s are *G*' even *admit* readings on which the quantifier is unrestricted. The setup in 'Counterpart Theory and Quantified Modal Logic' (Lewis 1968) may suggest such a view. There, the project of reducing modality is cast as one of finding translations from one formal language, containing modal operators, into another, which lacks them. The latter is not just the modality-free fragment of the former, since even sentences that lack modal operators are translated non-homophonically. For example, the sentence '$\exists x Fx$' of the modal language is translated as '$\exists x(Ix@ \wedge Fx)$' ('$Ix@$' means 'x is in the actual world'). This suggests that the modal language lacks unrestricted quantifiers. If one thought that this formal language was capable of representing every admissible interpretation of English sentences involving modality, one would be pushed to the view that quantifiers in English cannot be interpreted as unrestricted when they occur in the scope of a modal operator.

But such a prohibition is quite unmotivated. If unrestricted quantification were a rare practice engaged in only by philosophical initiates, the idea that this special way of talking cannot combine with the ordinary meanings of modal operators might have some plausibility. But in fact, ordinary people hold and express lots of opinions about what there is, unrestrictedly speaking. For example, they are fairly confident that no_u swans are blue, and very confident that no_u bachelors are married. Lewis, of course, thinks that many ordinary negative judgments involving unrestricted quantification are wrong. But if ordinary people can express unrestricted quantification when they say things like 'no swans are blue', surely they can also express unrestricted quantification when they say things like 'it is possible that no swans are white' and 'it is necessary that no bachelors are married'. Since Lewis thinks that many ordinary nonmodal claims involving unrestricted quantification are false, it would not be surprising if he thought that many ordinary claims involving unrestricted quantification under modal operators (e.g. 'Possibly, no_u swans are white') are also false. Ordinary usage gives no support at all to the claim that such readings are semantically prohibited.

3 Exegetical interlude

Did Lewis agree that modal operators are vacuous when applied to sentences built up from unrestricted quantifiers and qualitative predicates? There is one salient piece of evidence that suggests that he did not. In *OPW* §1.2, we are told that 'possibly there are blue swans iff, for some world W, at W there are blue swans', where 'at W' 'works mainly by restricting the domains of quantifiers in its scope, in much the same way that the restricting modifier "in Australia" does'

[9]Divers (1999) seems to agree: 'Whenever the possibility operator expresses a non-trivial semantic function on quantificational sentences it is, indeed, always that of altering the scope of formerly world-restricted quantifiers' (229). The class of sentences on which Divers thinks the possibility operator operates only trivially is, however, wider than this, including, for example, subject-predicate sentences where the subject is an object that is not part of any Lewis-world. Section 6 will make it clear why I think this is a mistake.

(*OPW* 5). This suggests that 'at W' can apply restrictions *even when it is applied to a sentence that doesn't come with its own restriction*, so that 'at W, Q_u Fs are Gs' means the same as 'Q_u Fs which are in W are Gs'. If so, 'At some Lewis-world W, no swans are blue', and hence also 'Possibly no swans are blue', will be true even when the quantifier is read unrestrictedly.[10]

On the other hand, Lewis shows no signs of endorsing any of the puzzling claims that—as we saw in section 1—follow from analyses like (1) and (2) when all the quantifiers are taken as unrestricted.[11] And there are several passages in which Lewis directly addresses the modal status of claims built up from unrestricted quantification and qualitative predicates, which suggest that such claims are necessary when true. Here is one example:

> Our *contingent* knowledge that there are donkeys at *our* world requires causal acquaintance with the donkeys, or at least with what produces them. Our *necessary* knowledge that there are donkeys at *some* worlds—even talking donkeys, donkeys with dragons as worldmates, and what have you—does not require causal acquaintance either with the donkeys or with what produces them. (*OPW* 112)

This presupposes that it is necessary that there are donkeys at some worlds, and thus that it is necessary that there are donkeys, unrestrictedly speaking. (It also suggests, interestingly, that the true reading of 'it is contingent that there are donkeys' is equivalent to 'there are donkeys at our world'—more of this anon.) In a similar vein, Lewis says that 'reality might have been different' is not true, if we understand 'reality' in such a way as to make 'reality is the totality of everything' true (*OPW* 101, note 1). And in Lewis 1996, he accepts without demur the attribution to him of a theory that 'treat[s] all statements about modal reality as non-contingent: if any such statement is possibly true, then it is true *simpliciter*'.

4 Contingency-inducing quantification as *de re* restricted quantification

According to the best version of modal realism, when ϕ is a closed sentence built up from qualitative predicates and quantifiers, ⌜Possibly ϕ⌝ and ⌜Necessarily ϕ⌝ can differ in truth value from ϕ only when the quantifiers in ϕ are understood as somehow restricted. But obviously not just any restriction would suffice to introduce contingency. For an implicitly restricted quantifier to contribute anything, it must enable us to express claims distinct from anything that could be spelled out using unrestricted quantifiers and qualitative predicates. What, then, is the non-qualitative kind of restriction that makes for contingency?

Since 'qualitative' is generally used in contrast to '*de re*', the obvious answer is that the relevant restrictions are those that involve some *de re* component. For example, one might utter the sentence 'there are no blue swans' and thereby express what one could equally well have expressed more explicitly by saying 'there are no blue swans *on Earth*'. If we have a theory of the meaning of 'It is contingent whether there are blue swans on Earth' that explains how it can be true, we can adapt this theory to explain how 'It is contingent whether there are blue swans' can be true, on the relevant restricted reading. Lewis's counterpart theory is such a theory. According to it, for it to be

[10] There is a complication: 'I do not suppose that [restrictive modifiers] must restrict all quantifiers in their scope, without exception. "In Australia, there is a yacht faster than any other" would mean less than it does if the modifier restricted both quantifiers rather than just the first. . . . [A] lot is left up to the pragmatic rule that what is said should be interpreted so as to be sensible' (*OPW* 6). This suggests that sentences involving restricting modifiers, including modal operators, have a range of readings, which differ as regards which quantifiers get restricted. If so, then 'In W there are many Lewis-worlds' and 'Possibly there are many Lewis-worlds' have readings on which they are both equivalent to 'There are many Lewis-worlds', as well as readings on which they are trivially false. It is easy to imagine a pragmatic story about why we would tend to prefer the former readings. This takes some of the sting out of Puzzle 3. But I don't think it does enough: the inference from ⌜Possibly ϕ⌝ to ϕ seems *valid*, and that should mean, I think, that it is truth-preserving on *all* uniform readings.

[11] At *OPW* 211, Lewis sounds like he is rejecting T, at least for some notion of possibility: 'I do not deny the existence of trans-world individuals, and yet there is a sense in which I say that they cannot possibly exist.' On the other hand, immediately afterwards he says 'As should be expected, the sense in question involves restricted quantification.' This implicates that there is another sense in which 'trans-world individuals can possibly exist' is *true*, and that this sense involves *unrestricted* quantification.

contingent whether there are blue swans on Earth is for there to be blue swans on some but not all of Earth's counterparts.

It will be convenient to have a name for the Lewis-world of which we are part: call it 'Cosmo'. One thing we could mean by saying 'there are no blue swans' is that there are no blue swans *in Cosmo*. On the approach I am proposing, this is just another case of quantification with a *de re* restriction. There is no reason to think that ordinary people often restrict their quantifiers in this particular way: typically, when quantifiers are restricted at all, the restriction will be something much stronger. Be that as it may, when quantifiers restricted to things in Cosmo occur within the scope of modal operators, our analysis of the result will take the same form as it would for any other *de re* restriction. If our analysis of 'It is possible that some swans on Earth are blue' is 'Some swans on some counterpart of Earth are blue', our analysis of 'It is possible that some swans in Cosmo are blue' must be 'Some swans in some counterpart of Cosmo are blue'; this is also our analysis of 'It is possible that some swans are blue' on the reading where the quantifier is restricted to things in Cosmo. We might think that necessarily, the counterparts of Cosmo are all and only the Lewis-worlds; if so, we will recover (1), since we will regard 'some swans in some counterpart of Cosmo are blue' as equivalent to 'there is a Lewis-world such that some swans in it are blue'. But this will be due not to some special role played by the concept of a Lewis-world in the analysis of possibility claims in general, but to the distinctive behaviour of the counterpart relation as applied to Lewis-worlds.

I think that identifying contingency-inducing quantification with *de re* restricted quantification is the right strategy for the modal realist. It is independently plausible that quantification is often subject to tacit *de re* restrictions, and modal realists need a theory of *de re* contingency anyway. So there is no clear motivation to set out on a quest for some non-qualitative, non-*de re* account of contingency-inducing quantification. Nevertheless, in the next section I will consider some forms such an account might take, and argue that they are all deeply problematic.

5 Alternative accounts of contingency-inducing quantification

What alternatives are there to identifying contingency-inducing quantification with *de re* restricted quantification? One possible view would be to think of 'Possibly' as a quantifier binding a hidden variable (ranging over Lewis-worlds), whose value is supplied 'deictically', by the context, when it is not bound. On this picture, the context-independent semantic value of 'no swans are blue' is like that of the open sentence 'no swans in w are blue'—something like a function from variable-assignments to propositions. When the sentence is uttered on its own, a specific value must be assigned to this variable. When it is embedded under a modal operator, on the other hand, a new kind of reading becomes available in which the variable is bound. Analogously, when 'he is clever' is embedded under 'everyone is sure that. . . ', it admits of a kind of interpretation which doesn't correspond to any possible interpretation of the unembedded sentence.

I don't think this semantic theory should be attractive to Lewis-style modal realists. For it would be completely implausible to posit a hidden world variable in 'no swans are blue' but not in 'no swans on Earth are blue'. But the idea that unembedded utterances of the latter sentence require deictic reference to a specific Lewis-world fits very poorly with Lewis's account of the kind of thing Earth is. According to Lewis, Earth is "worldbound": if there are no blue swans on it, then that's just how things are, *simpliciter*. Perhaps we can *also* make sense of the claim that there are no blue swans on Earth "at" this or that Lewis-world, by analysing this claim in terms of counterparts. But there is also the unrelativised proposition that no swans on Earth are blue, which we can (and presumably do) express when we say 'no swans on Earth are blue'.

The un-Lewisian kind of "modal realism" that postulates hidden world variables all over the place, even in atomic sentences, is certainly a serious alternative to the kind of modal realism I am trying to develop. This view is the modal analogue of the familiar B-theory of time. Just as B-theorists hold that propositions aren't the sorts of things that can be true temporarily, so this view holds that propositions aren't the sorts of things that can be true contingently.[12] A full investigation of this view is beyond the scope of this paper. But let me briefly indicate my reasons for suspecting that it will fall into incoherence. There is pressure to treat modal operators and propositional attitude verbs like 'believe' and 'assert' as broadly analogous—in particular, to regard the attitude verbs as variable binders if one regards modal operators as such. For one thing, we have sentences like 'It is both necessary, and universally believed, that no bachelors are married', which seem to require a uniform treatment for the two kinds of construction. But the treatment of attitude verbs as variable-binders seems to me to be incoherent. For if there is such a thing as believing or asserting that no swans on Earth are blue, as opposed to believing asserting that *at w* no swans on Earth are blue for some specific *w*, then surely this is something ordinary English speakers sometimes do when they sincerely and literally utter 'no swans on Earth are blue'. And in that case, it is just not true that asserting this sentence requires deictically assigning a value to a free variable. Neither is it true that this sentence can only be evaluated for truth relative to a variable-assignment (or a world). For if there is such a thing as believing that there are no swans on Earth *simpliciter*, there must also be such a thing as believing that 'there are no swans on Earth' is true *simpliciter*, i.e. evaluating it as true *simpliciter*. So the central point of the analogy with 'he is clever' breaks down.[13]

Let us assume, then, that the distinctive contingency-inducing form of restriction (which we continue to indicate with the subscript *r*) can attach even to unembedded uses of quantifiers. For the sake of a concrete example, suppose that no_r swans are blue, even though some_u swans are blue. Here is the question I want to press. Consider a person, Twin, who is generally similar to me as regards his intrinsic and environmental properties, but who happens to be part of a Lewis-world—Cosmo-Prime—which also contains blue swans. Suppose I say 'some swans are blue', and thereby say (falsely) that some_r swans are blue. When Twin says 'some swans are blue' under analogous circumstances, does he also say that some_r swans are blue?

There is a compelling argument that he does not. We have assumed that

(6) No_r swans are blue.

It is a basic principle about falsehood, which should be acceptable in any context, that

(7) If no_r swans are blue, the proposition that some_r swans are blue is false.

But it seems obvious that

(8) When Twin says 'some swans are blue', he says nothing false.

When people in Cosmo-Prime see blue swans swimming around and say 'some swans are blue!', the belief they thereby express is (usually) paradigmatically justified by ordinary perceptual methods. Are we supposed to think of Cosmo-Prime as a place of epistemic tragedy, where following these rational methods leads one to form systematically false beliefs? Surely not; hence (8). But (6), (7) and (8) jointly entail that

(9) When Twin says 'some swans are blue', he doesn't say that some_r swans are blue.

If one follows this kind of reasoning where it leads, one will end up thinking that the practice of using the sentence 'some swans are blue' to mean that some_r swans are blue is more or less confined to Cosmo. People in other Lewis-worlds, even ones in most respects similar Cosmo, do not express the very same propositions that we express when they use contingency-inducing quantifiers.

It would be a bad mistake to confuse (9) with the counterfactual claim that if I had been spatiotemporally related to blue swans but otherwise qualitatively similar to the way I actually am, *I* would not have used 'some swans are blue' to say that some_r swans are blue. There are lots things that people in other Lewis-worlds never do that I would have done even if I had been qualitatively different in all

[12] Cf. Williamson (2002) on views which reject "genuine contingency".

[13] But see the discussion of 'the relativist option' later in this section for a sophisticated attempt to make an explanatorily important notion of relative truth live side-by-side with an unrelativised concept of truth.

kinds of ways. For example, no-one in any other Lewis-world lives on Earth. But my living on Earth is counterfactually robust: there is a wide range of qualitative properties which I lack, such that I would still live on Earth even if I had them.[14]

The "pictorial ersatzism" attacked in *OPW* §3.3 is a view on which (8) and (9) both fail. There is a property "vim", which we often use in restricting our quantifiers. Cosmo and its parts have vim; other Lewis-worlds don't. Vim could have been distributed differently with respect to ordinary qualitative properties. You don't have to have vim to be a swan, or to be a person, to have beliefs, etc: thus analyses in the mould of (3) can still be extensionally adequate. It is reasonable for us to be highly confident that we have vim. It is also reasonable for the many people who lack vim to be highly confident that they have vim. But they are just wrong. The vimless part of reality *is* a place of pervasive epistemic tragedy, where good reasoning leads people to form systematically false beliefs about the distribution of vim.[15]

This is not an attractive view. Applying the epistemological standards that normally apply to the postulation of new primitive entities or properties, there seems to be no justification for postulating vim at all, or, assuming its existence, for believing anything very specific about its distribution. Of course, it is part of the view that these are the wrong standards to apply, since the epistemology of vim is quite different from the epistemology of any other property. But an implausible metaphysics is not generally made better by being combined with an implausible epistemology, one tenet of which is that the metaphysics is something it is reasonable to believe. Things might be different if striking theoretical simplifications could be achieved by taking vim to be involved in the analysis of our ordinary beliefs; but it is obscure what the theoretical benefits are supposed to be.

If we understand contingency-inducing quantification as *de re* restricted quantification, we should be happy to accept (9). For on this view, to say that some$_r$ swans are blue is to say that some swans on Earth are blue, or that some swans in Cosmo are blue, or some such thing. This isn't the sort of thing we should expect to find people at other Lewis-worlds doing very often. For one thing, saying that some swans on Earth are blue seems to involve referring to Earth; and it is not usually thought to be easy to refer to objects towards which one bears no spatiotemporal or causal relations.[16] When I say that some swans on Earth are blue, Twin surely does not: rather, he says that some swans on Earth-Prime are blue, where Earth-Prime is the planet Twin lives on. Similarly, when I say that some swans in Cosmo are blue, Twin under analogous circumstances says, instead, that some swans in Cosmo-Prime are blue.

One important motivation for wanting to resist (9) is the doctrine, defended by Lewis (*OPW* 1.4), that propositions—at least in one central sense—can be identified with sets of Lewis-worlds. Anyone who accepts this will presumably think that there is a proposition, call it *P*, which is—or at least, can for present purposes be identified with—the set of Lewis-worlds that contain blue swans. *P* will be a natural candidates to be the proposition that some$_r$ swans are blue. But if we sometimes express *P* by saying 'some swans are blue', surely people in other Lewis-worlds can do so with equal ease. There is nothing in the nature of *P* that could, given any sensible theory of what it takes

[14]Section 8 below will discuss the analysis of "multiply *de re*" modal claims like 'I could live on Earth while being 5 feet tall'.

[15]Phillip Bricker's view (2001, 2006) is similar in many ways to the one just described. One difference is that he does not rule out the possibility that more than one Lewis-world has vim (he calls it "actuality"). The other difference is more important: according to Bricker, people who are qualitatively like us but lack vim are not in a position to refer to vim when we do. On his preferred version of the view, when we express propositions about the distribution of vim, qualitatively similar but vimless people fail to express anything. The vimless part of reality is a place of epistemic tragedy; but the tragedy is not that good reasoning leads to false beliefs, but that it leads to contentless attempts at thought. (8) and (9) are thus true, assuming Twin lacks vim.

Bricker's central argument for going down this route is his rejection of Lewis's doctrine of the indexicality of actuality. In section 11 below, I will argue that this is one of the parts of Lewis's view that should be jettisoned in any case.

[16]Perhaps there are some contexts in which reference is very easily achieved—maybe it is even true in some of these contexts that whenever one says that all *F*s are *G*s, and x is an F, one says that x is G. By these lax standards, Twin can easily say that some swans on Earth are blue, just by saying that some swans on every planet (unrestrictedly speaking) are blue. But it is implausible that all contexts work like this; we can run our argument within a less permissive context. And even by very permissive standards, it is still not plausible that Twin says that some swans on Earth are blue when he utters the sentence 'some swans on Earth are blue'.

to express a set of worlds, make it easier to express here in Cosmo than anywhere else.

In fact, those (like Lewis) who identify *all* propositions with sets of Lewis-worlds are under pressure to reject claims like (9) even if they *do* identify contingency-inducing quantification with *de re* restricted quantification! For if the proposition that no swans on Earth are blue is a set of Lewis-worlds, which set is it? If we help ourselves to a counterpart relation, there are a few natural candidates: the set of Lewis-worlds in which some counterpart of Earth lacks blue swans; the set of Lewis-worlds in which every counterpart of Earth lacks blue swans; the set of Lewis-worlds in which there is exactly one counterpart of Earth, which lacks blue swans. Whichever we choose, we will be committed to the claim that whenever the counterparts of x are exactly the counterparts of Earth, the proposition that there are no blue swans on x is identical to the proposition that there are no blue swans on Earth. So if Earth-Prime and Earth happen to be similar enough to share exactly the same counterparts, people on Earth-Prime who utter the words 'some swans on Earth are blue' do thereby say that there some swans on Earth are blue![17] I think this is a *reductio* of the doctrine that *all* propositions can be identified with sets of Lewis-worlds. Let me reiterate the arguments I have given. First, since no swans on Earth are blue, anyone who says that some swans on Earth are blue says something false, but people on Earth-Prime who utter the words 'some swans on Earth are blue' do not thereby say anything false. Second, saying that some swans on Earth are blue requires referring to Earth, which normally requires being spatiotemporally or causally related to Earth.[18] However, someone might agree with me about this while maintaining that nevertheless there are *some* propositions which can be identified with sets of Lewis-worlds, and are eligible for being expressed by utterances of simple quantified sentences.

So much for why someone might be motivated to resist the argument for (9); what might they say against it? The response will surely involve insisting that, whatever about (8), we can certainly accept (8′):

(8′) When people in Cosmo-Prime say 'some swans are blue', they don't often say anything false *at Cosmo-Prime*.

But how is this supposed to help rebut the argument for (9)? I see two possible strategies, which I will call the contextualist strategy and the relativist strategy.

According to the contextualist strategy, sentences involving the unadorned 'true' are, in general, devices for making claims which can be explicitly spelled out using 'true at'. In particular, someone who sincerely and literally utters (8) will thereby claim, of some specific Lewis-world w, that when people in Cosmo-Prime say 'some swans are blue', they don't often say anything that is false at w. In general, the relevant Lewis-world will be the one the speaker is part of. But in the case of a sentence like (8), which mention other Lewis-worlds, this presumption can be overcome; thus (8) is naturally used to express what (8′) expresses. Thus (7) and (8) are both true if we resolve their context sensitivity in the most natural way, but in that case the argument to (9) is invalid.

This story is hard to square with the evident equivalence, across all contexts, of ϕ and $\ulcorner$the proposition that ϕ is true$\urcorner$. Given this equivalence, 'true' as applied to propositions cannot introduce any *new* context-sensitivity: if truth-ascriptions have a hidden contextual

[17] Similarly, if Cosmo-Prime and Cosmo have exactly the same counterparts—if, for example, each has all and only Lewis-worlds as counterparts, as entertained above—then the proposition that there are no blue swans in Cosmo-Prime is the proposition that there are no blue swans in Cosmo, and anyone who asserts one asserts both.

[18] This *reductio* thus reinforces the following argument against the general identification of propositions with sets of Lewis-worlds, which was developed in Dorr 2005: Consider a Lewis-world w that contains two counterparts of Earth, only one inhabited by blue swans. If the proposition that there are blue swans on Earth is a set of Lewis-worlds, it either does or doesn't contain w. In either case, we are in danger of having to accept something obviously false, assuming ascriptions of truth to propositions in modal contexts work in the obvious way. If the proposition does contain w, the worry is that 'The proposition that there are blue swans on Earth is such that possibly, it is true even though there are no blue swans on Earth' will come out true. If it doesn't, the worry is that 'The proposition that there are blue swans on Earth is such that possibly, it isn't true even though there are blue swans on Earth' will come out true. Dorr 2005 concludes that we cannot escape this dilemma by adopting some non-obvious analysis of ascriptions of truth to propositions in modal contexts.

parameter whose value is a Lewis-world, then *every* sentence has a hidden contextual parameter whose value is a Lewis-world. There is just no question whether there are blue swans on Earth *simpliciter*, only whether there are blue swans on Earth relative to this or that Lewis-world. But this just takes us back to the "modal B-theory" discussed and set aside at the beginning of the present section.

According to the relativist strategy, on the other hand, we admit that there is such a thing as just claiming a proposition to be true or false, as opposed to claiming it to be true or false at a given world. When truth and falsity is understood in this way, the *T*-schema is valid; thus (7) is acceptable. So given that we want to accept (6) while rejecting (9), we are indeed forced to reject (8). People in Cosmo-Prime *do* say (and mean, and believe) that some_r swans are blue, and what they say is false, since no_r swans are blue. Nevertheless, (8′) is true: what they say is not false *at Cosmo-Prime*. At Cosmo-Prime, it is they who are right and we who are wrong. This further claim is supposed to help us overcome our initial inclination to endorse (8).

Views that deploy the ideology of "relative truth" in this way have recently been quite popular in many domains: defenders include MacFarlane (2005, 2007), Lasersohn (2005), Richard (2008), Kölbel (2002), and many others. Another example should convey the general pattern. A Relativist about 'tasty' who, unlike me, dislikes Marmite will think (i) that Marmite is tasty for me and not tasty for him; (ii) that the proposition that Marmite is tasty is true for me and false for him; (iii) that Marmite is not tasty, and the proposition that Marmite is tasty is false; (iv) that I believe the false proposition that Marmite is tasty, and assert it when I say 'Marmite is tasty'; but (v) my believing and asserting this false proposition involves "no fault", in some strong sense that goes beyond the idea that I am fully *justified* in my belief.[19] The view about contingency-inducing quantification that we are considering works in a similar way. People in other Lewis-worlds who are looking at blue swans will frequently come to believe and assert the false proposition that some_r swans are blue. However, since this proposition is true *for them*, in believing and asserting it they are conducting themselves "correctly"; their having these false beliefs involves "no fault"; they are achieving the "goals" of belief and assertion; etc.

Even for words like 'tasty', the Relativist programme strikes me as extremely problematic. According to the Relativist, I ought to think that the things that are tasty for me are tasty, and the propositions that are true for me are true, whereas the propositions that are true for other people are often false; if they believe these propositions, as they ought, they will getting things wrong. This seems to describe a state of extraordinary intellectual hubris: why should I be so confident that *I* am the special person truth for whom coincides with truth? The further claim that everyone else ought to regard themselves as special in the same way doesn't do anything to dispel the implausibility of this.

I will admit, though, that Relativism for 'tasty' has some *prima facie* appeal. It is certainly tempting to think that if you don't like Marmite, you disagree with me about whether Marmite is tasty, and thus believe, falsely, that it isn't tasty. By reflecting on the difficulty of convincing you of this, I could easily end up thinking that there is no good reasoning that could convince you that Marmite is not tasty, and indeed, that good reasoning requires you to stick as firmly to your false belief as it requires me to stick to my true one. I can imagine getting this far and still feeling that in some sense our disagreement is not *deep*—and obscure as it is, the "no fault" idea perhaps does something to articulate this elusive notion of shallowness.

By contrast, when the difference between the relevant others and me is just that we are in different Lewis-worlds, there is nothing even *prima facie* appealing about Relativism. Why should I think, just on the grounds that Twin is not spatiotemporally related to me, that he will form lots of false beliefs, for example the belief that some_r swans are blue, if he reasons as he should? The claim that Twin and I are committed to *disagreeing* about some proposition (viz. that some_r swans are blue), just because I think there are no swans in my Lewis-world are blue while Twin thinks that some swans in his Lewis-world are blue, is no more plausible than the claim that if you and I are committed to disagreeing about some proposition just because I think that there is beer in my house and you think that there is no beer in

[19] See Cappelen and Hawthorne 2009, chapter 1.

yours. One would only be tempted to think that Twin disagrees with me if one confused this claim with some counterfactual claim to the effect that if things had been thus and so, I would have disagreed with the views I actually hold. But this would be a bad confusion: it would be like inferring the false conclusion that there is a city that Twin hates and I like from the (perhaps true) premise that there is a city I actually like but would have hated if I had instantiated Twin's qualitative profile.[20]

The case for (9) stands: when people in other Lewis-worlds use contingency-inducing quantifiers, they generally do not say the same things we say when we use contingency-inducing quantifiers. This is straightforwardly explained by the hypothesis that contingency-inducing quantification is *de re* restricted quantification. I grant that other explanations are conceivable. One could, for instance, propose that vim comes in a multitude of different flavours: our contingency-inducing quantifiers are restricted to things with our flavour of vim, while Twin's contingency-inducting quantifiers are restricted to things with his different flavour of vim. But what is the point? Given the strength of the independent reasons for regarding *de re* restricted quantification as pervasive, the postulation of a mysterious new realm of properties that are neither qualitative nor *de re* just in order to provide an *additional* source of contingency in quantified claims is utterly ill-motivated.

6 Counterpart theory: the singly *de re*

When ϕ is a closed sentence containing no *de re* elements at all, either overt or covert, the modal realist should claim that for it to be possible or necessary that ϕ is just for it to be the case that ϕ. What if ϕ does contain referential singular terms (including free variables)? Let us begin by considering how the analysis should work when there just one such term has occurrences in ϕ.

Lewis 1968 is a good place to start. Although that paper deals in translations between formal languages rather than analyses stated in English, there is an obvious way to read off from the translation a schematic analysis whose instances are sentences of (logician's) English:

Analysis A

Possibly $\phi(t) \leftrightarrow_{\text{df}}$

$$\exists w \exists v (w \text{ is a Lewis-world } \wedge v \text{ is in } w \wedge v\, \mathbf{C}\, t \wedge \phi^w(v)).$$

Necessarily $\phi(t) \leftrightarrow_{\text{df}}$

$$\forall w \forall v ((w \text{ is a Lewis-world } \wedge v \text{ is in } w \wedge v\, \mathbf{C}\, t) \rightarrow \phi^w(v)).$$

Here '$\phi(t)$' is to be replaced with a sentence in which t is the only free variable or directly referential term and everything else is qualitative; $\phi(v)$ is the result of replacing all occurrences of t in $\phi(t)$ with some variable v which does not already occur in $\phi(t)$; and $\phi^w(v)$ is the result of adding a restriction to things in w to every quantifier in $\phi(v)$ that isn't in the scope of any modal operator in ψ. '$v\, \mathbf{C}\, t$' abbreviates 'v is a counterpart of t'.

Since Lewis only deals with a simple formal language, it isn't entirely clear how we should define quantifier-restricting operation '^{w}' so as to apply to a larger range of English sentences. But there is no point in puzzling further about this: in the light of our conclusion that contingency-inducing quantification is *de re* restricted quantification, we should just drop the quantifier-restricting machinery from the analysis altogether. Since t is the only non-qualitative constituent of the formula $\phi(t)$, any syntactically simple quantifiers in $\phi(t)$ must be unrestricted, or restricted only qualitatively; in either case, they are modally constant. If the role of t in $\phi(t)$ is to restrict some quantifiers, then v will automatically play the same role in $\phi(v)$; there is no need for us to put in any new restrictions by hand.

Once we eliminate '^{w}' from Analysis A, the only remaining role played by the quantifier over Lewis-worlds is that of restricting the values of v to objects that are in some Lewis-world. But this is needlessly complex: if we wanted this effect, we could get it just by building

[20]Ironically, one of MacFarlane's favourite ways of defending Relativism in other domains is to appeal to something very like the view I have just been criticising: 'Consider Jane (who inhabits this world, the actual world) and June, her counterpart in another possible world. Jane asserts that Mars has two moons, and June denies this very proposition. Do they disagree? Not in any real way.' (MacFarlane 2007: p. 10)

it into the analysis of 'counterpart' that only things that are parts of Lewis-worlds can be counterparts of anything. Thus Analysis A can be reduced to the simpler Analysis B:

Analysis B

$$\text{Possibly } \phi(t) \leftrightarrow_{\text{df}} \exists v(v\, \mathbf{C}\, t \wedge \phi(v))$$
$$\text{Necessarily } \phi(t) \leftrightarrow_{\text{df}} \forall v(v\, \mathbf{C}\, t \rightarrow \phi(v))$$

Now we can take $\phi(t)$ to be any English sentence, provided that it contains no non-qualitative expressions apart from t.[21]

While we *could* say that only things that are in Lewis-worlds are counterparts of other things, we *shouldn't* do so if we want to respect obviously valid inferences involving modal operators. One such inference rule corresponds to the axiom T: ⌜Possibly ϕ⌝ follows from ϕ. Consider some object Frank which overlaps several Lewis-worlds. By T, it is possible that Frank overlaps several Lewis-worlds. Since 'overlaps several Lewis-worlds' is a qualitative predicate, this possibility claim is singly *de re*. So according to Analysis B, it is equivalent to the claim that some counterpart of Frank overlaps several Lewis-worlds. If we thought that only parts of Lewis-worlds could be counterparts, we would have to maintain, absurdly, that Frank overlaps several Lewis-worlds despite the fact that it is not possible for it to do so.

We are still free to maintain, if we wish, that only parts of Lewis-worlds are counterparts of other parts of Lewis-worlds. But even this seems unduly restrictive. Bigelow and Pargetter (1987) and Bricker (2001) consider Lewis-worlds which consist of two large lobes of spacetime, connected by a narrow and temporary wormhole. It seems perfectly consistent to suppose that if things had been a little different at earlier times, the wormhole wouldn't have formed at all, so that the thing that is in fact a Lewis-world would have been a fusion of two Lewis-worlds. Similarly, it seems consistent to suppose that there was a non-zero objective chance that the wormhole would never form, and that the Lewis-world would be a fusion of two Lewis-worlds. Each of these claims entails that the Lewis-world *could* have been a fusion of two Lewis-worlds; given Analysis B, this means that it must have a counterpart that is a fusion of two Lewis-worlds.[22]

What is it for one thing to be a counterpart of another? Lewis (1968) connects the notion with that of resemblance: 'Your counterparts resemble you closely in content and context in important respects. They resemble you more closely than do the other things in their worlds.' In advising would-be modal realists to endorse Analysis B, I don't mean to tie 'counterpart' to any such gloss. 'Possibly' and 'necessarily', and their close relatives 'can' and 'must', are notoriously context-sensitive, with an range of meanings including philosophically in-

[21]We can even allow $\phi(t)$ to contain propositional attitude ascriptions: if we take the name 'Hesperus' to be a referential term and hence an admissible substituend for 't', 'Possibly someone believes that Hesperus is bright $\leftrightarrow_{\text{df}} \exists x(x\, \mathbf{C}\,\text{Hesperus} \wedge$ someone believes that x is bright)' is a legitimate instance of Analysis B. Note that this is logically equivalent to the analysis of 'Possibly $\exists y(y =$ Hesperus and someone believes that y is bright)'. Some theories about the behaviour of names in attitude ascriptions deny that 'Someone believes that Hesperus is bright' is logically equivalent to '$\exists y(y =$ Hesperus and someone believes that y is bright)'; I count proponents of these theories as denying that 'Hesperus' is a referential singular term, in the sense relevant to what counts as a substitution instance of Analysis B. Most of these proponents will *also* deny that 'Hesperus' is purely qualitative; in that case, they will not be able to use Analysis B as an analysis of possibility claims involving 'Hesperus'. Nevertheless, they might endorse it as an analysis of possibility and necessity claims in which 'Hesperus' occurs only outside the scope of attitude verbs, while leaving the task of analysing modal sentences that embed attitude ascriptions for another occasion.

[22]Bigelow and Pargetter and Bricker use these cases to argue that it is possible for there to be "island universes"—objects that stand in no spatiotemporal, or analogically spatiotemporal, relations to one another. They take it to be a serious problem for Lewis's view that he cannot accept this possibility, and Lewis agrees Lewis (1992: p. 213–4). But since it is part of Lewis's view that *there are* island universes, unrestrictedly speaking, unless he rejects T he should accept that it is possible for there to be island universes, unrestrictedly speaking. If Lewis takes my advice, the only readings of 'there could not be island universes' which he should even consider accepting are those on which it is equivalent to something like 'there could not be island universes within Cosmo'. And as we have seen, there is no special reason to say this.

Bricker (2001) objects to certain strategies for interpreting utterances of 'island universes universes' as contingently false on the grounds that they entail that 'my utterance is both contingently possible and *analytically* false. Not a happy combination.' But if we take the utterance to mean 'island universes are parts of Cosmo', and take the name 'Cosmo' to have been introduced by the description 'the Lewis-world of which we are parts', then our knowledge that there are no island universes is just an instance of the familiar Kripkean phenomenon of contingent a priori knowledge associated with reference-fixing descriptions, which we should account for however we generally account for such things. (See Dorr MS for one approach.)

teresting notions such as metaphysical, nomological, historical and deontic modalities, as well as an open-ended range of further meanings too idiosyncratic to have any special names. The thesis that all contingency is *de re* contingency applies no matter which modality we have in mind; Analysis B has to serve duty as an analysis of all the kinds of modality.[23] To achieve this, we will have to allow 'counterpart' to inherit all the context-sensitivity of 'can' and 'must'. For each reading of modal operators that we dignify with a special name, there will be a corresponding reading of 'counterpart'; so we will have nomological counterparthood, deontic counterparthood, metaphysical counterparthood, etc.[24] For readings of 'possibly' and 'necessarily' that carry hidden indices, such as historical possibility as of a time or doxastic possibility for a subject at a time, there will be corresponding readings of 'counterparthood' that carry corresponding extra argument places, such as 'x is a historical counterpart of y as of t', or 'x is a doxastic counterpart of y for a at t'. Given this profusion of readings, the task of analysing the particular counterpart relation appropriate to a given context will have to involve a detailed consideration of the way we use modal vocabulary in that context. It would be surprising if there were useful generalisations relating all legitimate counterpart relations to our intuitive notion of resemblance. Section 13 below will consider the special case of modal talk in "metaphysical" contexts.

[23] Perhaps we should make an exception for epistemic modalities, which pose many distinctive challenges.

[24] The fully general translation-scheme given in Lewis 1968 also builds in a special role for an accessibility relation among Lewis-worlds, which is meant to allow us to model different varieties of modality without varying the interpretation of 'counterpart'. Given that 'counterpart' is plausibly going to turn out to be context-sensitive anyway (*OPW* §4.5), I don't see that there is any advantage to be gained by having two different moving parts in the analysis rather than one. So long as the objects we are concerned with are worldbound, we can always subsume Lewis's accessibility relations into the counterpart relation, by adding an extra conjunct to our analysis of 'y is a counterpart of x' requiring that if x and y are worldbound objects, y's Lewis-world be accessible from x's.

7 Necessary existence

Since every counterpart of everything is identical to something (unrestrictedly speaking), Analysis B entails that everything is necessarily identical to something (unrestrictedly speaking):

(NE) $\forall x \Box \exists y (y = x)$.

It has generally been found implausible that NE should be true in every context; this is one of the standard objections to counterpart theory.

One could avoid this without completely giving up on the spirit of counterpart theory. For example, one could have a special object such that having it among one's counterparts makes it true that one could have failed to exist: this would involve some further tinkering with the formula $\phi(v)$ on the right hand side of Analysis B to make it satisfiable (by the special object) even if $\phi(t)$ was '$\neg\exists y(y = t)$'.[25] But so long as we hold on to the aspiration to analyse every modal formula in English using a nonmodal formula of English, and the assumption that analyses licence substitution in modal contexts, there are serious limitations to what can be achieved by such trickery. The problem is that nonexistence seems to require having a very boring nonmodal profile. For each object x, it is necessary that if nothing is identical to x, then: x is not a person; x is not conscious; x is not positively charged; and so on. Whatever the analysis of 'possibly a philosopher' in nonmodal terms looks like, either it or its negation will be entailed by this boring nonmodal profile. In the latter case, we will have to say that if I hadn't existed, it wouldn't have been possible for me to be a philosopher; in the former case, we will have to say that if my pencil hadn't existed, it would have been possible for it to be a philosopher. Neither of these claims fits well with the way we want to talk about possible nonexistence in ordinary contexts.

Perhaps there is no point in starting down this path. When unrestricted quantification is in play, modal realists are used to disagreeing with ordinary opinion. Nothing is more familiar to the modal realist

[25] Cf. Lewis's (*OPW* 233) strategy for avoiding NE by allowing the extension of the counterpart relation to include "gappy" sequences.

than claiming, of some intuitively true sentence involving quantifiers, that it is true only when the quantifiers are taken to be restricted. I have argued that this is bound to happen with sentences like 'It is contingent whether some swans are blue'. Against the backdrop of this pattern of agreement and disagreement with common sense, would it really be bad for the modal realist to claim, analogously, that 'It is contingent whether something is identical with me' is false when its quantifier is taken unrestrictedly, so long as they go on to point out that it can be made true by interpreting the quantifier as restricted?

The restriction could be to things on Earth, for example. While have not yet considered how to analyse multiply *de re* sentences like 'Possibly, nothing on Earth is identical to me', there is no reason to worry that they are false. Or the restriction could be to things in Cosmo: however we end up accounting for the truth of 'Possibly, nothing on Earth is identical to me', we should be able to account in a parallel way for the truth of 'Possibly, nothing in Cosmo is identical to me.'

The claim that I could have failed to be in Cosmo is lousy as a paraphrase of the commonsense thought that I could have failed to exist. This thought is surely inconsistent with the claim that I could not have failed to be a flesh-and-blood living being; whereas this claim is perfectly consistent with the claim that I could have failed to be part of Cosmo. I think it is quite plausible that the 'exists' in such contexts expresses the property of being identical to something, unrestrictedly speaking. The point I am making is just that once we have departed from common sense to the extent of accepting claims of the form 'If something is F, then necessarily something is F, unrestrictedly speaking' when F is qualitative, we should not be much perturbed if we also decide to accept the instances where F is of the form 'identical to x'.

Having been deeply unpopular for decades, NE has recently been vigorously defended by Zalta and Linsky (1994) and Timothy Williamson (1998, 2002, MS). Part of Williamson's defence involves the claim that ordinary concrete objects could fail to be concrete. According to Williamson, commonsense claims about the possible nonexistence of concrete objects are often true if 'exists' in them is replaced with 'is concrete'. So for example, Caesar could have been non-concrete, and would have been non-concrete if his parents had never met, and Caesar's death could not have been concrete unless Caesar was. The modal realist is free to incorporate this idea, by claiming that concrete objects can have non-concrete counterparts. This allows for a more extensive area of agreement with ordinary opinion. As part and parcel of holding that I could have failed to be identical to anything at all, common sense holds that I could have failed to have a mass, to be located in space, to be made of flesh and blood, to be a person, to have parents, etc. Intuitively, I would have failed to do any of these things if my parents had never met, as could easily have happened. Modal realists can agree with this by allowing that some of my counterparts don't have a mass, are not located in space, etc. If they don't allow this, then—assuming that they follow Lewis in holding that what is necessarily the case would have been the case under any counterfactual supposition—they will have to say that if my parents had never met, I would still have been a flesh-and-blood person, with different parents, perhaps living on a different planet or in a different Lewis-world. This seems needlessly absurd. [26]

8 Counterpart theory: the multiply *de re*

Let us now turn to the general case, where modal operators are applied to formulae that may contain more than one variable or referential term. We can again take the 1968 theory as our starting point, reading an analysis-schema off its translations in the obvious way:

Analysis C Possibly $\phi(t_1, \ldots, t_n) \leftrightarrow_{\mathrm{df}}$ there is a Lewis-world w

[26] However, some of our ordinary opinions about possible non-concreteness, like our ordinary opinions about possible non-existence, are hard to square with any reductive analysis of modality. Common sense seems to require non-concrete objects to have rich and interesting modal profiles. If neither your parents nor mine had ever met, neither of us would have been concrete; intuitively, under these circumstances, I could fairly easily have been a concrete child of my actual parents, whereas it would have been impossible, or at least much more difficult, for you to be a concrete child of my actual parents. It is not obvious what nonmodal properties of non-concrete objects, and nonmodal relations between them and concrete objects, could plausibly be invoked to explain these differences in their modal properties.

and objects $v_1 \dots v_n$ all in w, such that $v_1 \mathbf{C}\, t_1 \wedge \cdots \wedge v_n \mathbf{C}\, t_n \wedge \phi^w(v_1, \dots, v_n)$.

Necessarily $\phi(t_1, \dots, t_n) \leftrightarrow_{\text{df}}$ for any Lewis-world w, and any objects $v_1 \dots v_n$ all in w such that $v_1 \mathbf{C}\, t_1 \wedge \cdots \wedge v_n \mathbf{C}\, t_n$, $\phi^w(v_1, \dots, v_n)$.

'$\phi(t_1, \dots, t_n)$' stands for any formula in which the syntactically simple referring terms (including variables) are $t_1 \dots t_n$, in order of first occurrence, and without repetition, and in which all other vocabulary is qualitative; '$\phi(v_1, \dots, v_n)$' is the result of uniformly substituting for these terms variables $v_1 \dots v_n$ which do not already appear in $\phi(t_1, \dots, t_n)$.

In the light of the thesis that contingency-inducing quantification is *de re* restricted quantification, we will want to drop the quantifier-restricting operation '^{w}' from this analysis. But the quantification over Lewis-worlds in Analysis C isn't just supplying a restrictor for the quantifiers; it is also imposing some measure of *co-ordination* on the sequences $v_1, \dots, v_n$ that can witness the truth of a possibility-claim. Suppose we just used Analysis D, which stands to Analysis C as Analysis B stands to Analysis A.

Analysis D

Possibly $\phi(t_1, \dots, t_n) \leftrightarrow_{\text{df}}$

$$\exists v_1 \dots \exists v_n (v_1 \mathbf{C}\, t_1 \wedge \cdots \wedge v_n \mathbf{C}\, t_n \wedge \phi(v_1, \dots, v_n))$$

Necessarily $\phi(t_1, \dots, t_n) \leftrightarrow_{\text{df}}$

$$\forall v_1 \dots \forall v_n ((v_1 \mathbf{C}\, t_1 \wedge \cdots \wedge v_n \mathbf{C}\, t_n) \rightarrow \phi(v_1, \dots, v_n))$$

This would saddle us with some unwelcome results. Consider a painted wooden statue, Athena. I take it that some paint is part of Athena, as opposed to merely being contiguous with Athena: one does not need to deduct the weight of the paint from the reading on the scale when one is asked to determine the weight of Athena, for example. But there is an object that is made entirely of wood and overlaps all the wood in Athena throughout her life. Perhaps there are several such objects: focus on one, Athena-Minus, that is as statue-like as possible, e.g. in that it comes into existence when the wood is carved into a statue-shape. Then (10) seems like it should be true in many ordinary contexts:

(10) It is not possible for Athena and Athena-Minus to be disjoint.

According to Analysis D, (10) is false if *any* counterpart of Athena is disjoint from *any* counterpart of Athena-Minus: a condition that is almost certainly satisfied in any context. Analysis C, by contrast, makes it easier for (10) to be true: for it to be false, some counterpart of Athena would have to be disjoint from some counterpart of Athena-Minus *in the same Lewis-world*.

However—as Hazen (1979) argued, and as Lewis came to agree—this still makes it too hard for claims like (10) to be true.[27] For according to Lewis, it is quite common for objects to have multiple counterparts in the same Lewis-world. There are various considerations which support this. One especially weighty one involves qualitatively symmetric Lewis-worlds—e.g. worlds of two-way eternal recurrence—which are strongly isolated (no part of them bears any perfectly natural relation to anything outside them). Consider some such Lewis-world w. For any qualitative relation R, and object x not in w, if x bears R to any part y of w, x also bears R to all the other qualitative duplicates of y in w. But counterparthood, in many ordinary contexts, including some where (10) is true, is a qualitative relation.[28] So if an object has any counterpart in a strongly isolated, symmetric Lewis-world other than its own, it has many. But a context in which no object in a symmetric, strongly isolated Lewis-world counted as a counterpart of any object in any other Lewis-world would be quite bizarre. Suppose that *you* live in a symmetric and strongly isolated Lewis-world: surely you could *still* have lived in such a world even if you (along with all your images under the symmetry) had raised

[27] The entities in Hazen's example are Caesar and his death; Lewis uses a pair of twins.

[28] It wouldn't really matter to this argument if we considered non-qualitative counterpart relations: for all of the objects which might plausibly figure as *de re* elements of the analysis of possibility claims made by us are spatiotemporally related to us, and thus qualitative relations between them, us, and objects in other, symmetric, strongly isolated Lewis-worlds are still invariant under the symmetries of those Lewis-worlds.

your right hand just now, while things remained the same in other respects. But for this to be true, you may have to have counterparts in other symmetric, strongly isolated Lewis-worlds: there may not be anyone in *this* Lewis-world who is like you except for a raised right hand.[29]

The trouble for Analysis C is deeper than this. The sentences that require draconian and implausible constraints on the counterpart relation to make true include not just intuitive claims like (10), but sentences that express obviously valid principles of modal logic. Consider for example the following modal schemas:

(S1) $\Diamond Fa \rightarrow \Diamond(Fa \vee Fb)$

(S2) $\Box(Fa \wedge Fb) \rightarrow \Box Fa$

These seem as manifestly valid as anything could in the realm of modal logic: they are especially trivial instances of the closure of possibility and necessity under logical consequence, as ensured in standard modal logic by the rule of necessitation and axiom *K*. But look at the analysis of S1 given by Analysis C:

> If some Lewis-world contains a counterpart of *a* that is *F*, then some Lewis-world contains both a counterpart of *a* and a counterpart of *b*, such that either the former or the latter is *F*.

This is false if *a* has counterparts that are *F*, but all of them are in Lewis-worlds that contain no counterparts of *b*. Thus, given Analysis C, guaranteeing the truth of all instances of S1 would require claiming that every object has at least one counterpart in every Lewis-world. (The same is easily seen to be true for S2.) But such a requirement would generate wildly implausible assignments of truth values to other sentences. For example, consider a tiny Lewis-world w with no proper parts: w is in w, but nothing else is. The requirement would force w to be a counterpart of absolutely everything; and that would make it true that everything could have been a spatiotemporally isolated mereological atom. While this may be true in some exotic contexts, it is surely not true across all legitimate contexts, unlike S1.

In the 1983 postscripts to Lewis 1968 and in *OPW*, Lewis proposed an elegant solution to some of the problems with Analysis C. According to this proposal, the analysis of multiply *de re* modal claims involves a relation of counterparthood holding between *sequences*.[30] Here is a statement of this analysis, incorporating the insight that there is no need to include any special-purpose machinery for restricting quantifiers:

Analysis E

Possibly $\phi(t_1, \ldots, t_n) \leftrightarrow_{\text{df}}$
$$\exists v_1 \ldots \exists v_n(\langle v_1, \ldots, v_n\rangle\, \mathbf{C} \langle t_1, \ldots, t_n\rangle \wedge \phi(v_1, \ldots, v_n))$$
Necessarily $\phi(t_1, \ldots, t_n) \leftrightarrow_{\text{df}}$
$$\forall v_1 \ldots \forall v_n(\langle v_1, \ldots, v_n\rangle\, \mathbf{C} \langle t_1, \ldots, t_n\rangle \rightarrow \phi(v_1, \ldots, v_n))$$

Analysis E is strictly more general than Analysis C. If we wanted to recover the effect of Analysis C in some context, we could do so by analysing the counterpart relation on sequences in terms of a counterpart relation on objects:

[29] Biting the bullet here might be less implausible for someone who thought of counterparthood in general as involving some external relation of the sort that cannot hold between strongly isolated objects. On such a view, it is much harder for ordinary possibility claims to be true: for an object to be possibly *F*, there needs to be a chain of perfectly natural relations connecting it to something that is *F*. Lewis's doctrine of Humean Supervenience, however, commits him to thinking that ordinary modal judgments are consistent with the hypothesis that the only perfectly natural relations instantiated in our Lewis-world are spatiotemporal in character; this hypothesis entails that our Lewis-world is strongly isolated.

[30] In postscript D to the reprint of Lewis 1968, Lewis presents the "counterparts of sequences" account not as a modification of the original 1968 translation from the formal modal language to the language of counterpart theory, but as an alternative to the obvious translation from English into the formal modal language. His idea is that the English sentence 'It is possible that Dee and Dum are unrelated' should be rendered formally as something like '$\exists z(z = \langle \text{Dee}, \text{Dum}\rangle) \wedge \Diamond\exists x \exists y(z = \langle x, y\rangle \wedge \text{Unrelated}(x, y))$'. Given that the ultimate point is to come up with analyses that can be stated in English, I take it nothing turns on this distinction.

(11) $\langle x_1, \ldots, x_n \rangle \, \mathbf{C} \langle y_1, \ldots, y_n \rangle \leftrightarrow_{\mathrm{df}} x_1 \, \mathbf{C} \, y_1$ and ... and $x_n \, \mathbf{C} \, y_n$ and $x_1 \ldots x_n$ are all in the same Lewis-world.

But we have already seen why we should not expect to be able to do this (in ordinary contexts).[31]

Analysis E does not yield a reasonable modal logic all by itself: to recover, for example, the inferences from 'Possibly *Fa* and *Gb*' to 'Possibly *Gb* and *Fa*' and 'Possibly *Fa*', we would need an axiom ensuring that whenever $\langle a, b \rangle$ is a counterpart of $\langle c, d \rangle$, $\langle b, a \rangle$ is a counterpart of $\langle d, c \rangle$ and $\langle a \rangle$ is a counterpart of $\langle c \rangle$.[32] This suggests that in taking 'counterpart' to apply to *pairs of sequences*, we are importing superfluous structure: the work we are using pairs of sequences $\langle \langle a_1, \ldots, a_n \rangle, \langle b_1, \ldots, b_n \rangle \rangle$ to do could be done just as well by the sets of ordered pairs $\{\langle a_1, b_1 \rangle, \ldots, \langle a_n, b_n \rangle\}$. The central role in an analysis based on this insight will be done by a one-place predicate I will pronounce 'counterpairing' and symbolise '**C**'. (Since 'counterpart' is two-place, the use of the same symbol will not lead to ambiguities.) For the sake of generality, instead of taking '**C**' as applying to *sets* of ordered pairs, I will take it as a *plural* predicate, applying to ordered pairs taken collectively. It will be convenient to state the analysis in the notation of second-order logic, using 'Xx' to abbreviate 'x is one of X', and 'Rxy' to abbreviate '$\langle x, y \rangle$ is one of R':

Analysis F

Possibly $\phi(t_1, \ldots, t_n) \leftrightarrow_{\mathrm{df}}$

$$\exists R \exists v_1 \ldots \exists v_n (\mathbf{C}R \wedge Rt_1v_1 \wedge \ldots \wedge Rt_nv_n \wedge \phi(v_1, \ldots, v_n))$$

Necessarily $\phi(t_1, \ldots, t_n) \leftrightarrow_{\mathrm{df}}$

$$\forall R \forall v_1 \ldots \forall v_n ((\mathbf{C}R \wedge Rt_1v_1 \wedge \ldots \wedge Rt_nv_n) \rightarrow \phi(v_1, \ldots, v_n))$$

We can recover Analysis E from Analysis F by analysing '$\langle x_1, \ldots, x_n \rangle \, \mathbf{C} \langle y_1, \ldots, y_n \rangle$' as '$\exists R \mathbf{C}R \wedge Rx_1y_1 \wedge \cdots \wedge Rx_ny_n$'. And we can recover Analysis B for singly *de re* sentences by analysing 'x is a counterpart of y' (in the sense of Analysis B) as '$\langle x \rangle \, \mathbf{C} \langle y \rangle$', i.e. '$\exists R(\mathbf{C}R \wedge Rxy)$'.

Like Analysis E, Analysis F needs to be supplemented with further axioms if we want to recover a reasonable modal logic, validating inferences like S1 and S2. In both cases, we can recover as much of orthodox modal logic as we want by imposing such axioms (see section 9). From my point of view, Analysis F has one big advantage over Analysis E, namely the fact that it can very easily be extended to cover sentences in which *plural* terms and free variables occur in the scope of modal operators. All we need to do is to define 'RXY' to abbreviate the following conjunction: (i) for any x that is one of X, there is some y that is one of Y such that Rxy and (ii) for any y that is one of Y, there is some x that is one of X such that Rxy. We can then use Analysis F as it stands to analyse modal sentences involving plural terms: we simply allow the terms $t_1, \ldots, t_n$ to be plural as well as singular, understanding that the variables v_i on the right-hand side should be made plural or singular according as the original terms t_i were.

9 Constraints on counterpairings

Since modal operators are context-dependent, the answer to the question what it is for some ordered pairs to be a counterpairing must vary from one context to another. But it is plausible that certain schematic principles involving modal operators are valid across all contexts;

[31] An alternative idea, due to Graeme Forbes (1985), is, roughly, to adopt Analysis E while analysing $\langle x_1, \ldots, x_n \rangle \, \mathbf{C} \langle t_1, \ldots, t_n \rangle$ as 'for some world w, $\bigwedge_i$(either x_i is in w and $x_i \, \mathbf{C} \, t_i$, or t_i has no counterpart in w and $x_i = t_i$)'. This analysis has the advantage of making S1 and S2 valid. However, it has implausible consequences as it stands, e.g., that if Gordon Brown is necessarily not a lonely electron, then for every x, necessarily, if x is a lonely electron, then Gordon Brown is Prime Minister. Forbes's remedy for this involves a much more radical departure from Lewis's project, in which atomic predicates get endowed with extra argument places that in effect turn them into relations to worlds.

[32] In general, whenever $k_1 \ldots k_m$ is a sequence of distinct numbers $\leq n$, $\langle x_1, \ldots, x_n \rangle \, \mathbf{C} \langle y_1, \ldots, y_n \rangle \rightarrow \langle x_{k_1} \ldots x_{k_m} \rangle \, \mathbf{C} \langle y_{k_1} \ldots y_{k_m} \rangle$.

these will correspond to constraints which all legitimate senses of 'counterpairing' must meet.

The most central such principle is *K*:

(K) $$\Box(\phi \to \psi) \to (\Box\phi \to \Box\psi).$$

This does not follow from Analysis F by itself. For example, '$\Box((Fa \land b = b) \to Fa) \to (\Box(Fa \land b = b) \to \Box Fa)$' is false if some counterpairings map a to objects that are not F, but none of these counterpairings have b in their domain. Given Analysis F, the most straightforward way to guarantee the truth of every instance of (K) is to lay it down as an axiom, true across all contexts, that *counterpairings have universal domains*: whenever R is a counterpairing, $\forall x \exists y Rxy$. It is easy to see that this validates (K).

We don't, strictly speaking, need something quite this strong to validate (K). It would be enough, for example, if we stipulated that *every counterpairing can be extended to a counterpairing with a universal domain*:

(12) $$\mathbf{C}R \to \exists S(\mathbf{C}S \land \forall x \forall y(Rxy \to Sxy) \land \forall x \exists y Sxy).$$

But given (K) and Analysis F, we lose nothing by restricting our attention to those counterpairings that do have universal domains: if any counterpairing witnesses the truth of 'possibly ϕ', some counterpairing whose domain is universal does. The reasoning is simple. Let U be *all the things there are*—the things such that everything is one of them, and suppose that it is possible that $\phi(t_1, \ldots, t_n)$. By Analysis F, it is (trivially) necessary that if $\phi(t_1, \ldots, t_n)$ then $\phi(t_1, \ldots, t_n) \land \forall x(Ux \to Ux)$. So by K, it is possible that $\phi(t_1, \ldots, t_n) \land \forall x(Ux \to Ux)$. By Analysis F, this is true iff there is a counterpairing R that maps $t_1 \ldots t_m$ to objects (singular or plural) $v_1 \ldots v_m$ such that $\phi(v_1, \ldots, v_m)$, and also maps U to some objects X such that $\forall x(Xx \to Xx)$. But any such counterpairing has a universal domain. Thus, even if we started with a sense of 'counterpairing' that applied to some relations that don't have universal domains, we will end up with equivalent analyses if we redefine 'counterpart' so that it only applies to relations with universal domains.

We can imagine *other* analyses of modal operators in terms of counterpairings on which the existence of counterpairings with non-universal domains makes a real difference: it would be no great technical feat to formulate an analysis-schema under which 'I could have failed to be identical to anything' is equivalent to 'there is a counterpairing whose domain does not include me'. But as we saw in section 7, there are formidable challenges facing reductionists about modality who want to recover an *intuitive* account of the possibility of nonexistence, under which, for example, I could have both failed to be identical to anything and possibly been a philosopher. The strategy of using counterpairings whose domain excludes x to encode possibilities of x's nonexistence, in particular, seems quite hard to develop in a way that captures the range of predications that are intuitively compatible with failure to exist. So I don't think that in focusing on Analysis F we are passing up any obviously superior alternatives.

Another characteristic feature of the standard theories in propositional modal logic is necessitation: if ϕ is a theorem, so is $\Box\phi$. If all contingency is *de re* contingency, any theory whose axioms are purely qualitative is guaranteed to have this feature. More generally, a theory will be closed under necessitation whenever its theorems are indifferent to the identities of particular objects: if $\phi(t_1, \ldots, t_n)$ is a theorem, $\forall v_1 \ldots \forall v_n \phi(v_1, \ldots, v_n)$ is a theorem too.

Another axiom that is valid in all standard quantified modal logics is Leibniz's Law:

(LL) $x = y \to (\phi \to \psi)$

where ψ is derived from ϕ by replacing one or more occurrences of x with occurrences of y. An instance of LL is $x = y \to (\Box x = x \to \Box x = y)$. Since $\Box x = x$ is a theorem, this simplifies to the principle that identity is necessary:

(NI) $x = y \to \Box x = y$.

Given Analysis F, NI is equivalent to the claim that *counterpairings are functions*: that is, whenever R is a counterparing and Rxy and Rxz, $y = z$. A straightforward induction on the complexity of formulas shows that this suffices for the full generality of LL, in the language of quantified modal logic.

Lewis was not a friend of the necessity of identity. There are two main arguments against it in his work. The first appeals to the 1968 version of counterpart theory (our Analysis C): there, validating NI would require denying that a single object ever has multiple counterparts in one Lewis-world, which is implausible (especially because of qualitatively symmetric Lewis-worlds). This argument lapses once Analysis C is replaced with Analysis E or Analysis F.

The second argument involves putative counterexamples like (13):

(13) The plastic is identical to the dishpan, but might not have been.

According to Lewis, (13) can be used to say something true. But (13) cannot be true in any context if NI holds in every context. I don't think we should be swayed by this argument either, even if we accept the premise. We already know that sentences like (14) are not true in any *single* context:

(14) The plastic is identical to the dishpan, but while the plastic could have survived squashing, the dishpan could not.

If there is a way to say something true by uttering (14), it requires "changing the context in mid-utterance", i.e. resolving the context-sensitivity of "could" in a non-uniform way. But all kinds of sentences, even paradigmatic logical falsehoods like 'Mary is ready and Mary is not ready', or 'Bruce Wayne is identical to Batman and Bruce Wayne is strong and Batman is not strong', can be used to express truths when we resolve their context-sensitivity nonuniformly. In general, when one claims a schema, say '$\neg(\phi \wedge \neg\phi)$', to be "logically valid", one is committed only to its instances being true on all *uniform* resolutions of their context-sensitivity. But the considerations that might motivate someone to assert (13) are the same kinds of considerations that might motivate someone to assert (14). If we anchor ourselves in a single context, say by stipulating that by our current standards 'the plastic could have survived squashing' is true, and hence 'if the plastic is identical to the dishpan, the dishpan could have survived squashing' is true too, the temptation to assert (13) evaporates. Thus, it would not be implausible to claim that (13) is like (14) in being false on all uniform interpretations. Granted, since (13) only contains one occurrence of a modal operator, it is not obvious how to generate a non-uniform interpretation of (13) on which it is true. Perhaps, if we think that (13) can be used to communicate a truth, we will have to regard it as some kind of nonliteral discourse. But this seems better than trying to find a single context within which (13) is literally true: the way we are tempted to talk when we are tempted to utter sentences like (13) cannot sensibly be accommodated within any one context.[33]

Thus, I am not persuaded by Lewis's case against the validity of NI. Nor do I see that Lewis has done anything to undermine the force of the canonical (Kripkean) argument for NI. If x is necessarily identical to x, and y is x, then y must also be necessarily identical to x! There is no point in having a semantic debate about whether this counts as an genuine instance of Leibniz's Law. If one denies the validity of the Kripkean argument while accepting the validity of 'a is red; $b = a$; so b is red', one will of course want to find a meaning for 'Leibniz's Law' on which the latter argument is, and the former argument is not, among its instances. It is not technically challenging for a counterpart theorist to do this. But this terminological achievement does nothing at all to undermine the impression that the argument is, in fact, obviously valid. Endorsing a counterpart-theoretic analysis of modal claims does not mean one has to throw away one's prior intuitions about the validity of arguments involving modal operators! Rather, as we have seen, such intuitions are a crucial guide in determining what it takes for the counterpart relation to hold, or for a relation to be a counterpairing.[34]

[33] Sider (2009: p. 28) makes a similar point.

[34] One further point. There is no problem making sense of a sense of 'counterpairing' under which it applies to non-functions, or of sentences ⌜schmossibly ϕ⌝ stipulated to be analysed in terms of such a notion. But 'schmossibly', so understood, is semantically anomalous, in that the stipulated meaning of ⌜schmossibly ϕ⌝ depends on merely *orthographic* features of ϕ. In general, we are free to introduce new words by stipulating them to be semantically equivalent to old words, and we expect the new words so introduced to be intersubstitutable *salva veritate* with the old words they were stipulated to be equivalent to, with the exception of quotation-like contexts. For example, I can stipulate that 'Lavid Dewis' is to be semantically equivalent to the name 'David Lewis'. If we hold on to Analysis F as our analysis of ⌜schmossibly ϕ⌝, however, we find that 'Schmossibly David

Requiring counterpairings to be functions also validates a further principle of plural modal logic which captures one half of the idea that *plurals are rigid*: when a thing is one of some things, it is so necessarily.

(NO) $Xx \rightarrow \Box Xx$.

If x is one of X, and there is only one object y such that Rxy, then it follows from our definition of 'RXY' that y is one of Y whenever RXY. The converse is true too: if any counterpairing relates some object to two distinct objects, NO is not universally true.[35] This is unsurprising, given that such counterpairings generate counterexamples to the necessity of identity: if one thought, concerning Russell, that Russell and he identical but could have failed to be, one would also naturally think, concerning Russell and Whitehead, that Russell is one of them but could have failed to be.

If one rejected the necessity of existence, one might be worried about NO even if one had no doubts about the necessity of identity. Consider Russell and Whitehead again. Would Russell still have been one of them if Whitehead had failed to be anything at all? Would Russell still have been one of them if *Russell* had failed to be anything at all? The answers are far from obvious. If we tried to tinker with counterpart theory to allow for contingent existence, we would face delicate and difficult questions about how our analysis should deal with occurrences of 'is one of' in modal contexts. But if we follow the advice of section 7 and don't bother, I can't think of any other reason to worry about the consequence that NO and NI stand or fall together.

If we are going to require counterpairings to be universally defined functions, we can simplify the formulation of our analysis by helping ourselves to the standard functor notation: $R(x)$ stands for the object y such that Rxy, and likewise $R(X)$ stands for the objects Y such that RXY:

Analysis F* Possibly $\phi(t_1, \ldots, t_n) \leftrightarrow_{\mathrm{df}} \exists R(\mathbf{C}R \wedge \phi(R(t_1), \ldots, R(t_n)))$

Necessarily $\phi(t_1, \ldots, t_n) \leftrightarrow_{\mathrm{df}} \forall R(\mathbf{C}R \rightarrow \phi(R(t_1), \ldots, R(t_n)))$

However, abbreviations like this create the potential for scope ambiguity when dealing with iterated modalities. If we want Analysis F* to be equivalent to Analysis F, we must be careful to treat the complex terms $R(t_i)$ as having widest possible scope. We want '$\Diamond\Diamond Fa$' to be equivalent to '$\exists R(\mathbf{C}R \wedge \exists S(\mathbf{C}S \wedge FS(R(a))))$', not '$\exists R(\mathbf{C}R \wedge \exists S(\mathbf{C}S \wedge FS(R)(S(a))))$'. One rigorous way to achieve this would be to follow Russell in taking sentences involving functors as abbreviations of quantified sentences in a functor-free language, and stipulate that the Russellian translations are to be applied in such a way that the quantifier introduced by each complex term takes the widest possible scope.

There are many other formal schemas which have been thought to be logically valid for some or all readings of 'necessarily' and 'possibly'. Many of these correspond naturally to constraints on counterpairings. Several of these schemas, including those we have already considered, are listed in Table 1, together with the constraints on counterpairings that correspond to them. Some remarks on these results:

(i) The axioms listed stand in the following logical relations: (i) T entails D; (ii) Given K and D, 5 and T are jointly equivalent

Lewis ≠ David Lewis' is analysed as '$\exists R\exists x_1(\mathbf{C}R \wedge R(\text{David Lewis}, x_1) \wedge x_1 \neq x_1)$', which is false, whereas 'Schmossibly Lavid Dewis ≠ David Lewis' is analysed as '$\exists R\exists x_1\exists x_2(\mathbf{C}R \wedge R(\text{David Lewis}, x_1) \wedge R(\text{Lavid Dewis}, x_2) \wedge x_1 \neq x_2)$', which is true if there is a counterpairing that includes two distinct ordered pairs having Lewis as first element. So 'schmossibly' with those stipulated truth-conditions creates a quotation-like context, in which even expressions that are stipulated to be semantically equivalent cannot be substituted *salva veritate*. Our ordinary word 'possibly', by contrast, surely does not create a quotation-like context: the truth-value of ⌜possibly ϕ⌝ is sensitive only to semantic features of ϕ.

While requiring counterpairings to be functions is one way to insure that the resulting operator is not quotation-like, it is not the only way. We could also explore an schema like Analysis F except that the list $t_1, \ldots, t_n$ is taken to stand for the possibly repeating list of *token* singular terms in ϕ, in order of occurrence. On this analysis, '$\Diamond(Ft \wedge \neg Ft)$' is equivalent to '$\exists R\exists x_1\exists x_2(\mathbf{C}R \wedge Rtx_1 \wedge Rtx_2 \wedge Fx_1 \wedge \neg Fx_2)$', which can be true if R is non-functional. More interestingly, we could, following Kit Fine's suggestion (2007), make the truth-conditions of ⌜Possibly ϕ⌝ sensitive to semantic *relations* between the terms in ϕ that do not depend on their semantic *values*. It may be that whereas 'Lavid Dewis' bears the same semantic relations to 'David Lewis' that 'David Lewis' bears to itself, this is not generally true of pairs of coreferential names, or of pairs of distinct variables.

[35] Take x to be an object which a counterpairing R maps to two distinct objects y and z, X to be any objects that include X, and Y to be be all the objects to which objects in X bear R, except for z. Then RXY: each of X bears R to one of Y, and each of Y is borne R to by one of X. Since R is a counterpairing such that Rxz and RXY and not Yz, it is not necessary that Xx.

Axiom		*Constraint*
K	$\Box(\phi \rightarrow \psi) \rightarrow (\Box\phi \rightarrow \Box\psi)$	Counterpairings have universal domains: $\mathbf{C}R \rightarrow \forall x \exists y Rxy$
D	$\Box\phi \rightarrow \Diamond\phi$	There is at least one counterpairing: $\exists R \mathbf{C}R$
T	$\Box\phi \rightarrow \phi$	The identity relation is a counterpairing: $\forall x \forall y(Rxy \leftrightarrow x = y) \rightarrow \mathbf{C}R$
NI NO	$x = y \rightarrow \Box x = y$ $Xx \rightarrow \Box Xx$	Counterpairings are functional: $(\mathbf{C}R \wedge Rxy \wedge Rxz) \rightarrow y = z$
ND NNO	$x \neq y \rightarrow \Box x \neq y$ $\neg Xx \rightarrow \Box \neg Xx$	Counterpairings are one-one: $(\mathbf{C}R \wedge Rxz \wedge Ryz) \rightarrow x = y$
CBF CBF2	$\Box \forall x \phi \rightarrow \forall x \Box \phi$ $\Box \forall X \phi \rightarrow \forall X \Box \phi$	Automatic from Analysis F
BF	$\forall x \Box \phi \rightarrow \Box \forall x \phi$	Every counterpairing can be extended so that any given object is in its range: $\mathbf{C}R \rightarrow \forall x \exists S \exists y(\mathbf{C}S \wedge \forall z_1 \forall z_2(Rz_1z_2 \rightarrow Sz_1z_2) \wedge Syx)$
BF2	$\forall X \Box \phi \rightarrow \Box \forall X \phi$	Counterpairings have universal ranges: $\mathbf{C}R \rightarrow \forall y \exists x Rxy$
B	$\phi \rightarrow \Box\Diamond\phi$	R^{-1} (the converse of R) is a counterpairing when R is: $(\mathbf{C}R \wedge \forall x \forall y(Sxy \leftrightarrow Ryx)) \rightarrow \mathbf{C}S$
4	$\Box\phi \rightarrow \Box\Box\phi$	$R \circ S$ (the relative product of R with S) is a counterpairing when R and S are: $(\mathbf{C}R \wedge \mathbf{C}S \wedge \forall x \forall y(Qxy \leftrightarrow \exists z(Sxz \wedge Rzy)) \rightarrow \mathbf{C}Q$
5	$\Diamond\phi \rightarrow \Box\Diamond\phi$	$R \circ S^{-1}$ is a counterpairing when R and S are: $(\mathbf{C}R \wedge \mathbf{C}S \wedge \forall x \forall y(Qxy \leftrightarrow \exists z(Szx \wedge Rzy)) \rightarrow \mathbf{C}Q$

Table 1. Some modal axioms, together with constraints on counterpairings that generate them.

to 4 and B; (iii) Modulo K and B, 4 is equivalent to 5, ND is equivalent to NI, NNO is equivalent to NO, and BF is equivalent to CBF. The same pattern of logical relations holds among the corresponding constraints on counterpairings.

(ii) Given Analysis F, BF2 entails BF, and the same entailment holds between the corresponding constraints.

(iii) Given Analysis F, the constraints listed in the right-hand column entail every instance of the corresponding axiom-schemas in the left-hand column, with the proviso that for 4, *B* and 5, the entailments only hold on the assumption that 'counterpairing' is a qualitative predicate.[36] In proving that these entailments hold, we need to rely on the fact that our definition of 'RXY' is well-behaved, in the following ways: if R is functional ($y = z$ whenever Rxy and Rxz), then it is also "functional on plural arguments": if RXY and RXZ, then $\forall x(Yx \leftrightarrow Zx)$; similarly for the property of being one-to-one. If S is the converse of R ($\forall x \forall y(Sxy \leftrightarrow Ryx)$, then SXY iff RYX. And if Q is the relative product of R and S ($\forall x \forall y(Qxy \leftrightarrow \exists z(Rxz \wedge Szy)))$, then QXY iff $\exists Z(RXZ \wedge SZY)$.[37]

[36]Our analysis allows non-qualitative senses of 'counterpairing', corresponding to contexts where 'possible' means something like 'historically possible as of 1900' or 'consistent with Clinton's beliefs in 1995'. For these, something a bit more complicated is needed to validate 4, *B* or 5. Take for instance a notion of 'counterpairing' that takes one extra singular argument. For 4 ('$\Box_x \phi \rightarrow \Box_x \Box_x \phi$') to be valid for the corresponding sense of necessity, we need it to be the case that whenever R is an x-counterpairing, S is a y-counterpairing, and Rxy, $S \circ R$ is an x-counterpairing.

[37]I will prove the last of these lemmas, and show how to use it to establish the entailment for S4. *Right-to-left*: suppose that RXZ and SZY. Then $\forall x{\in}X\ \exists z{\in}Z(Rxz)$ and $\forall z{\in}Z\ \exists y{\in}Y(Szy)$, so $\forall x{\in}X\ \exists y{\in}Y\ \exists z(Rxz \wedge Szy)$. So $\forall x{\in}X\ \exists y{\in}Y(Qxy))$, since $Q = S \circ R$. By analogous reasoning, $\forall y{\in}Y\ \exists x{\in}X(Qxy))$; hence QXY. *Left-to-right*: Let Z comprise all and only those objects z such that for some x and y, $Xx \wedge Yy \wedge Rxz \wedge Szy$. If QXY, then $\forall x{\in}X\ \exists y{\in}Y\ Qxy$. So $\forall x{\in}X\ \exists y{\in}Y\ \exists z(Rxz \wedge Szy)))$. By the definition of Z, every such z is one of Z. So $\forall x{\in}X\ \exists z{\in}Z(Rxz)$. And it follows from the definition of Z that $\forall z{\in}Z\ \exists x{\in}X(Rxz)$. Hence RXZ. Analogous reasoning shows that SZY.

We can now show that if $R \circ S$ is a counterpairing whenever R and S are, and $\Box\phi(t_1, \ldots, t_n)$, then $\Box\Box\phi(t_1, \ldots, t_n)$. By Analysis F, if $\Box\phi(t_1, \ldots, t_n)$, then $\phi(v_1, \ldots, v_n)$ whenever Q is a counterpairing and $Qt_1v_1 \ldots$ and Qt_nv_n. By the constraint, it follows that this is also true whenever $Q = R \circ S$ and R and S are counterpairings. By the

(iv) With the exception of NI/NO, ND/NNO, and D, the modal axiom-schemas do not actually entail the corresponding constraints. Rather, the relation is the one we have already saw in the case of *K*: if we have a sense of 'counterpairing' under which all instances of the axiom-schema are true (given Analysis F), we can use it to define a new sense of 'counterpairing' which satisfies the corresponding constraint, without thereby affecting the analysis of any modal sentence or formula. In the case of K, BF and BF2, the new sense will *strengthen* the old sense just enough to satisfy the constraint—e.g. for BF2, to be a counterpairing in the new sense is to be a counterpairing in the old sense whose range is universal. In the case of T, B, 4 and 5, the new sense will *weaken* the old sense just enough to satisfy the constraint—e.g. for 4, the new sense is the closure of the old sense under composition.[38] We can prove that the analyses we get from Analysis F using the new sense of 'counterpairing' will be logically equivalent to analyses using the old sense of 'counterpairing'.[39]

above lemma, $Qt_iv_i \leftrightarrow \exists u(St_iu \wedge Ruv_i)$, whether t_i, v_i and u are singular or plural. So $\phi(v_1, \ldots, v_n)$ whenever R and S are counterpairings and $\exists u_1 \ldots \exists u_n\ St_1u_1 \wedge Ru_1v_1 \wedge \cdots \wedge St_nu_n \wedge Ru_nv_n$. (Here u_i and v_i are plural variables iff t_i is a plural term.) That is: whenever S is a counterpairing and $St_1u_1 \wedge \cdots \wedge St_nu_n$, then: whenever R is a counterpairing and $Ru_1v_1 \wedge \cdots \wedge Ru_nv_n$, then: $\phi(v_1, \ldots, v_n)$. So by a double application of Analysis F, $\Box\Box\phi(t_1, \ldots, t_n)$.

[38] This closure can be defined with a little trickery using plural quantification over ordered triples. Thus: R is a counterpairing in the extended sense $\leftrightarrow_{\text{df}}$ there is a number n and some ordered triples X such that (i) the first element of each of X is a number less than n; (ii) whenever $0 \leq i < n$, the ordered pairs $\langle x, y\rangle$ such that $\langle i, x, y\rangle$ is one of X are a counterpairing in the old sense; (iii) any ordered pair $\langle x, y\rangle$ is one of R iff for some function f, $f(0) = x$ and $f(n) = y$ and whenever $0 \leq i < n$, $\langle i, f(i), f(i+1)\rangle$ is one of X.

[39] Here is the proof for B: the others are similar. Let $\mathbf{C}^*R$ be defined as $\mathbf{C}R \vee \mathbf{C}R^{-1}$; let $\Diamond^*$ and $\Box^*$ be defined as in Analysis F but using $\mathbf{C}^*$ instead of $\mathbf{C}$. It is obvious from the definition that for any formula ϕ, $\Diamond\phi$ entails $\Diamond^*\phi$ and $\Box^*\phi$ entails $\Box\phi$; what we need to show is that the converse entailments also hold. For simplicity, suppose ϕ contains just one singular term t and no plural terms. Assume $\Diamond^*\phi(t)$: that is, $\exists R\exists x((\mathbf{C}R \vee \mathbf{C}R^{-1}) \wedge Rtx \wedge \phi(x))$. If $\mathbf{C}R$, then evidently $\Diamond\phi(t)$; so suppose $\mathbf{C}R^{-1} \wedge Rtx \wedge \phi(x)$. Since B is valid for $\Box$ and $\Diamond$, it follows that $\Box\Diamond\phi(x)$: that is,

$$\forall R_1\forall z_1((\mathbf{C}R_1 \wedge R_1yz_1) \rightarrow \exists R_2\exists z_2(\mathbf{C}R_2 \wedge R_2z_1z_2 \wedge \phi(z_2)))$$

10 "Possible worlds"

Lewis often writes in *OPW* as if the following schematic equivalences were common ground between him and his opponents:

(15) a. Possibly ϕ iff ϕ at some possible world.

b. Necessarily ϕ iff ϕ at every possible world.

Lewis presents his analysis as the result of analysing 'possible world' in these schemas as 'Lewis-world', and analysing 'at w, ϕ' (also written 'ϕ according to w' and 'w represents that ϕ') in terms of counterparts. I have argued that in fact, quantification over Lewis-worlds *per se* plays no role in the best counterpart-theoretic analysis of modal claims. And the claim is highly misleading even if we stick with the counterpart theory of Lewis 1968: 'at w' would need to be spelled out using existential quantification over counterparts in (15a) and using universal quantification over counterparts in (15b).

This isn't to say, however, that counterpart theory analysis can't be understood as a specification of (15). It can! For as we have seen, provided that we require all counterpairings to be universally defined functions, Analysis F is equivalent to Analysis F*. And Analysis F* is of the right logical form to be a specification of (15a) and (15b): we need only understand 'possible world' to mean 'counterpairing', and adopt the following analysis of what it is for something to be the case "at" a relation R:

(16) $$\text{at}\, R\, \phi(t_1, \ldots, t_n) \leftrightarrow_{\text{df}} \phi(R(t_1), \ldots, R(t_n))$$

If to be a possible world is just to be something that plays the role defined by (15), then Lewis-worlds are not possible worlds, but counterpairings—provided that they are required to be universally

Putting R^{-1} for R_1 and t for z_1, we can deduce that

$$\exists R_2\exists z_2(\mathbf{C}R_2 \wedge R_2tz_2 \wedge \phi(z_2))$$

—that is, $\Diamond\phi(t)$. Similar reasoning shows that $\Box\phi(t)$ entails $\Box^*\phi(t)$. The extension to sentences containing multiple variables is straightforward. For the extension to plural variables, we also need the fact that if $S = R^{-1}$ then SXY iff RYX; this follows from the definition of SXY.

defined functions—are. (But remember that strictly speaking there are no such *things* as counterpairings, since quantification over counterpairings is officially cashed out as plural quantification over ordered pairs.)

In fact, however, there is more to the role implicitly defined by the way philosophers and semanticists talk about possible worlds than (15). There are some other principles that seem almost as central. If counterpairings are possible worlds, the following should surely be true for each counterpairing R:

(17) a. $\Box(\text{at}\, R\, (\phi \wedge \psi) \leftrightarrow \text{at}\, R\, \phi \wedge \text{at}\, R\, \psi)$

b. $\Box(\text{at}\, R\, (\neg\phi) \leftrightarrow \neg\, \text{at}\, R\, \phi)$

c. $\Box(\text{at}\, R\, (\Diamond\phi) \leftrightarrow \exists S(S \text{ is accessible from } R \wedge \text{at}\, S\, \phi))$

d. $\Box(\text{at}\, R\, \phi \rightarrow \Box\, \text{at}\, R\, \phi$

We can find conditions on counterpairings under which all these principles hold, but these go beyond the mere requirement that counterpairings be universally defined functions.

The problem with (17a) and (17b) is the initial 'necessarily'. (16) entails that whenever R is a universally defined function, $\text{at}\, R\, (\phi \wedge \psi) \leftrightarrow \text{at}\, R\, \phi \wedge \text{at}\, R\, \psi$ and $\text{at}\, R\, (\neg\phi) \leftrightarrow \neg\, \text{at}\, R\, \phi$. The problem is that even if it is necessary that all counterpairings are universally defined functions, it does not follow that each counterpairing is necessarily a universally defined function. For if the logic of the relevant sense of 'possible' is not S5, there can be possible worlds which could have failed to be possible worlds—in other words, counterpairings which could have failed to be counterpairings—in other words, counterpairings S such that for some counterpairing R, $R(S)$ is not a counterpairing. Guaranteeing the truth of (17a) and (17b) thus requires not only that every counterpairing is a universally defined function, but that $R(S)$ is a universally defined function whenever R and S are counterpairings.

In thinking about what this means, a natural starting point is the appealing thought that ordered pairs are rigid: whenever z is the ordered pair of x and y, it is necessarily so. In the context of our analysis, this is equivalent to

Rigid Pairs Whenever R is a counterpairing, $R(\langle x, y\rangle) = \langle R(x), R(y)\rangle$.

Rigid Pairs entails that when R is a counterpairing and S is any plurality of ordered pairs, an ordered pair is one of $R(S)$ iff it is $\langle R(x), R(y)\rangle$ for some $\langle x, y\rangle$ that is one of S. That is, $R(S)(z_1 z_2) \leftrightarrow \exists x \exists y(Rxz_2 \wedge Sxy \wedge Ryz_2)$: in other words, $R(S) = R \circ S \circ R^{-1}$. Thus if we were to require not only counterpairings but the converses of counterpairings to be universally defined functions, we would be guaranteed that $R(S)$ is a universally defined function whenever R and S are counterpairings. And it is hard to think of any other plausible way to guarantee this. $R \circ S \circ R^{-1}$ will certainly not have a universal domain unless R^{-1} does; and unless S is very special, it will not be functional unless R^{-1} is. So if ordered pairs are rigid, the desire to vindicate (17a) and (17b) pushes us towards the view that every counterpairing is a *global permutation*—some ordered pairs such that everything is the first element of exactly one of them, and everything is the second element of exactly one of them.

The challenge posed by (17c) is to find a meaning for 'S is accessible from R' that makes it true. We can find one by substituting Analysis F* into our analysis 'at R'. In the simple case where the counterpart relation is qualitative, this is easily done:

$$\begin{aligned} &\text{at}\, R \Diamond\phi(t_1, \ldots, t_n) \\ \leftrightarrow\ & \text{at}\, R\, \exists Q(\mathbf{C}Q \wedge \phi(Q(t_1), \ldots, Q(t_n))) \\ \leftrightarrow\ & \exists Q(\mathbf{C}Q \wedge \phi(Q(R(t_1)), \ldots, Q(R(t_n)))) \\ \leftrightarrow\ & \exists Q(\mathbf{C}Q \wedge \text{at}(Q \circ R)\, \phi(t_1, \ldots, t_n)) \end{aligned}$$

Thus we can accept (17c) provided we understand 'S is accessible from R' to mean 'there is a counterpairing Q such that $S = Q \circ R$'. If counterpairings are one-to-one, this is equivalent to '$S \circ R^{-1}$ is a counterpairing'.[40]

[40]What about non-qualitative counterpart relations? Suppose $\mathbf{C}(S)$ is analysed as $\psi(a_1, \ldots, a_j, S)$, where ψ is qualitative and $a_1 \ldots a_j$ are some singular or plural terms. Then, in the third and fourth lines of the above derivation, instead of '$\mathbf{C}(Q)$' we should have '$\psi(R(a_1), \ldots, R(a_j), Q)$'; so our analysis of '$S$ is accessible from R' should be '$\exists Q(\psi(R(a_1), \ldots, R(a_j), Q) \wedge S = Q \circ R)$'. If counterpairings are global permutations, then we can express this analysis in terms of $\mathbf{C}$: in that case, '$\exists Q(\psi(R(a_1), \ldots, R(a_j), Q) \wedge S = Q \circ R)$' is equivalent to '$\psi(R(a_1), \ldots, R(a_j), S \circ R^{-1})$', which is equivalent to '$\psi(R(a_1), \ldots, R(a_j), R(R^{-1}(S \circ R^{-1})))$', which is equivalent to

The most difficult to vindicate is (17d). This is an important part of the standard "possible world" role: much of our ordinary talk about possible worlds would have to be drastically rethought if facts about what is the case at a given world could be contingent. But none of the constraints on counterpairings that we have encountered so far entails (17d). Worse: the very appealing principle Rigid Pairs entails that what is the case according to a counterpairing often *is* contingent. For Rigid Pairs entails that counterpairings map identity pairs to identity pairs: if $R\langle x, x\rangle\langle y, z\rangle$, then $y = z$. If so, each counterpairing must map I, the plurality of all identity pairs, to some plurality J of identity pairs. (If we counterpairings must also have universal ranges, $J = I$.) But the conjunction of 'at $J\,\phi$' with the claim that J consists only of identity pairs entails ϕ. Thus for any counterpairing R, if 'at R (at $I\,\phi$)' is true, then 'at $R\,\phi$' is true. It is necessary that if at $I\,(\phi)$, then ϕ. (And if counterpairings have universal ranges the converse is also necessary). So whenever it is contingent whether ϕ, it is contingent whether at $I\,\phi$.[41]

Thus, to render claims of the form 'at $R\,(\phi)$' non-contingent, counterpairings will have to treat ordered pairs in a strange way that does not fit with the intuition that they are rigid. Can we do it if we are prepared to bite this bullet? Yes: it turns out that everything works out nicely if we assume both (a) that all counterpairings are global permutations, or at least universally defined, one-to-one functions, and (b) the following rather odd treatment of ordered pairs:

Semi-Rigid Pairs $R(\langle x, y\rangle) = \langle R(x), y\rangle$ for every counterpairing R.

Semi-Rigid Pairs entails that whenever R is a counterpairing and S is any relation, $\langle x, y\rangle$ is one of $R(S)$ iff for some z, Szy and Rzx. That is, $R(S) = S \circ R^{-1}$. Now consider what it means for 'at R at $S\,\phi(t_1, \ldots, t_n)$' to be true. According to (16), this is equivalent to 'at $R\,\phi(S(t_1), \ldots, S(t_n))$', and hence to

(18) $$\phi(R(S)(R(t_1)), \ldots, R(S)(R(t_n))).$$[42]

If R is a counterpairing, then by Semi-Rigid Pairs, $R(S) = S \circ R^{-1}$, so $R(S)(R(t_i)) = (S \circ R^{-1})(R(t_i)) = S(R^{-1}(R(t_i)))$. And since R is universally defined and one-to-one, $R^{-1}(R(t_i)) = t_i$. (All this is true whether t_i is a singular or plural term.) So (18) is equivalent to '$\phi(S(t_1), \ldots, S(t_n))$', and hence to 'at $S\,\phi(t_1, \ldots, t_n)$'. We have thus shown that if 'at $S\,\phi(t_1, \ldots, t_n)$' is true, 'at R at $S\,\phi(t_1, \ldots, t_n)$' is true whenever R is a counterpairing: in that case 'at $S\,\phi(t_1, \ldots, t_n)$' is necessarily true.

Our previous strategy for vindicating (17a) and (17b) involved combining Rigid Pairs with the claim that counterpairings are global permutations. But this works out just as well if we replace Rigid Pairs with Semi-Rigid Pairs. If $R(S) = S \circ R^{-1}$, then $R(S)$ is a global permutation (and hence a universally defined function) whenever R and S are.

Nevertheless, the strategy of vindicating (17d) by accepting Semi-Rigid Pairs takes a lot of getting used to. For the strategy requires facts about the constitution of counterpairings to be contingent, in a surprising way. For example, the identity pairs I—"the actual world"—could have failed to comprise all and only identity pairs. Indeed, they would have failed to do so had anything been otherwise in any respect! For whenever it is true that ϕ, it is necessary that at I, ϕ; and it is always necessary that (ϕ iff at whichever pairs are the identity pairs, ϕ); hence, whenever it is true that ϕ, it is necessary that (if not-ϕ then I are not the identity pairs). Every counterpairing is the identity relation at itself: $R(R) = R \circ R^{-1} = I$, since counterpairings are global permutations. *Being the identity relation* plays the role, in this theory, that *being actualised* plays in the standard possible worlds framework.

We face a dilemma: give up (17d), or give up Rigid Pairs. One way to deal with this dilemma would be to apply the Lewisian idea that choices between different ways of referring to the same thing(s) can

'at $R\,\mathbf{C}(R^{-1}(S \circ R^{-1}))$'.

[41] This objection to the identification of possible worlds with pluralities of ordered pairs parallels a common objection to Lewis's identification of properties with sets, and instantiation with set-membership. Namely: whenever an object is a member of a set, it is necessary that it is a member of that set (at least if it exists); but it is not true that whenever an object has a property, it is necessary that it has that property.

[42] Note that we get the same result if we first eliminate 'at R' to get 'at $R(S)\,\phi(R(t_1), \ldots, R(t_n))$' and then eliminate 'at $R(S)$'.

affect the truth value of our modal claims, by affecting the contextually determined interpretation of 'counterpairing' (or in Lewis's case, 'counterpart'). Here are some ordered pairs. If we refer to them in one way—as "these ordered pairs", say—that will evoke an interpretation of 'counterpairing' on which Rigid Pairs is true. If we refer to them in a different way—as "a possible world"—that will evoke a different interpretation of 'counterpairing', on which Semi-Rigid Pairs is true, so that claims about what is the case "at" a given plurality of pairs are non-contingent. If we try to do both these things in the same breath, we will be misled into thinking that we are thinking with two distinct (pluralities of) entities.[43]

It is worth noting that not all of the theoretical roles we might want "possible worlds" to play require claims about what is the case at a world to be non-contingent. For example, this is not required for a Lewis-style analysis of counterfactual conditionals in terms of a closeness relation among worlds. Even if we accept Rigid Pairs, we are free to analyse 'If it were that ϕ it would be that ψ' as 'Either there is no counterpairing at which ϕ, or some counterpairing at which $\phi \wedge \psi$ is closer to the identity relation than any counterpairing at which $\phi \wedge \neg\psi$'.[44] Many of the applications of possible worlds for which it actually matters that claims about what is the case at a world should be non-contingent are in formal semantics; and there, it is not at all obvious that we couldn't achieve the same explanatory goals equally well in a framework that didn't require worlds to work like this. There is one important exception, however, and that is the application of possible worlds to the task of analysing modal claims involving 'actually' operators—a task that has been a stumbling block for counterpart theorists up to now, and which is important enough to deserve its own section.

11 Actuality

Consider Twin, off in some other Lewis-world. He is about six feet tall. He could have been much shorter than that, say five feet tall. And if so, he would have been much shorter than he in fact is, since in fact he is about six feet tall.

'Actually' and 'in fact' are pretty much synonymous. The way Twin in fact is is the way he actually is. Once we agree that Twin is about six feet tall, it would be absurd to deny that he is in fact about six feet tall. It would be no less absurd to deny that he is actually six feet tall.

Lewis generally uses 'actual' as a predicate. He claims that only things that are in Cosmo are actual; things that are in other Lewis-worlds are nonactual. 'Actual', according to him, is indexical: in our context its extension includes only things that are parts of Cosmo; as used by someone in another Lewis-world, its extension includes only things that in that world.

I'm not quite sure how this adjective 'actual' is supposed to relate to the adverb 'actually'—I'm not even sure that 'is actual', as opposed to 'is an actual *F*', is grammatical English. But it would certainly be strange to agree with Lewis that Twin is not actual, while accepting, as I claimed we must, that he is actually six feet tall. Maybe we should say to be actual is to be actually identical to something. If so, then for the same reason that I think we must say that Twin, being six feet tall, is actually six feet tall, I think we must say that Twin, being identical to something, is actually identical to something, and thus actual.

If we thought that Lewis-worlds were *ways things might be*, we would naturally be led to think that there must be one Lewis-world that is *the way things are*, and thus to give this Lewis-world a special role in the semantics of 'actual' and 'actually'.[45] But once we see that

[43] Another, less Lewisian, route would be expand our ontology to include several different kinds of ordered-pair-like objects that can be assigned different modal profiles within a single context. As well as pairs, there are pairs*: for all x and y, there is exactly one pair* whose first member* is x and whose second member* is y. Even in a context where ordered pairs are rigid, pairs* may not be: Rigid Pairs may be true if we take '$\langle x, y\rangle$' to refer to a pair, while Semi-Rigid Pairs is true if we take it to refer to a pair*. If so, we can identify possible worlds with pluralities of pairs* rather than pluralities of pairs, and thus assert within a single context that what is the case according to a world is non-contingent and that ordered pairs have their first and second elements essentially.

[44] In fact, if the task is that of analysing counterfactual conditionals in nonmodal terms, there is no need for a three-place closeness relation, since one of the argument places will always be saturated by the identity relation: we can simply think in terms of a two place 'closer to being actualised than' relation among counterpairings.

[45] Lewis says that he 'would find it very peculiar to say that modality, as ordinarily

the concept of a Lewis-world plays no special role in the semantics for modal claims, we will see that this is a mistake. Lewis-worlds, like everything else, are counterparts, and in that sense represent ways certain specific things—the things whose counterparts they are—might be. If the Lewis-worlds are all one another's counterparts, then each Lewis-world represents a way any other given Lewis-world might be.[46] There is only one Lewis-world—namely Cosmo itself—that represents *the way Cosmo actually is*. But this doesn't give Cosmo a distinctive role *vis-à-vis* actuality: every Lewis-world represents the way it itself is. ⌜Actually ϕ⌝ involves indexical reference to Cosmo only when ϕ already involves indexical reference to Cosmo. Since quantification is often tacitly restricted in an indexical way, many claims which contain no overt indexical words are indexical all the same. There is no particular reason to think that covert indexical reference to Cosmo is particularly common among the folk, however, although it might be more common among certain physicists and philosophers.

So much for what actuality is *not*. But what is it? What does 'actually' *actually* mean? Hazen (1979) was the first to notice the difficulty of extending the counterpart-theoretic translation scheme of Lewis 1968 to a language containing an 'actually' operator; Fara and Williamson (2005) explain why some natural ideas, as well as some more intricate proposals due to Graeme Forbes and Murali Ramachandran, don't succeed in endowing the 'actually' operator with anything like the right logical behaviour.

In a context where Semi-Rigid Pairs holds and counterpairings are global permutations, this challenge is easily met in the present framework. We can simply analyse ⌜Actually ϕ⌝ as ⌜at I (ϕ)⌝, where I is a rigid plural name for the identity pairs. As we have seen, the result turns out to be non-contingent. How could there be such a big difference between ⌜at(I)(ϕ)⌝ and ϕ? Because, in these contexts, it is far from being necessary that I *are* all and only the identity pairs. For example, the identity pair ⟨Lewis, Lewis⟩ is not necessarily an identity-pair, since ⟨x, Lewis⟩ is a counterpart of ⟨Lewis, Lewis⟩ whenever x is a counterpart of Lewis. But since all its counterparts have Lewis as their second member, ⟨Lewis, Lewis⟩ *is* necessarily a pair whose second member is a philosopher. Likewise, concerning the identity pairs I, it is not necessary that they are all identity pairs, but it is necessary that whichever of them has Lewis as a first member has a philosopher as its second member.

It will be objected that there are at least some contexts where 'Ordered pairs are rigid' is true, and that the actuality operator makes sense, and obeys its usual logic, even in these contexts. One could try to invoke the idea of mid-sentence context-shifting to handle this. But such a move seems less than fully satisfying: sentences which employ the actuality operator in the course of expounding the rigidity of ordered pairs, like 'it is necessary that each ordered pair have the members it actually has', certainly don't have the feel of discourse that is true only on nonuniform interpretations.

However, if we are prepared to lower our sights a bit, demanding not a recipe for giving *analyses* of the form 'Actually $\phi \leftrightarrow_{\text{df}} \ldots$', but only a recipe for transforming any given sentence with 'actually' and various other modal operators into a logically equivalent sentence free of modal operators, we can adapt our previous approach so that we can do without Semi-Rigid Pairs. The idea is to use as an intermediary a two-sorted language with a special category of terms which are stipulated to behave, in modal contexts, the way Semi-Rigid Pairs requires all terms for relations to behave.

Let me sketch the strategy in a bit more detail. We start with a language $\mathcal{L}_{\text{ACT}}$ with the modal operators $\Box$, $\Diamond$ and ACT, singular and plural quantifiers and variables, a predicate **C** taking one plural argument, a distinguished plural term I, and the ordered-pair-forming functor '$\langle \cdot, \cdot \rangle$'. We will recursively specify a translation function from $\mathcal{L}_{\text{ACT}}$ into $\mathcal{L}$, the modal-operator-free sublanguage of $\mathcal{L}_{\text{ACT}}$. Our translation will use sentences of a third language $\mathcal{L}_W$ as intermedi-

understood, is quantification over parts of actuality. If I were convinced that I ought to call all the worlds actual. . . then it would become very implausible to say that what might happen is what does happen at some or another world' (*OPW* 100). It is not obvious how to square this with his allowing (*OPW* 231–2) that actual objects can be one another's counterparts.

[46] Cf. *OPW* 230: '[A] possible world. . . is a way that an entire world might possibly be. But lesser possible individuals, inhabitants of worlds, proper parts of worlds, are possibilities too. They are ways that something less than an entire world might possibly be.'

aries. $\mathcal{L}_W$ is like $\mathcal{L}$ except that (i) its plural terms can optionally be underlined, in which case we will call them "world terms", and (ii) it contains an operator 'at' that takes a world term $\underline{W}$ and a sentence ϕ to make a sentence $\ulcorner \text{at}\,\underline{W}\,(\phi)\urcorner$.

The translation from $\mathcal{L}_{\text{ACT}}$ to $\mathcal{L}_W$ is straightforward: wherever we have '$\Diamond\phi$', we substitute '$\exists\underline{V}(\mathbf{C}\underline{V} \wedge \text{at}\,\underline{V}\,\phi)$', where $\underline{V}$ is some new world variable; wherever we have '$\Box\phi$', we substitute '$\forall\underline{V}(\mathbf{C}\underline{V} \rightarrow \text{at}\,\underline{V}\,(\phi))$'; wherever we have '$\text{ACT}\,\phi$', we substitute '$\text{at}\,\underline{I}\,(\phi)$'.

The central task in translating from $\mathcal{L}_W$ to $\mathcal{L}$ is to eliminate all occurrences of the 'At' operator. To do so, we replace each formula of the form '$\text{at}\,R\,\phi(t_1,\ldots,t_n)$' with $\phi(\alpha_1,\ldots,\alpha_n)$, where α_i is $\ulcorner R(t_i)\urcorner$ when t_i is a singular term or a non-underlined plural term, and α_i is $\ulcorner t_i \circ R^{-1}\urcorner$ when t_i is an world term. As usual, we treat sentences involving complex terms like '$R(a)$' and '$S \circ R^{-1}$' in Russellian fashion, as abbreviations for quantified sentences of $\mathcal{L}_W$: '$(S \circ R^{-1})ab$', for example, abbreviates '$\exists Q(\forall xy(Qxy \leftrightarrow \exists z(Rzx \wedge Szy)) \wedge Qab)$'. By repeatedly applying this rule, we can turn each sentence of $\mathcal{L}_W$ into an 'at'-free sentence. Finally, we can translate this sentence into $\mathcal{L}$ simply by dropping all the underlines.

Here is an example of the machinery at work. Suppose our original sentence ϕ of $\mathcal{L}_{\text{ACT}}$ is

(19) $$\exists x \Diamond \exists y\, \text{ACT}\, Fxy.$$

The translation of (19) into $\mathcal{L}_W$ is

(20) $$\exists x \exists \underline{X}(\mathbf{C}\underline{X} \wedge \text{at}\,\underline{X}\,(\exists y(\text{at}\,\underline{I}\,(Fxy)))).$$

Eliminating the two occurrences of 'At' in reverse order yields first

(21) $$\exists x \exists \underline{X}(\mathbf{C}\underline{X} \wedge \text{at}\,\underline{X}\,(\exists y(F\underline{I}(x)\underline{I}(y))))$$

and then

(22) $$\exists x \exists \underline{X}(\mathbf{C}\underline{X} \wedge \exists y(F(\underline{I} \circ \underline{X}^{-1})(\underline{X}(x))(\underline{I} \circ \underline{X}^{-1})(\underline{X}(y)))).$$ [47]

(22) can be turned into (an abbreviation of) a formula of $\mathcal{L}$ by eliminating the underlines. From the premise that counterpairings are global permutations, we can deduce that this formula is equivalent to

(23) $$\exists x \exists X(\mathbf{C}X \wedge \exists y FI(x)I(y)).$$

and thus, appealing to the further premises that there is at least one counterpairing and that I is the identity relation, to

(24) $$\exists x \exists y Rxy$$

which is what we want.

This translation yields an orthodox logic for 'actually'. From the premises that all counterpairings are global permutations and that I is a global permutation, it is a straightforward exercise to derive the following standard axiom-schemas:

$$\text{ACT}(\phi \rightarrow \psi) \rightarrow (\text{ACT}\,\phi \rightarrow \text{ACT}\,\psi)$$
$$\text{ACT}\,\neg\phi \leftrightarrow \neg\,\text{ACT}\,\phi$$
$$\text{ACT}(\text{ACT}\,\phi \leftrightarrow \phi)$$
$$\text{ACT}\,\phi \rightarrow \Box\,\text{ACT}\,\phi$$

All of these are "globally valid" under the standard logic for 'actually'. The additional "real-world valid" axiom-schema

$$\text{ACT}\,\phi \leftrightarrow \phi$$

follows if we add the further premise that I is the identity relation.[48]

[47] Note that we would get the same result if we eliminated the occurrences in the opposite order.

[48] To assure ourselves properly that the translations defined above deliver the orthodox logic for 'actually' in its entirety, we need to venture into model theory. Let a model for $\mathcal{L}$ be a pair of a domain $\mathcal{D}$ and interpretation function $\mathcal{I}$, except that we require $\mathcal{D}$ to be closed under taking ordered pairs, and require $\mathcal{I}(\langle t_1, t_2\rangle)$ to equal $\langle \mathcal{I}(t_1), \mathcal{I}(t_2)\rangle$. Truth in a model is defined as usual. Let a model for $\mathcal{L}_{\text{ACT}}$ be a quintuple $\langle W, <, \mathcal{D}, \mathcal{J}, w_@\rangle$, where W is any nonempty set, $<$ any relation on W, $\mathcal{D}$ is any nonempty set, $\mathcal{J}$ is a function from W to interpretation functions over $\mathcal{D}$ (that treats names as rigid), and $w_@$ is a member of W. To the standard recursive definition of truth in $\mathcal{S}$ relative to w, we add the clause that $\ulcorner \text{ACT}\,\phi\urcorner$ is true at any world iff ϕ is

Note that allowing counterpairings that are not global permutations would make the logic go haywire. Consider the simple formula (25), which should be true:

$$\Diamond \text{ACT}\, Fa \leftrightarrow Fa. \tag{25}$$

The translation of (25) into $\mathcal{L}$ is

$$\exists W(\mathbf{C}W \wedge F(I \circ W^{-1})(W(a))) \leftrightarrow Fa. \tag{26}$$

Given our narrow-scope Russellian treatment of complex terms, (26) is false if any counterpairing W maps a to nothing or to two different things, or maps a to something to which it also maps some distinct object b. Indeed, just as the necessity of identity follows from Leibniz's Law, the necessity of distinctness follows from the standard logic for "actually" together with Leibniz's Law (understood so as to apply within the scope of "actually" as elsewhere). By LL, $\Box(a = b \rightarrow (\text{ACT}\, a = a \leftrightarrow \text{ACT}\, a = b)$; so by the reflexivity of identity, $\Box(a = b \rightarrow \text{ACT}\, a = b$; so if it is possible that $a = b$, it is possible that $\text{ACT}\, a = b$, and so $a = b$.[49] So it is no surprise that recovering the standard logic for 'actually' involves requiring counterpairings to be one-to-one. Similarly, if counterpairings could fail to have universal ranges, the translation (28) of (27) would not be valid, as it ought to be.

$$\Box\forall x(Fx \rightarrow \text{ACT}\,\Diamond Fx) \tag{27}$$

$$\forall W(\mathbf{C}W \rightarrow \forall x(Fx \rightarrow \exists V(\mathbf{C}V \wedge FV((I \circ W^{-1})(x))))) \tag{28}$$

It is important to understand the difference between the sense in which this theory provides an explanation of sentences involving 'Actually' and the sense in which the counterpart theory of section 8 provides an explanation of claims of the form 'Possibly ϕ'. The latter can be viewed as a collection of *analyses*, English sentences of the form 'For it to be possible that ϕ is for it to be the case that . . . '. Our "translations" of claims involving 'actually' are not like this. The translation of 'Actually Mars is red' is 'I(Mars) is red', i.e. 'The object that is the second member of the ordered pair that is one of I and has Mars as its first member is red'. Suppose Rigid Pairs is true in our current context. Then 'Necessarily, I is the identity relation' is also true in our current context, and so is 'Necessarily, Mars is red iff I(Mars) is red'. But even in this context, 'Necessarily, Mars is red iff Mars is actually red' is false. So in this context at least, we can't accept the analysis 'For Mars to be actually red is for I(Mars) to be red'. We *could* accept this analysis if we understood it not as a sentence of English but as a sentence of a three-sorted language standing to English as $\mathcal{L}_W$ stands to $\mathcal{L}_{\text{ACT}}$. But then again, while the three-sorted language can in some sense be translated into English, these translations don't seem to work like analyses.

Does this mean that modal realists are after all are forced to accept "primitive modality" in the form of the 'actually' operator? I think not. It is a familiar point that the philosopher's 'actually' is impoverished by comparison with comparable devices in natural language. Actual sentences using 'actually' seem to exhibit something akin to scope ambiguity: it can locally undo some but not all of the modal operators in whose scope it occurs. For example, 'Necessarily, everyone could have had a child he doesn't actually have' is naturally read as inconsistent with the claim that possibly, some parent x has a child

true at $w_@$. A formula of $\mathcal{L}_{\text{ACT}}$ is said to be *globally valid* (relative to a class of models) iff it is true at every world in every model in the class, and *real-world valid* relative to a class of models iff it is true at $w_@$ in every model in the class. (The terminology is from Crossley and Humberstone 1977.)

We want to show that the translation function described above maps each globally valid formula of $\mathcal{L}_{\text{ACT}}$ to a consequence in $\mathcal{L}$ of 'every counterpairing is a global permutation and so is I', and maps every real-world valid formula to a consequence in $\mathcal{L}$ of 'every counterpairing is a global permutation and I is the identity relation'. We do so by constructing an appropriate model $\mathcal{S}_\mathcal{M} = \langle W, <, \mathcal{D}, \mathcal{J}, w_@\rangle$ for $\mathcal{L}_{\text{ACT}}$, given as input a model $\mathcal{M} = \langle \mathcal{D}, \mathcal{I}\rangle$ for $\mathcal{L}$ in which 'every counterpairing is a global permutation and so is I' is true. W is the set of permutations of $\mathcal{D}$. For an atomic predicate F, $\mathcal{J}(\pi)(F) = \pi^{-1}(\mathcal{I}(F))$. $\pi_1 < \pi_2$ iff $\pi_1^{-1} \circ \pi_2 \in \mathcal{I}(\mathbf{C})$. $w_@ = \mathcal{I}(I)$. It can then be proved that a sentence of $\mathcal{L}_{\text{ACT}}$ is true at the identity in $\mathcal{S}_\mathcal{M}$ iff its translation into $\mathcal{L}$ is true in $\mathcal{M}$. This entails that (i) if the translation of a sentence into $\mathcal{L}$ is false in some model of $\mathcal{L}$ in which 'every counterpairing is a global permutation and so is I' is true, the sentence is false at a world in $\mathcal{S}_\mathcal{M}$, and thus not globally valid; and (ii) if the translation of a sentence into $\mathcal{L}$ is false in some model of $\mathcal{L}$ in which 'every counterpairing is a global permutation and I is the identity relation' is true, the sentence is false at $w_@$ in $\mathcal{S}_\mathcal{M}$, and thus not real-world valid.

[49] This argument is due to Williamson (1996).

y and could not have had any child other than y. It is easy to devise formal languages with 'actually'-like operators that exhibit this flexible behaviour. For example, we can have a modal language $\mathcal{L}_{\uparrow\downarrow}$ with a pair of operators $\uparrow$ and $\downarrow$, each taking a numerical subscript: $\uparrow_i$ functions like a label for a world which occurrences of $\downarrow_i$ within its scope can refer back to.[50] The sentence above can then be symbolised as follows:

$$\Box\uparrow_1\forall x\Diamond\exists y(y \text{ is a child of } x \wedge \downarrow_1\neg(y \text{ is a child of } x)).$$

It is a straightforward matter to extend our translation scheme for 'actually' to this more flexible language. We use a stock of world variables $\underline{W_1}, \underline{W_2}, \underline{W_3}\ldots$. In going from $\mathcal{L}_{\uparrow\downarrow}$ to $\mathcal{L}_W$, we replace '$\downarrow_i \ldots$' with 'at $\underline{W_i}$ (…)', and we replace '$\uparrow_i \ldots$' with $\exists \underline{W_i}(\underline{W_i}$ are the identity pairs $\wedge \ldots$). The translation from $\mathcal{L}_W$ to $\mathcal{L}$ proceeds as before.

There is a clear sense in which $\mathcal{L}_{\uparrow\downarrow}$ has more expressive power than $\mathcal{L}_{\text{ACT}}$. We can translate from $\mathcal{L}_{\text{ACT}}$ to $\mathcal{L}_{\uparrow\downarrow}$ by prefixing each sentence with $\uparrow_1$, and replacing each occurrence of ACT with $\downarrow_1$; there is no comparable translation that maps every sentence of $\mathcal{L}_{\uparrow\downarrow}$ to a sentence of $\mathcal{L}_{\text{ACT}}$. But in dealing with $\mathcal{L}_{\uparrow\downarrow}$, there is no particular temptation to treat sentences that contain occurrences of $\downarrow_i$ that are not within the scope of $\uparrow_i$ as expressing propositions in their own right. While '$\downarrow_{17}$ Mars is red' is meaningful—it makes a distinctive contribution to the meaning of larger sentences that embed it—its meaning, like that of the open sentence 'x is red', is not a matter of its expressing a particular proposition. Thus, 'What is it for it to be the case that $\downarrow_{17}$ Mars is red?' doesn't look like a good question; our inability to answer it nontrivially does not amount to "taking $\downarrow_{17}$ as primitive". The situation with ACT is, I suggest, similar. The semantic contribution of a sentence involving ACT is not properly thought of as a matter of its expressing a proposition, so the quest for an analysis of these sentences is misguided. (Of course we can use these sentences to *assert* propositions, just as we can use sentences with free variables to assert propositions.) Once we understand the sense in which everything that can be said using 'actually' can be said using '$\uparrow_1$' and '$\downarrow_1$', and we know how to analyse sentences using $\uparrow_1$ and $\downarrow_1$ in nonmodal terms, we have achieved everything the reductionist should want.

[50]For operators that work in similar ways see, e.g., Vlach 1973, Fine 1977, Hodes 1984, Williamson MS. Under certain circumstances, the numerical subscripts can be dispensed with. But they are convenient, as they make the statement of the translation into $\mathcal{L}_W$ easier.

12 Surprising dependencies across Lewis-worlds

Consider a very detailed qualitative property with just one instance in the whole of reality, which does not overlap our Lewis-world. Call the property 'F-ness' and its instance 'Felix'. Suppose that I could have been F, i.e. that Felix is one of my counterparts. Given the necessity of distinctness—a principle which, as we have seen, we must embrace if we want a reasonable logic for 'actually'—it is necessary that I am not Felix. Since the claim that exactly one thing is F is also necessary, being purely qualitative, it follows that it is necessary that if I am F, Felix is not F. If it is possible for me to be F, it must be possible for Felix not to be F. This is all true for any notion of possibility whatsoever, even quite narrowly restricted ones. There is something rather odd here. For suppose we are talking about historical possibility as of t, where t is some instant of time in Cosmo. Then the fact that Felix is F is historically contingent as of t, despite the fact that Felix bears no temporal relation at all to t. This seems odd.

Counterfactuals about me and Felix raise similar issues. If it is metaphysically necessary that if I am F, Felix isn't, it follows that if I were F, Felix wouldn't have been. This is odd too. Since Felix and I stand in no spatiotemporal or analogically spatiotemporal relations, it is hard to see how we could be *causally* related; but this makes the relation of counterfactual dependence rather mysterious. So far, at least, we have seen no reason to rule out the possibility that I could have made myself be F with minimal effort, say by raising my arm a little bit. But I have no miraculous powers to reach across the gulf between Lewis-worlds, so how could it be true that if I had raised my arm, Felix would have failed to be F?

If we embraced the "two languages" picture, according to which modal operators cannot meaningfully be applied to formulae involving unrestricted quantification, we might be tempted to dismiss questions like 'Was it historically possible at t for Felix not to be F?' and 'What would Felix have been like if I had been F?' as involving a similar kind of illegitimacy. Perhaps the mysterious repulsive force that prevents modal operators from attaching meaningfully to sentences with unrestricted quantifiers also prevents them from attaching to sentences involving terms for objects outside Cosmo. I have already explained why this is a bad picture for unrestricted quantifiers; its extension to terms for objects outside Cosmo is clearly no better.

Perhaps it would not be so bad simply to accept the oddities. We can note, for example, that the extent of the counterfactual dependence between me and Felix is very limited: there is no reason to suppose that there is a range of different ways I could have been such that for if I had been any of these ways, Felix would have been qualitatively different in some corresponding way. So I doubt there is a serious worry here for counterfactual analyses of causation: it should not be hard to craft an analysis of causation on which this one isolated counterfactual involving me and Felix is consistent with the absence of causation.[51]

Nevertheless, it would be nice if modal realists could avoid these surprising conclusions altogether. And they can, provided that they commit themselves to an ontological claim about which Lewis was agnostic (*OPW* 224 n. 17):

> Reduplication Every Lewis-world, and hence every part of a Lewis-world, is qualitatively indiscernible from infinitely many other things.

If Reduplication is true, then the only uniquely instantiated qualitative properties are those whose instances span infinitely many Lewis-worlds. But if being F requires spanning infinitely many Lewis-worlds, it is not plausible that it is historically possible at t that I am F, or that I could easily have been F just by raising my arm, or anything like that. Indeed, given Reduplication, we are free to maintain that whenever $\phi(x)$ (where 'ϕ' is qualitative) and x is not in Cosmo, it is historically necessary at t that $\phi(x)$. For we can stipulate that for a global permutation to be a counterpairing in the sense relevant to historical possibility at t, counterpairing, it must map every object not in the same Lewis-world as t onto a qualitatively indiscernible object. Given Reduplication, a counterpairing can satisfy this condition while mapping objects that *are* in the same Lewis-world as t onto any worldbound objects it pleases. If we want to map a to b, we can map the infinitely many qualitative duplicates of b onto the things that are qualitative duplicates of b and distinct from b—like the guests in Hilbert's Hotel, they can always make room for one more—while mapping the things that are qualitative duplicates of a and distinct from a onto the things that are qualitative duplicates of a.[52]

Incidentally, modal realists who accept Reduplication can avail themselves of a novel response to the objections considered by Lewis in *OPW* §2.6 ('A Road to Indifference?'). There, Lewis grants that the conjunction of modal realism with strict, agent-neutral consequentialism entails that no-one ever acts wrongly, or has reason to do anything, since '[t]here would be the same sum total of good and of evil throughout the worlds', no matter how we act. But there are versions of consequentialism that can give substantive advice even on the assumption that the total amount of goodness (and evil) is infinite, and will be infinite no matter what we do. For example, consequentialists who follow Kagan and Vallentyne (1997) will make claims like this: if for each living being x and interval of time t, x would be at least as well off during t if you did action A as it would be if you did anything else, and there is at least one x and t such that x would be better off during t if you did A than it would be if you did anything else, then you ought to do A. This principle seems quite in

[51] Lewis (2000) gives a counterfactual analysis on which such considerations play an important role.

[52] Things would be even neater if we strengthened Reduplication to the claim that *absolutely everything* has infinitely many qualitative duplicates. But this would require some very unorthodox mereology. Classical mereology entails that there is exactly one fusion of all blue things—since *being a fusion of all blue things* is a qualitative property, this fusion cannot have any qualitative duplicates. Even opponents of classical mereology might balk at the idea that the blue things have infinitely many fusions which differ *solo numero*. But there is nothing especially counterintuitive about the claim that if *I* had fused the blue things, the thing that actually fuses the blue things would not have fused the blue things. What seemed puzzling was the claim that even my instantiating quite "close" qualitative profiles would require objects spatiotemporally separated from me to change their qualitative properties.

keeping with the spirit of universalistic ethics. And a modal realist who endorses it can claim that there are some things we ought not to do: for if life will be better for people in Cosmo if I do *A* than if I do *B*, and everyone outside Cosmo will have exactly the same qualitative properties whether I do *A* or *B*, it will follow that I ought not do *B*. According to Lewis,

> If I had acted otherwise, for instance by taking to a life of crime, each and every good or evil that is present somewhere in the totality of worlds would still have been present, and none would have been added. It is wrong to think: then this world would have been a little worse, and the rest would have been no different, so the totality of worlds would have been a little worse.

I am suggesting that the thought Lewis rejects is perfectly fine. Even though totality of worlds could not have been qualitatively different from the way it actually is, given Reduplication, it can still be possible for some parts of the totality to be better while the rest are no worse.[53]

Should modal realists accept Reduplication? I'm not going to say. My aim has been to identify the optimal modal realist analysis of modal claims, not to advise those who accept this analysis about when they should and should not endorse the surprising ontological claims they will believe to follow various intuitive modal judgments. But Lewis, at least, seems generally happy to accept extravagant ontological claims when doing so is required for holding onto modal intuitions, even intuitions of a fairly subtle sort. Given this overall policy, acceptance of Reduplication seems a fair price to pay to vindicate the ordinary intuition that if there are objects spatiotemporally disconnected from us, their qualitative properties are fixed and entirely beyond our control.[54]

13 Metaphysical modality

Our counterpart-theoretic analyses purport to represent all of the many things that 'possibly' and 'necessarily' can mean in a context, or at least some large class of these meanings. What should one think, if one accepts some such analysis, about uses of 'possibly' and 'necessarily' *by philosophers*? Metaphysicians who are trying to explain what they up to when they argue about "metaphysical necessity" often give a little speech where they explain that the notion they have in mind is in some sense *maximally strong*. Thus Kripke:

> . . . [C]haracteristic theoretical identifications like 'Heat is the motion of molecules', are not contingent truths but necessary truths, and here of course I don't mean just physically necessary, but necessary in the highest degree—whatever that means. (Kripke 1972: p. 99)

And Peter van Inwagen:

> A proposition is physically possible if its conjunction with the laws of nature is . . . well, *possible*. Possible *tout court*.

[53] If we accept the necessity of existence, we will have to agree with Lewis that it is true of each good and evil that it would have existed no matter what I had done. But we need not be worried: we can say that some of these goods would be *better*, and some of the evils *less evil*, if I did *A* than if I did *B*, and we can also say (if we like Williamson's idea of contingent concreteness) that some things that would be nonconcrete if I did *A* would be concrete evils if I did *B*, and that some things that would be concrete goods if I did *A* would be nonconcrete if I did *B*.

[54] There is also a promising argumentative route to Reduplication from an ontological claim that Lewis definitely *did* endorse, namely the "principle of recombination". The relevant ideas are assembled by Bricker (1993), though he uses them for a different purpose. First, we need the claim, which follows from the principle of recombination (*OPW* 88), that everything has a duplicate that is "lonely"—a Lewis-world or fusion of Lewis-worlds. Second, we need the idea that objects in the same Lewis-world can be linked by chains of perfectly natural relations rather than linked directly by perfectly natural relations: this means that parts of Lewis-worlds can have duplicates spanning multiple Lewis-worlds. Third, we need an idea which we get from the principle of recombination: that for every part of a Lewis-world, there is a Lewis-world containing infinitely many spatially separated duplicates of it. (We needn't worry that this would be ruled out by the proviso 'size and shape permitting': we can always, e.g., arrange the duplicates along a new dimension "like a stack of flatlands in three-space" (*OPW* 72).) Fourth, we need the idea that some of these worlds are ones in which spatially separated objects are not connected directly by any perfectly natural spatiotemporal relations, but only by chains of such relations. If a world of this sort contains infinitely many spatially separated duplicate objects, then any lonely duplicate of the fusion of these objects will be a fusion of infinitely many duplicate Lewis-worlds. Putting all this together, we can infer that everything that is in a Lewis-world has infinitely many lonely duplicates. It is a very small step from this to Reduplication.

> Possible *simpliciter*. Possible *period*. Explanations come to an end somewhere. I can say only that by possibility I mean possibility without qualification. If there were no such thing as modality without qualification, there could be no qualified modalities like physical and biological possibility and necessity. If we understand "qualified" modal statements (of any sort), we must understand "unqualified" modal statements. (van Inwagen 1998: p. 72)

Remarks like these do much to constrain the interpretation of metaphysicians' talk of possibility and necessity. Suppose that, after going in for some of this table-thumping, a metaphysician says something of the form 'necessarily ϕ' which, according to you, is true in some contexts and false in others. Normally, considerations of charity would push you toward interpreting the speaker as asserting the true thing. But given that modifiers like 'without qualification' and 'in the highest degree' are getting thrown around, it is plain that by following charity in this way, you would be wilfully misconstruing the metaphysician as saying something weaker than what she in fact is saying. Given the clarificatory remarks that have been offered, you have no choice but to go for the strongest possible interpretation of the claim. This means you may end up interpreting the metaphysician as saying something you think *obviously* false. In general, we worry that we are misunderstanding people when we interpret them as asserting obvious falsehoods; but such considerations are much weaker when the people we are interpreting are philosophers, doing what philosophers do, which notoriously often involves denying the obvious.

Given a broadly counterpart-theoretic analysis of modal claims, adopting the strongest possible interpretation of 'necessarily' means adopting the weakest possible interpretation of 'counterpart' or 'counterpairing'.[55] Does that mean that we have to take every sequence to be a counterpart of every other sequence, or take every relation to be a counterpairing? No. For considerations of *logic* may push us not to do so even when we are interpreting modal talk in metaphysical contexts. The strongest meaning an operator on propositions could have is one that turns every proposition whatsoever into a falsehood; but obviously metaphysicians' speeches about "unrestrictedness" and "absoluteness" are not a good reason to assign this trivial interpretation to 'necessarily' in their mouths. Talk of maximality is restricted to some reasonably natural class of meanings, and one thing that this class of meanings should have in common is their basic logical behaviour. We should not carry our policy of preferring stronger interpretations of metaphysicians' 'necessary' to weaker ones so far as to overturn logical principles which even the metaphysicians rely on in reasoning with their concept.

Leibniz's Law, understood so as to apply in modal contexts, is one such principle; like everything in logic, it is controversial, but those who reject it have to struggle to stop themselves from slipping into it in spite of themselves. I have already explained why I am not convinced by Lewis's arguments against it. For the counterpart theorist, then, there is good reason to think that even in the very weak sense of 'counterpairing' appropriate in metaphysical contexts, all counterpairings are functions. Similarly, the foundational role played by K gives us reason to think that all counterpairings are universally defined. Another source of constraints is the logic of the actuality operator: even metaphysicians are comfortable using such operators and reasoning with them in the standard way. And as we saw in section 11, a logically well-behaved 'actually' operator can be introduced into the counterpart-theoretic framework only if we require all counterpairings to be global permutations.

Unless we can find some further constraint, then, we should conclude that the sense of 'counterpairing' appropriate to metaphysical contexts applies to all and only global permutations. All the axioms listed in 1 are valid on this interpretation. This pretty much includes all the "logical" principles about metaphysical modality that have every been taken seriously.

If that's how metaphysical possibility is analysed, all kinds of strange things are metaphysically possible. For example, it is metaphysically possible for me to be a poached egg. My unit set is such that it is metaphysically possible for me not to be a member of it. Controversial stuff! Counterintuitive? Perhaps; it is not so clear which

[55] Cf. Lewis: 'In the broadest sense, all possible individuals without exception are possibilities for me' (*OPW* 234).

of our pre-theoretic opinions about what is and isn't "possible" are opinions about the absolutely unqualified notion of possibility that metaphysicians care about. In any case, it's not exactly a novel situation for modal realists to find themselves disagreeing with common sense about "absolutely unrestricted" claims, while agreeing that they are true in various restricted senses.

Lewis thinks, with good reason, that modal claims are highly context-sensitive. But he also thinks that a substantial amount of context-sensitivity remains in play even when we are doing metaphysics, in spite of the kinds of clarificatory remarks offered by the likes of Kripke and van Inwagen:

> . . . I suggest that those philosophers who preach that origins are essential are absolutely right—in the context of their own preaching. They make themselves right: their preaching constitutes a context in which *de re* modality is governed y a way of representing (as I think, by a counterpart relation) that requires match of origins. (*OPW* 252)

While Lewis generally takes it for granted that the *accessibility* relation that is relevant in metaphysical contexts is the trivial relation on which every Lewis-world is accessible from every Lewis-world, he takes a very different view about the counterpart relation. Even if we thought that an accessibility relation on Lewis-worlds was needed in addition to a counterpart relation for the general analysis of modal claims, it would be hard to justify a differential treatment of the two relations.[56] And once we see that we don't, there is no plausible way to understand the putative absoluteness of the metaphysicians' sense of 'possibly' save as invoking a maximally weak counterpart relation. For the counterpart theorist to interpret Kripke as asserting something true in his context when he says 'it is impossible for anything to have different origins', by invoking a less-than-universal counterpart relation, is as perverse as, say, interpreting Shoemaker (1998) as saying something true in *his* context when he says 'the laws of nature are necessary', by taking him to be talking about merely nomological necessity.

[56]Lewis is fully aware that accessibility and counterparthood are close cousins: see *OPW* 8, 234, 248. This makes the differential treatment all the more surprising.

14 Beyond counterpart theory

The counterpart theoretic analyses of ⌜possibly ϕ⌝ and ⌜necessarily ϕ⌝ are supposed to apply only when ϕ is couched in a special well-behaved language, in which the job of referring to particular things is done exclusively by what I have been calling "terms"—expressions that occupy syntactic positions that can also be occupied by singular or plural variables. Not all English sentences are like this. For example, to be a German is—roughly—to be a person from Germany. And necessarily every person from Germany is spatiotemporally related to Germany. It follows that necessarily every German is spatiotemporally related to Germany. But if, ignoring the requirement of well-behavedness, we applied the counterpart-theoretic analysis to this sentence, we would get 'Every Germans is spatiotemporally related to every counterpart of Germany', which is false, assuming Germany has counterparts in other Lewis-worlds.

Thus no plausible counterpart theory can take the form of an algorithm for providing analyses of *arbitrary* English sentences of the form ⌜Possibly ϕ⌝. The first step in providing an analysis of such a sentence is to find a well-behaved analysis of ϕ; only then can the algorithm be applied. And this first step is by no means straightforward. For example, it is controversial whether predicates like 'is a swan' and 'is a donkey' belong in the well-behaved language, and if not, how they should be analysed in terms of it. Some think that swanhood and donkeyhood are qualitative matters: Lewis assumes this when he is discussing what it is for it to be possible for there to be blue swans or talking donkeys. Others may think that to be a donkey is to be a certain kind of descendant of some particular object, say Old Father Donkey; or that to be a donkey is to be a certain kind of *part* of some particular object, say *Equus Asinus*, understood as a large scattered material object. We can't use counterpart theory to explain what it is for it to be possible for there to be a talking donkey until we have chosen a side in this dispute.

I don't see this as a problem: surely a uniform algorithm for analysing all English sentences of the form ⌜Possibly ϕ⌝ in nonmodal terms would be too much to hope for. I am emphasising this point for two reasons. The first is *ad hominem*. A central contrast Lewis draws between his own view and "linguistic ersatzism" (*OPW* section 3.2) is that the linguistic ersatzer, unlike Lewis, must appeal to "primitive modality" in explaining how it is that certain very detailed propositions about the arrangement of point particles entail, or are inconsistent with, the proposition that there are talking donkeys. There are two thoughts. The first is that *specifying*, as opposed to gesturing at, an extensionally adequate linguistic erstazist theory of modality would require a huge, perhaps infinite, set of "connecting axioms" relating macro to micro descriptions. The second is subtler:

> The job was to analyse *modality*.... It was not also part of the job to analyse 'talking donkey'. But [the linguistic ersatzer] did; for he needed axioms that would tell him, for every possible arrangement of particles, whether or not that arrangement would make there be a talking donkey.... Why should the analysis of modality have to wait on *that*? Surely it ought to be possible to take 'talking donkey' and whatnot as primitive when we are analysing modality, whatever other project we might care to undertake on another day. That's how *I* do it: I say it's possible for there to be a talking donkey iff some world has a talking donkey as part—no utopian analysis of 'talking donkey' in terms of arrangements of particles is required. (*OPW* 156)

The claim at the end rests on the controversial assumption that 'talking donkey' is qualitative. Once we give that up, we see that Lewis and the linguistic ersatzer are in structurally similar situations: to say what it is for it to be possible that there is a talking donkey, both require analyses of 'talking donkey' in terms of some favoured vocabulary—the language of "arrangements of particles" in the ersatzer's case, the "well-behaved" language in Lewis's. It may not be *utopian* to hope that we can find the kind of analysis Lewis needs, but as I have pointed out, it is far from straightforward.

The second, and more important reason for dwelling on this point is to draw attention to a larger class of programmes for analysing modality which are like counterpart theory except that they involve a different specification of the "well-behaved" language to which the algorithm is to be applied. Consider Lewis's unit set: call it Lucky. Suppose for example that you think that *what it is* for Lucky to contain a philosopher is for Lewis to be a philosopher. Then you will think it is necessary—absolutely, unrestrictedly, necessary—that Lucky contains a philosopher iff Lewis is a philosopher. So you can't accept counterpart theory. But you might still consider accepting a theory like counterpart theory, except that it applies only to sentences in a more restrictive language in which the only non-qualitative expressions are terms referring to non-sets. Moreover, if you think that every sentence can be analysed in terms of such a language, you may think that this restriction of counterpart theory tells the full story about the meaning of modal operators, just as counterpart theorists think their theory tells the full story about the meaning of modal operators despite the fact that not every sentence is well-behaved. This thought can be taken quite far. Even if you believe that ordinary objects are involved in all kinds of interesting *de re* metaphysical necessities, you might think that there are some special objects—elementary particles, say—such that (i) there are no interesting *de re* metaphysical necessities involving them, and (ii) every sentence has an analysis (perhaps infinitary) in which the only referring terms refer to them. (The view is reminiscent of Wittgenstein's *Tractatus*.) Then you may still accept the restriction of counterpart theory to these sentences, and think of this restriction as telling the full story about the meaning of modal operators. Granted, the project of *finding* analyses of ordinary claims in terms of sentences about "combinatorial atoms" is vastly more difficult than the project of finding analyses of ordinary claims in terms of the counterpart-theorist's well-behaved language. But the difference seems to be one of degree, not of kind.

Alongside these *restrictions* of counterpart theory, we can also consider *extensions* of counterpart theory which, in analysing ⌜possibly ϕ⌝ and ⌜necessarily ϕ⌝, apply counterpart theory-style transformations to other syntactically simple constituents of ϕ besides singular and plural terms—predicates, for example. One suggestion would be to treat predicates on the model of plural terms; but this would lead to an unwanted rigidity—simple subject-predicate sentences could never be contingent. A straightforward way to avoid this is simply to drop the restriction on the variables that stand in for predicates, so that we get analyses like

(29) It is metaphysically possible that $Fa \wedge Gb \leftrightarrow_{\text{df}} \exists R \exists x \exists y \exists X \exists Y(R$ is a global permutation $\wedge Rax \wedge Rby \wedge Xx \wedge Yy)$.

In the special case where ϕ contains no terms, the result is akin to Tarski's theory of *logical* possibility: '$\Diamond\phi$' is equivalent to the result of replacing all the predicates in ϕ with corresponding higher-order variables bound by an initial existential quantifier.[57]

Of course one would get wildly implausible results if one applied this analysis indiscriminately to English sentences. This would result in analysing 'Possibly *a* is married and a bachelor' as '$\exists R \exists x \exists X \exists Y$(R is a global permutation and Rax and Xx and not Yx)', which is true. (29) is defensible as an analysis of metaphysical possibility only if ϕ is required to be in some *very* special language—one whose predicates are all completely independent of one another. Perhaps, if we make enough progress in physics and/or metaphysics, we will be able to identify a language which we could plausibly claim to have this property. And even if we have not yet done this, we might think, with the logical atomists, that it must be possible in principle to analyse everything in terms of such a language. If we did think this, we could think of the analysis of possibility-claims in the special language as telling us the full story about the meaning of 'possibly'. Daunting as the project of analysing ordinary claims in terms of the special language may be, as before, the difference between this theory and Lewisian counterpart theory still seems to be just a matter of degree.[58]

Unlike counterpart theory, these extensions need not validate sentences of the form 'If possibly ϕ, then ϕ' even for purely qualitative ϕ. They leave us free to maintain, for example, that there are no blue swans, golden mountains, or mutually attractive electrons, although there could have been all of these things. They allow us to maintain that the totality of all concrete objects could have been big and interesting even though it is actually small and (relatively speaking) dull. They do not, however, allow us to maintain that there could have been, more things than there in fact are, unrestrictedly speaking. Getting *that* to come out true on a reductive analysis of modality would require resources of a very different kind from those used by the modal realist.[59]

[57]Cf. the treatment of referential terms in Fine 2005, and the domain-free treatment of quantifiers in Williamson 2000.

[58]The analysis given in (29) is just a gesture towards a theory: there are big problems we would need to face up to if we really wanted to work out a view of this sort. The most serious involves the treatment of actuality. If we just forget about counterpairings in the treatment of predicates, we can no longer use them in the analysis of 'actually' to get things like '$Fa \leftrightarrow \Diamond$ ACT Fa' to come out true. If we wanted to rectify this while still adopting something like the approach of section 11, we would have to introduce some third-order analogue of counterpairings. It is not obvious whether the kind of higher-order quantification we would need to make this work is something one can legitimately appeal to in a properly reductive account of modality.

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References

Bach, Kent (1994). 'Conversational Impliciture.' *Mind and Language* 9: 124–162.

Bigelow, John and Robert Pargetter (1987). 'Beyond the Blank Stare.' *Theoria* 53: 97–114.

Bricker, Phillip (1993). 'The Fabric of Space: Intrinsic versus Extrinsic Distance Relations.' In Peter French, Theodore E. Uehling, Jr. and Howard K. Wettstein (eds.), *Midwest Studies in Philosophy XVIII: Philosophy of Science*, 271–294. Notre Dame, Indiana: University of Notre Dame Press.

— (2001). 'Island Universes and the Analysis of Modality.' In Gerhard Preyer and Frank Siebelt (eds.), *Reality and Humean Supervenience: Essays on the Philosophy of David Lewis*, 27–56. Lanham, Maryland: Rowman and Littlefield.

— (2006). 'Absolute Actuality and the Plurality of Worlds.' In John Hawthorne (ed.), *Philosophical Perspectives 20: Metaphysics*, 41–76. Oxford: Blackwell.

Cappelen, Herman and John Hawthorne (2009). *Relativism and Monadic Truth*. Oxford: Oxford University Press.

Crossley, John N. and Lloyd Humberstone (1977). 'The Logic of "Actually".' *Reports on Mathematical Logic* 8: 11–29.

Divers, John (1999). 'A Genuine Realist Theory of Advanced Modalising.' *Mind* 108: 217–239.

Dorr, Cian (2005). 'Propositions and Counterpart Theory.' *Analysis* 65: 210–18.

— (MS). '*De Re* A Priori Knowledge.'

Fara, Michael and Timothy Williamson (2005). 'Counterparts and Actuality.' *Mind* 114: 1–30.

Fine, Kit (1977). 'Prior on the Construction of Possible Worlds and Instants.' In A.N. Prior and Kit Fine (eds.), *Worlds, Times and Selves*. London: Duckworth.

— (2005). 'Quine on Quantifying In.' In *Modality and Tense: Philosophical Papers*, 105–130. Oxford: Oxford University Press.

— (2007). *Semantic Relationalism*. Malden, Mass: Blackwell.

Forbes, Graeme (1985). *The Metaphysics of Modality*. Oxford: Oxford University Press.

Hazen, Allen (1979). 'Counterpart-Theoretic Semantics for Modal Logic.' *Journal of Philosophy* 76: 319–38.

Hodes, Harold (1984). 'On Modal Logics Which Enrich First-order S5.' *Journal of Philosophical Logic* 13: 423–454.

Hudson, Hud (1997). 'Brute Facts.' *Australasian Journal of Philosophy* 75: 77–82.

Kagan, Shelly and Peter Vallentyne (1997). 'Infinite Value and Finitely Additive Value Theory.' *Journal of Philosophy* 94: 5–26.

Kripke, Saul (1972). *Naming and Necessity*. Revised edition. Cambridge, Mass.: Harvard University Press, 1980.

Kölbel, Max (2002). *Truth without Objectivity*. London: Routledge.

Lasersohn, Peter (2005). 'Context Dependence, Disagreement and Predicates of Personal Taste.' *Linguistics and Philosophy* 28(6): 643–86.

Lewis, David (1968). 'Counterpart Theory and Quantified Modal Logic.' *Journal of Philosophy* 65: 113–26. Reprinted in Lewis 1983: 26–46.

— (1983). *Philosophical Papers*, volume 1. Oxford: Oxford University Press.

— (1986). *On the Plurality of Worlds*. Oxford: Blackwell.

— (1992). 'Armstrong on Combinatorial Possibility.' *Australasian Journal of Philosophy* 70: 211–224. Reprinted in Lewis 1999: 196–214.

— (1996). 'Maudlin and Modal Mystery.' *Australasian Journal of Philosophy* 74: 683–684. Reprinted in Lewis 1999: 221–223.

— (1999). *Papers in Metaphysics and Epistemology*. Cambridge: Cambridge University Press.

— (2000). 'Causation as Influence.' *Journal of Philosophy* 97: 182–197.

MacFarlane, John (2005). 'Making Sense of Relative Truth.' *Proceedings of the Aristotelian Society* 105: 321–329.

— (2007). 'Relativism and Disagreement.' *Philosophical Studies* 132: 17–31.

Parsons, Josh (2009). 'Against Advanced Modalising.' Available online at `http://www.otago.ac.nz/philosophy/Staff/JoshParsons/papers/against-advanced2.pdf`.

Richard, Mark (2008). *When Truth Gives Out*. Oxford: Oxford University Press.

Shoemaker, Sydney (1998). 'Causal and Metaphysical Necessity.' *Pacific Philosophical Quarterly* 79: 59–77.

Sider, Theodore (2009). 'Beyond the Humphrey Objection.' Available online at `http://tedsider.org/papers/counterpart_theory.pdf`.

Stanley, Jason and Zoltán Gendler Szabó (2000). 'On Quantifier Domain Restriction.' *Mind and Language* 15: 219–261.

van Inwagen, Peter (1998). 'Modal Epistemology.' *Philosophical Studies* 92: 67–84.

Vlach, Frank (1973). *'Now' and 'Then': a Formal Study in the Logic of Tense and Anaphora*. Ph.D. thesis, UCLA.

Williamson, Timothy (1996). 'The Necessity and Determinacy of Distinctness.' In Savina Lovibond and Stephen G. Williams (eds.), *Essays for David Wiggins: Identity, Truth and Value*, 1–17. Oxford: Blackwell.

— (1998). 'Bare Possibilia.' *Erkenntnis* 48: 257–273.

— (2000). 'Existence and Contingency.' *Proceedings of the Aristotelian Society* 100: 321–343.

— (2002). 'Necessary Existents.' In Anthony O'Hear (ed.), *Logic, Thought and Language*, Royal Institute of Philosophy Supplement: 51, 233–251. Cambridge: Cambridge University Press.

— (MS). 'Necessitism, Contingentism and Plural Quantification.'

Wittgenstein, Ludwig (1961). *Tractatus Logico-Philosophicus*. Ed. D.F. Pears and B.F. McGuinness. London: Routledge and Kegan Paul.

Zalta, Edward N. and Bernard Linsky (1994). 'In Defense of the Simplest Quantified Modal Logic.' In James Tomberlin (ed.), *Philosophical Perspectives 8: Logic and Language*, 431–458. Atascadero: Ridgeview.