

Humility and Constraints on *O*-Language*

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Draft - Comments Welcome!

According to scientific realism, it is one the ambitions of science to discover the fundamental properties. If the argument in David Lewis's "Ramseyan Humility" is sound, however, that ambition must remain unfulfilled: we are irremediably ignorant about what these properties are.

That surprising conclusion has already given rise to a sizeable literature, which includes Langton [2004], Schaffer [2005], Whittle [2006] and Ney [2007]. These responses discuss Lewis's ignorance thesis in the light of more general issues in the theory of knowledge and the metaphysics of properties. In contrast, some of the semantic assumptions that Lewis relies on have so far received little scrutiny. In this paper, I aim to make them explicit, and argue that they are false.

"Ramseyan Humility" can be read as continuing a debate about what the content of scientific theories is. It was once widely held that the vocabulary of the language of science divides into theoretical and non-theoretical terms. The content of the theory is, roughly, given by its Ramsey sentence, which does not contain any theoretical terms, on this view.¹ For theoretical terms are taken to be definable by non-theoretical ones, and definitions, being merely abbreviations, do not increase the expressive power of a language.

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Is such a conception of scientific language and theories compatible with scientific realism? For a scientific realist, it ought to be a substantive claim that a given scientific theory is true, and there ought to be a fact of the matter what entities are referred to by theoretical terms. The so-called model-theoretic arguments, championed by Hilary Putnam (e.g. in Putnam [1980] and Putnam [1981]), threaten scientific realism thus construed. They raise the double specter of triviality and indeterminacy. Triviality, because it seems that every consistent theory comes out true. Indeterminacy, because a true theory does not seem to uniquely determine the referents of subsentential expressions. In Lewis [1983a] and Lewis [1984], Lewis is concerned with the threat of triviality. He argues that if only relatively natural, non-disjunctive properties are eligible to be referents, then there is no danger that every consistent theory comes out true. In Lewis [forthcoming], Lewis in effect concedes that this move does not help to foil the threat of indeterminacy. There would not be a unique referent even if only perfectly natural properties were eligible. Moreover, he proclaimed not to be worried by such indeterminacy.

In this paper, I do not try to settle whether we ought to endorse Lewis's conclusion, and whether we ought to be worried if it were true. Such questions would lead us deeply into the theory of knowledge and the metaphysics of properties. My project here is limited to showing that the particular argument for the indeterminacy that Lewis offers in "Ramseyan Humility" does not work.

The plan of the paper is as follows. In section 1, I try to pin down the thesis of Humility that Lewis is arguing for. Section 2 presents a reconstruction of the argument in deductive form, and clarifies some terminology. Section 3 attacks what I call "Structuralism," a premise about the expressive power of the language that does not contain the theoretical terms. Finally, section 4 considers and criticizes two strategies to rescue Lewis's argument.

1 The Thesis of Humility

The conclusion of Lewis’s argument is named after a virtue: it is the thesis of “Humility.”² But Lewis does not give us a canonical formulation of that thesis. The first problem in reconstructing the argument is to determine what exactly its conclusion is. What sort of knowledge concerning fundamental properties and their roles are we supposed to lack? According to Lewis, we cannot know “the identity of the properties ...” (p. 12); the “true contingent proposition about which of the possible realizations is actual” (p. 5/6); and the answer to “the question: which property occupies the role?” (p. 13).

Examining Lewis’s arguments provides us with a better clue to what the thesis of Humility is than these formulations do. He offers two different, though closely related arguments: the Replacement Argument and the Permutation Argument. The former concludes that we cannot know which ones among the possible fundamental properties and relations are actually instantiated. (I assume that for a fundamental property to exist in a world and for it to be instantiated in a world are the same thing.) The latter concludes that we cannot know which ones among the actual fundamental properties play which roles.

I will only analyse the Replacement Argument in detail, but my diagnosis carries over to the Permutation Argument, *mutatis mutandis*. The latter deploys premises that are more likely to be acceptable to certain actualist philosophers.³ However, I set actualist scruples aside in this paper and grant Lewis that we can freely quantify over non-actual entities. Since the permutation argument does not offer advantages other than greater acceptability to actualists, it does not require separate discussion here.

Lewis allows that Humility may apply to some fundamental properties and relations but not to others. Perhaps he thinks that it applies to mass and charge, but not to spatiotemporal distance. But if it applies to F , then it will likewise apply to every G in the same category as F . Lewis introduces the notion of a category, to which Humility is relativized, as follows:

I speak of ‘fundamental properties’ for short, but they fall into several categories. There are all-or-nothing monadic properties. There are all-or-nothing n -adic relations, at least for smallish n . There are properties that admit of degree, that is, magnitudes; more generally, there are scalar-valued, vector-valued, tensor-valued, ... magnitudes. There are relational magnitudes. Maybe my list is too long; maybe the magnitudes could somehow be reduced to all-or-nothing properties and relations, but that is a question I shall not take up here. (Lewis [forthcoming, p. 3])

It emerges from Lewis’s discussion that he takes it to be non-contingent what category a given fundamental property belongs to. For example, if mass is actually a scalar-valued fundamental property, it could not be vector-valued, or even a relation, in some other world.

For present purposes, let Humility about category C be the thesis that we do not know which members of C are actual. On standard views, that S knows which things are ϕ implies that S knows that x is ϕ , if x is one of the things which are ϕ . I am assuming here that this is correct.⁴ Therefore, Humility about C follows from the claim that for any fundamental property F that belongs to C , we cannot know that F exists.

2 The Replacement Argument for Humility

Here is a simplified version of the Replacement Argument: Consider a world w that is just like the actual world @, except that whenever a particular value of mass is instantiated in a region of actual spacetime, the corresponding value of some non-actual fundamental property, schmass, is instantiated in the corresponding region of w . Then we cannot tell whether we are in @ or in w , the argument goes, and we cannot know that we are in a world where mass is instantiated. The same point can be made about other putatively fundamental properties: we can consider a world where charge is replaced by schmarge, and where spin is replaced by schpin. The Permutation

Argument considers a world where mass is instantiated in all the locations where charge is in the actual spacetime, and *vice versa*, and otherwise proceeds much like the Replacement Argument.

Lewis's actual arguments are more complex than the simplified versions just given. I present a reconstruction of his Replacement Argument in deductive form. While I deviate to some extent from his terminology, I take the reconstruction to be faithful.⁵ However, I do not attempt to defend this exegetical claim in this section. It should become clear later in the paper that the argument I discuss is indeed Lewis's, except that some premises are made more explicit.

In my reconstruction, there are three key premises: First, an *expressibility premise*: knowledge must be expressible in the language O , to be introduced below; or more weakly, a knowable proposition must be logically entailed by a proposition expressible in O . Second, a *structuralist premise*: O -language cannot discriminate between worlds with the same structure. Third, a *combinatorialist premise*: fundamental properties are recombinable in such a way that there are distinct possible worlds that have the same structure.

These three claims appear as premises 1), 2), and 5), respectively, in the following valid argument:

- 1) If a proposition is knowable, then it is entailed by a true proposition that is expressible in O .
- 2) If a proposition is expressible in O , then it supervenes on fundamental structure.
- 3) If a proposition is knowable, then it is entailed by a true proposition that supervenes on fundamental structure. (from 1) and 2))
- 4) Not every member of category C is actual.
- 5) If $F \in C$ and not every member of category C is actual, then the existence of F is not entailed by any true proposition that supervenes on fundamental structure.

- 6) If $F \in C$, then the existence of F is not entailed by any true proposition that supervenes on fundamental structure. (from 4) and 5))
- 7) If a proposition entails that some member F of C exists, it is not knowable. (from 3) and 6))

As noted, the conclusion 7) entails Humility about C . Some of the premises require comment.

Premise 5) may not initially look like a statement of combinatorialism. However, it is a consequence of a general combinatorial principle for fundamental properties and relations. Suppose the antecedent of 5) holds. Then there is a G , of the same category as F , that is not instantiated in the actual world. Then combinatorialism guarantees that there is a world w in which the fundamental properties and relations are distributed just like in the actual world, except that F is throughout “replaced” by G . Then the proposition that F exists is true in the actual world, but false in the fundamentally isomorphic w , and consequently does not supervene on fundamental structure. Any proposition that is true and supervenes on fundamental structure is true in w , and hence does not entail that F exists. Thus the consequent of 5) holds as well.

Since Humility is relativized to categories, the argument is schematic, and for all we know, premise 4) may be true for some choices of a category C but not for others. Perhaps the spatial and the temporal distance relations are the only members of the category of scalar-valued two-place fundamental relations. If so, we can know that these relations exist, for all the replacement argument says. But since we have set actualist scruples aside, we can grant Lewis that premise 4) is true for at least some interesting categories C .

This leaves us with the three substantive premises introduced above: the expressibility premise 1), the structuralist premise 2), and the combinatorialist premise 5). Premises 1) and 2) require clarification in two respects. What is it for a proposition to supervene on fundamental structure? And crucially, what is the language O ? In the

rest of this section, I answer the first of these questions, and discuss the second in a preliminary way. The content of 1) and 2) will be further clarified in section 3.

What is it for a proposition to supervene on fundamental structure? The notion of supervenience relevant for premise 2) is *global* supervenience. A proposition A globally supervenes on fundamental structure if whenever worlds w and w' have the same fundamental structure, then the truth-value of A is the same in w and in w' . What it is to have the same fundamental structure can be cashed out using the notion of an isomorphism. Let F_w and $F_{w'}$ be the classes of fundamental properties instantiated in w and w' , respectively, and let D_w and $D_{w'}$ be the domains of individuals of these worlds. Then a one-one function f from $D_w \cup F_w$ onto $D_{w'} \cup F_{w'}$ is a *fundamental isomorphism* from w to w' if it preserves instantiation structure in both directions, i.e. if the following holds for every $x \in D_w$ and $X \in F_w$: x instantiates X in w iff $f(x)$ instantiates $f(X)$ in w' .⁶ The existence of a fundamental isomorphism is a necessary and sufficient condition for worlds to have the same fundamental structure.

Sameness of fundamental structure has been explained in terms of fundamental properties. While we cannot define what it is for a property to be fundamental, we can clarify it to some extent. It would be best to start with examples, but unfortunately, we cannot identify any clear cases. Even supposing that Humility is false, and that it is thus knowable what the actual fundamental properties are, it is unlikely to be known at the present stage of inquiry. Lewis conjectures that mass and charge might be fundamental, and would thus be referred to even in a final and complete scientific theory of our world. Arguably, some spatiotemporal relation is fundamental too, but it is not clear exactly which relation. While there are no clear paradigm cases, there are clear foils. Most properties we ordinarily talk about, such as being red or being metallic, are non-fundamental. From the reduction of thermodynamics to statistical mechanics, we can conclude that degrees of temperature are not fundamental either. Likewise, properties that are intuitively negative or disjunctive or relational fail to be fundamental. As Lewis puts it, fundamental properties and relations are “perfectly natural.” Moreover, part of what it is to be fundamental is to belong to a minimal

global supervenience base for all classes of properties.⁷

The notion of supervenience on fundamental structure is relatively unproblematic in the context of this argument. More issues will be raised by the question what the language *O*, referred to in premises 1) and 2), is supposed to be. As I noted in the introduction, Lewis is appealing to a distinction between two types of terms, theoretical and non-theoretical. The language in which the final and complete theory of the world is stated contains terms of both sorts, and *O* is the fragment of that language which does not include the theoretical terms.

What are the non-theoretical terms? Traditionally, they have been taken to be observational terms. But in Lewis [1970], Lewis proposed that we take ‘*O*’ to mean ‘old’ rather than ‘observational’. The terms in *O* are those that are understood pre-theoretically.

Given its prominent role in the argument, it is surprising how little Lewis says about what features *O* is meant to have. Maybe he thought that his argument is schematic in *O*, and would be sound for any choice of *O* that meets the constraints he explicitly lays down. But as will be shown in detail in section 3, it is not sound for any such choice, but rather stands or falls with the expressive power of *O*.

What constraints does Lewis impose? He assumes that fundamental properties are not named in *O* “except as occupants of roles.” The nature of this constraint will be discussed in section 3. Further:

I’ll assume ... that O-language does suffice to express all possible observations, whatever else it may also be able to do. I’ll assume that O-language is interpreted—never mind how.” (Lewis [forthcoming, p.3])

Lewis is adamant that he does not impose certain other constraints on *O* that one might expect:

‘*O*’ stands for ‘old’; it is the language that is available to us without the benefit of the term-introducing theory *T*. ‘*O*’ does not stand for ‘observation’. *O*-language is not meant to be a ‘pure observation language’, and

indeed I doubt that there could be any such thing...

I do not assume it to be first-order or extensional or finitary or free of indexicality. Nor do I assume it to be unmetaphysical, suited only to talk of everyday matters. (pp. 3-4)

After reconstructing Lewis's replacement argument and clarifying some of its premises, I will critically examine it in the rest of the paper. To anticipate my evaluation: I claim that the argument is highly sensitive to what we are assuming about the language O . In particular, I will argue that 2), the structuralist premise, is not explicitly acknowledged by Lewis, let alone adequately defended. This premise guarantees that a world where the actual fundamental properties are replaced has the same complete description in the language O . I will argue that this premise is not just unacknowledged and unsupported, but also highly implausible.

3 The Structuralist Premise

The achilles' heel of the Replacement Argument, I claim, is the structuralist premise:

2) If a proposition is expressible in O , then it supervenes on fundamental structure.

Informally, 2) can be taken to claim that the language O does not capture anything over and above the structure of the world. I will refer to 2) as the thesis of "Structuralism," despite the fact that this term has other uses in different philosophical debates.

Does Structuralism have any *prima facie* plausibility, or if not, is it supported by theoretical considerations?

Before arguing for a negative answer to this question, I need to make a case that the Replacement Argument indeed relies on Structuralism, even though Lewis does not explicitly acknowledge 2) or anything equivalent to it as a premise. To answer the worry that I am reconstructing the argument uncharitably, I will identify the transition in which 2) must work as a background assumption.

In his presentation of the argument, Lewis deploys the notion of an n -tuple of properties realizing a final and complete theory T of our world. T itself is not formulated in O : it contains property names P_1, \dots, P_n that are not part of O 's vocabulary. If we replace these property names with variables, we obtain an open sentence T_O which belongs to O . T_O is the matrix of the Ramsey sentence T_R of T ; i.e. T_R is existentially quantified with respect to all variables free in T_O . To say that an n -tuple realizes T is to say that it satisfies the open sentence T_O .

Here is Lewis's statement of the replacement argument:

We start with the unique actual realization of T ; all fundamental properties except idlers and aliens are members of it. If we replace those properties by others, we get a possible realization by combinatorialism. (p. 10)⁸

The last transition in this argument crucially depends on 2).⁹ Let $\langle F_1, \dots, F_n \rangle$ be the actual realization of T . It is true that combinatorialism and relevant instances of 4) guarantee the existence of a world w in which the actual fundamental properties have been replaced by aliens. That is, there is an n -tuple $\langle G_1, \dots, G_n \rangle$ such that a function that maps F_i to G_i can be extended to a fundamental isomorphism between @ and w . But combinatorialism and instances of 4) do not guarantee that $\langle G_1, \dots, G_n \rangle$ realizes T in w , and hence that the Ramsey sentence of T is true in w . If 2) is false, some O -expressible truth of @ may be false in w . If so, the Ramsey sentence T_R , which is equivalent to the conjunction of all truths expressible in O ,¹⁰ is false in w , and $\langle G_1, \dots, G_n \rangle$ is not a possible realization of T . Therefore, 2) is essential to the argument.¹¹

After arguing that the Replacement Argument does indeed rely on Structuralism, it remains to examine the status of the latter.¹²

Clearly, 2) is a substantive claim about O : there certainly are possible languages that can express truths that fail to supervene on fundamental structure. Suppose that some constant P denotes a fundamental property F that is instantiated in @. Then the sentence ' $\exists x x$ has P ' is true in @, but not in a fundamentally isomorphic world where F has been replaced. Hence not every truth expressible in that language supervenes

on fundamental structure.

In the rest of this section, I am arguing against Structuralism. First, I show that it is not a consequence of principles that Lewis acknowledges. This does not constitute an argument for the falsity of 2), but is dialectically effective provided that the burden of proof is on the proponent of the Replacement Argument. Secondly, I attack Structuralism directly: there appear to be counterexamples to it. Thirdly, I attack Structuralism indirectly, by modifying the Replacement Argument in such a way that it becomes a *reductio ad absurdum*.

3.1 Structuralism is unsupported

I showed that Structuralism is needed in the Replacement Argument. Lewis does not acknowledge it explicitly as a premise. Is it at least implicit, i.e. is it entailed by some other principle that he does endorse? Here I argue that it is not. The burden of proof is arguably on those who propound an argument with a surprising conclusion, not on those who deny it. If Structuralism is the only premise in the argument for which no support is offered, we already have reason to be skeptical of it.

Above, I noted that 2) is false if some property constant in O denotes a fundamental property. In his paper, Lewis is explicit that there are no such constants in O . He writes that “fundamental properties are not named in O except as occupants of roles” (p. 3). Presumably, a property is named *sans phrase* in O if it is denoted by an atomic term, and it is named as an occupant of a role if it is definable in O by the Ramsey-Carnap-Lewis method [Lewis, 1970]. Call the claim that no fundamental properties are denoted by atomic O -terms the *anonymity constraint*.¹³ Given a gloss of O as the non-theoretical part of the language, the anonymity constraint has some plausibility. Surely, a term standing for a fundamental property would be a theoretical term.

Lewis does not impose any further constraints on what sort of properties could be denoted by atomic terms of O . This raises the question whether the anonymity constraint entails 2), the structuralist premise? The answer is clearly negative. Let F and G be fundamental properties, and suppose that ‘ P_1 ’ denotes the conjunction of F

and G , or $C(F, G)$ for short.¹⁴ Further, suppose that ' P_2 ' denotes $C(F, NG)$ (where NG is the negation of G), and ' P_3 ' denotes $C(NF, G)$. Then an individual has F if and only if it satisfies ' $P_1(x) \vee P_2(x)$ ', and an individual has G if and only if it satisfies ' $P_1(x) \vee P_3(x)$ '. Thus these two properties are named in O as the occupiers of the roles corresponding to these open sentences, but not named in any other way. Now consider the sentence ' $\exists x x$ has P_1 '. This sentence is true in a world in which some individual has both F and G , but false in a fundamentally isomorphic world in which G has been replaced by H . Thus Lewis's anonymity constraint does not guarantee the truth of 2).

We may ask, though, whether there are plausible stronger constraints that do entail 2)? Does Structuralism follow from a principle in the same spirit as the anonymity constraint?

A natural candidate is the *strong anonymity constraint*, according to which no Boolean combinations of fundamental properties and relations are denoted by an atomic constant of O . However, it is easy to see O may distinguish between fundamentally isomorphic worlds even it satisfies the strong constraint. Suppose a pair of individuals satisfies ' $P_4(x, y)$ ' if and only if the first has F and the second has G . The term ' P_4 ' denotes a two-place relation which is not a Boolean combination of monadic fundamental properties like F and G . Then again, O can distinguish between fundamentally isomorphic worlds: ' $\exists xy P_4(x, y)$ ' is true in world with two individuals, one of which has F and one of which has G , but false in another world where G is replaced by H .

The strong anonymity constraint only bans properties definable from fundamental ones by the application of Boolean operators. We can formulate an even stronger condition. To satisfy the *ultrastrong anonymity constraint*, an atomic property constant may not denote any property definable from the class of fundamental properties and relations by the application of finitary or infinitary quantifiers and Boolean operators, and identity.

The constraint does not imply 2) either. Consider two worlds w and w' of two-way infinite recurrence which are fundamentally isomorphic, but in which distinct

fundamental properties are instantiated. Then there are properties that are had only by individuals in one epoch in w , and by no individuals in w' . Such properties have the following two features: First, they may be denoted by atomic constants of O compatibly with the ultrastrong anonymity constraint, for not even infinitary logical resources allow us to define them from fundamental properties and relations. Second, if a constant ' P ' of O denotes such a property, then the O -sentence 'something has P ' expresses a proposition that fails to supervene on fundamental structure: it is true in w and false in w' . Hence this way of strengthening the anonymity constraint likewise fails to ensure that 2) holds.¹⁵

Should we consider Structuralism to be a consequence of principles Lewis articulates in other papers, and might work as a background assumption in "Ramseyan Humility"? Of course, I cannot conclusively establish the negative existential claim that there is no such principle. Nonetheless, I want to mention an example of a claim from which Structuralism might be thought to follow, but does not, as a moment of reflection shows.

If we are speaking loosely, we might express Lewis's well-known doctrine of Humean supervenience by saying that "everything supervenes on fundamental structure." But structuralism as understood here emphatically does not follow from Humean supervenience. Roughly, Humean supervenience is the claim that if two worlds have the same fundamental properties and relations in corresponding places in spacetime, then they do not display any qualitative differences [Lewis, 1986b].¹⁶ Evidently, it does not follow that if two worlds have different fundamental properties, but arranged in the same way, they do not display any differences that O can capture. An analogy: the claim that no two mosaics differ in their aesthetic properties if they consist of the same arrangement of stones is very different, and much weaker, than the claim that no two mosaics differ in their aesthetic properties if they have isomorphic arrangements of stones, even if blue stones have been swapped throughout for red ones and vice versa.¹⁷

3.2 Structuralism is implausible

After noting that Structuralism is not supported by any principles Lewis acknowledges, I now want to argue against it. My strategy is to offer examples of O -expressible differences between structurally isomorphic possible worlds. If there are such examples, the claim that every O -expressible proposition supervenes on fundamental structure is false. The counterexamples to Structuralism I suggest involve exotic examples of fundamental properties and relations, which most of us think are not instantiated in actuality. This is legitimate in the dialectical context, since the Replacement Argument explicitly asks us to consider alien fundamental properties.

However, I can see no reason to think that Structuralism is true when we restrict our quantifiers in the supervenience claim to worlds that are nearby in modal space, say to worlds in which no alien fundamental properties are instantiated, or to worlds of a similar complexity as ours. Supposing that mass and positive charge belong to the same category, combinatorialism implies that there is a world w_s in which they have swapped places in the spatiotemporal manifold relative to the actual world.¹⁸ I do not know how to begin to describe how such a world would look like, and which O -sentences are true in it. Physics does not tell us anything about what w_s is like, since physics is only concerned with nomologically possible world, and w_s will pervasively violate actual dynamical laws. The reason I focus on small and exotic worlds is that they are much easier to describe. I offer a variety of examples, each one of which is contentious, and may be rejected by philosophers with certain theoretical commitments. Nonetheless, pointing to different apparent counterexamples to Structuralism should make it plausible that at least one of them is a real counterexample.

Example 1. Let w_p be a world in which there is just one point-sized particle that exists for a given period of time, and throughout instantiates the fundamental property of having a mass of 1 milligram. Let w_i be a world in which there is one point-sized immaterial thing, which exists for the same amount of time, and instantiates exactly one non-fundamental physical property. The worlds w_p and w_i are fundamentally isomorphic.

Sentences as “there is a material thing” and “some physical property is instantiated” express propositions that are true in w_p and false in w_i . If either of the terms ‘material’ or ‘physical’ belongs to the language O , or has a synonym in O , then these propositions can be expressed in O , and Structuralism is false.

Example 2. Take your favorite paradigms of a phenomenal experience, say being in pain and having an experience as of seeing red. Suppose that in some worlds, things have such experiences not in virtue of having a complex arrangement of various properties and relations, but in virtue of instantiating fundamental properties F and G , respectively. (On some views, this is consistent with physicalism being true in our world.) Let w_F and w_G be worlds in which there is just one thing instantiating one fundamental property, F and G respectively. Then w_F and w_G are fundamentally isomorphic.

The sentence “something is in pain” expresses a proposition that is true in w_F and false in w_G . If ‘in pain’ or a synonym is in O ,¹⁹ then that proposition can be expressed in O , and Structuralism is false.

Example 3. Let F and G now be what David Chalmers calls “edenic” color properties, say perfect red and perfect blue. These are non-actual fundamental properties, not role properties that need a realizer. As in Example 2, there is a pair of fundamentally isomorphic world that differ only as to whether F or G is instantiated.²⁰

The sentence “something is red” expresses a proposition true in one of these worlds but false in the other. If ‘red’ or a synonym is in O , then that proposition can be expressed in O , and Structuralism is false.

Examples 1 to 3 involve pairs of fundamentally isomorphic worlds that differ with respect to which fundamental monadic properties are instantiated. Plausibly, such pairs might instead differ with respect to which fundamental relations are instantiated. On Lewis’s view, spatiotemporal relations are the only actual non-monadic fundamental properties. But perhaps there are other fundamental relations in other possible worlds. To use an example due to Hawthorne [2001], there might be a perfectly natural relation of attending, such that whether one entity attends to another is not constrained by

the intrinsic properties of the relata or by the spatiotemporal relations between them. There might be a possible dyadic fundamental relation of telepathic connection that comes in degrees, and that in some worlds is distributed isomorphically to distance relations in our world. If we accept that there could be such fundamental relations, we can construct further *prima facie* counterexamples to Structuralism.

Example 4. Let w_D be a world where there are two things, each instantiating one fundamental monadic property, at a small distance from each other. Let w_T be a world where there are two non-spatial things, each instantiating one fundamental monadic property, in some fundamental intentional relation in the same category as distance.²¹ Then w_D and w_T are fundamentally isomorphic.

Then there are sentences, such as “two things are apart from each other, but close,” that express propositions that are true in w_D and false in w_T . If terms like ‘apart’ and ‘close’, or synonyms, are in O , then such propositions can be expressed in O , and Structuralism is false.²²

It is easy to construct further examples, some more plausible than others. Perhaps we can even describe a pair of fundamentally isomorphic worlds that have a different causal structure.²³ If there are causal locutions in O , then this will give rise to further O -expressible propositions that do not supervene on fundamental structure.

Of course, there are several ways to resist the conclusion that Structuralism is false. First, for each example it could be objected that I have failed to describe a pair of possible worlds. Secondly, my semantic ascent could be challenged: the sentences of English that I mention do not express propositions with different truth-value in the two worlds. Thirdly, it could be denied that the terms I mention belong to O .

It turns out that the second and third of these objections are of no help to the proponent of the Replacement Argument. Explaining why will require a closer examination at how the argument works, which I provide in 3.3 below. I

The first objection is hard to refute conclusively. Roughly, my claim that the worlds I described are possible was based on their conceivability and a presumption that what is conceivable is also possible. Justifying the possibility claims in detail would involve

a general discussion of modal epistemology that is beyond the scope of this paper. But I think it is fair to say that Lewis, of all philosophers, was willing to accept that the burden of proof is on those wishing to deny a possibility claim.²⁴ In 3.3, I will present a more targeted *ad hominem* argument for the claim that Lewis is committed to reject Structuralism.

3.3 A *reductio* against Structuralism

So far, I tried to shed doubt on the structuralist premise in two ways. Negatively, I argued that it is not entailed by premises that Lewis explicitly endorses (3.1). Since it is fair to say that the burden of proof is on the philosopher who is producing an argument with a surprising conclusion, I take that to be an effective criticism. Positively, I presented *prima facie* counterexamples to Structuralism. However, my case that a given pair of worlds constituted a counterexample to structuralism was always conditional on an assumption: that some term of ordinary English belongs to O , or has a synonym in O . It is unsurprising that premise 2) is hard to assess as long as we are in the dark about what O is. But there is a way around that dialectical difficulty for the critic of the Replacement Argument. For that argument has other premises that do tell us something about O that is in tension with 2). Rather than attacking 2) as a claim about some unspecified language, we can try to present a *reductio ad absurdum* of the structuralist premise.

That strategy immediately faces a problem: while the thesis of Humility, the conclusion of the Replacement Argument, is surprising, it is hardly absurd. Perhaps there are possible fundamental properties F and G that differ so subtly that we are in principle unable to know whether F or G is actually instantiated. Humility is not a suitable basis for a *reductio*. The key to the *reductio* strategy is realizing that the premises of Lewis's argument do not just entail Humility, but also another, truly implausible claim. The Replacement Argument proves too much.

The claim that I take to be the basis for the *reductio* is the following:

8) We cannot entertain any proposition that does not supervene on fundamental structure.

In other words: we cannot entertain any proposition that is true in one of a pair of fundamentally isomorphic worlds and false in the other.

In one sense, ‘to entertain A ’ means to deliberate about A without committing yet to either its truth or falsity. The sense in which the expression is used in 8) is weaker. If you have a propositional attitude towards A , you *eo ipso* entertain A .²⁵

There is no reference to O in 8), and it thus can be assessed without knowing what O is. An implementation of the strategy now requires two things: first, showing that the Replacement Argument indeed commits Lewis to 8), and arguing that 8) is false.

The second task has in effect been already dispatched. In 3.2, I tried to describe worlds that are fundamentally isomorphic yet qualitatively different, and thereby to express, and to make the reader entertain, propositions that are true in one but not the other. In so far as I succeeded, I have established that 8) is false. Which terms are O , and which ones are not, is neither here nor there.

Thus there remains the first task: showing that the premises of Lewis’s Replacement Argument entail 8). Of course, it does not follow from the premises 1), 2), 4) and 5) of my reconstruction in section 2. But that reconstruction was only as fine-grained as was needed then.

The premises that, jointly with Structuralism, entail 8) are hidden in a sub-argument for the expressibility premise 1):

1) If a proposition is knowable, then it is entailed by a true proposition that is expressible in O .

We can reconstruct an argument for premise 1) as follows, where L_T is the language in which the final and complete theory T is formulated:

1a) If a proposition is expressible in L_T , it is expressible in O .

1b) If a proposition is entertainable, it is expressible in L_T .

1c) If a proposition is knowable, it is entailed by an entertainable proposition.

From 1a) and 1b), it follows that entertainable propositions are expressible in O . Together with 1c), they imply 1).

Crucially for present purposes, premises 1a), 1b) and 2) together imply that we can only entertain propositions that supervene on fundamental structure, and hence 8).

Premise 1c) ought to be uncontroversial. Knowledge that p implies belief that p , and the belief that p implies the entertainability of p , or at least of some something that entails p .²⁶ It remains for me to show that Lewis is committed to 1a) and 1b).

To see why premise 1a) holds, we need to take a closer look at the language L_T in which the hypothesized final and complete theory T of the world is formulated. The language O is just a fragment of L_T : in addition to O -terms, L also contains T -terms, or “theoretical” terms. In the framework Lewis deploys, T -terms are introduced, and implicitly defined, by the theory T .²⁷ In Lewis [1970, section IV], Lewis showed how implicit definitions can be turned into explicit ones. Explicit definitions are mere abbreviations: they do not increase the expressive power of the language.²⁸ To be sure, not each term of L_T needs to have a synonym in O . But while some L_T -expressible propositions might not find a succinct expression in O , they will find some expression, however cumbersome. Hence as a matter of logic, any proposition expressible in L_T is also expressible in O .

To see why premise 1b) holds, we need to recall what role the theory T plays in the Replacement Argument. T is meant to imply all truths that we can think or say. If it did not, then we should move to a more comprehensive theory, and try to run the Replacement Argument for it. Hence L_T must be able to express any proposition that we can express, in natural language or in scientific language. Indeed, the expressive power of L_T must not only match, but exceed the expressive power of our actual language. The argument is about limits to what we can know in principle, not about our present epistemic limits. Premise 1b) would thus not be warranted if L_T were an actual language used at a particular stage in history. All such languages have contingent limitations in their expressive power that humans might eventually

overcome. That something is not expressible in an actual language at best entails that it fails to be known, not that it fails to be knowable. Clearly, Lewis allows that L_T is idealized, free from contingent limitations.

I thus conclude that a proponent of the Replacement Argument is committed to 8). (Though I will briefly reconsider the question in 4.1, when I respond to an objection.) As I noted, all the examples I gave in 3.2 are *prima facie* counterexamples to 8), quite independently of any assumptions about which terms do or do not appear in O . But I would like to strengthen my case against 8) further by an *ad hominem* move against Lewis: 8) implies that materialism, as defined by Lewis himself, is not entertainable. If it is not entertainable, then it cannot be believed, or disbelieved, or doubted, or argued about—a conclusion that some philosophers would have welcomed, but certainly not Lewis.

For Lewis, materialism is compatible with modal space including outlandish, spirit-ridden possible worlds (see Lewis [1983a], Lewis [1999, What Experience Teaches, pp. 274-5], and Lewis [1999, Reduction of Mind, pp. 291-3]), as long as these worlds are not in the “inner sphere of possibility” around the actual world. According to his definition, a world is *materialistic* iff among the worlds in the inner sphere around it, no two differ without differing in the distribution of physical properties.²⁹ The inner sphere of worlds around w consists of those worlds in which no fundamental properties alien to w exist.³⁰ If all fundamental properties in a world are physical, then it is materialistic. For the fundamental properties in any two worlds in the inner sphere are likewise physical, and hence these worlds do not differ without differing physically. Conversely, if a world is materialistic, then all its fundamental properties are physical.³¹ So we can equivalently take materialism to be true in a world iff all fundamental properties in that world are physical.³²

Surely, there can be physical and non-physical fundamental properties in the same category. For example, mass is a scalar-valued monadic physical property. In some world where dualism is true, pain perhaps is, or is realized by, a scalar-valued monadic non-physical property. It is now easy to see how the *reductio* is completed. A com-

binatorial principle will imply that there are two fundamentally isomorphic worlds such that materialism is true in one of them but not the other.³³ Thus materialism, as defined by Lewis, does not supervene on fundamental structure, and by 8) fails to be entertainable.³⁴ The same sort of argument applies to many other contingent supervenience claims as well: they fail to be entertainable if 8) is true.³⁵

4 Objections considered

So far, I have been on the attack, criticizing the Replacement Argument by undermining its second premise. In this section, I switch to defense. I consider two objections to the effect that the Replacement Argument can be reconstructed in such a way that it is not vulnerable to my criticism. In response, I argue that it does not fare better on these alternative reconstructions.

4.1 Unknowability without Inexpressibility?

The *reductio* argument against the Structuralism depends on 1a) and 1b). But surely, someone not committed to those premises might still advance a variant of the Replacement Argument? She might support premise 1) in some other way. Even expressible propositions may be unknowable, after all. Another necessary condition for the knowability of p is that we could have justification to believe it, and we can arguably only have such justification if we have evidence for p . Perhaps there could not be any evidence for those propositions not expressible in O . This line of thought suggests the following alternative sub-argument for premise 1):

1a') If a proposition is knowable, it is entailed by a true proposition that we could have evidence for.

1b') If a proposition is not expressible in O , we could not have evidence for it.

Given a language O , we can distinguish two characters who may run the Replacement Argument, whom I call the “expressive skeptic” and the “evidential skeptic.” The ex-

pressive skeptic denies that we can express, or entertain, any propositions that are not expressed by a sentence of O . Anything not translatable into that idiom is unintelligible to her. The evidential skeptic grants that we can think and speculate about many questions that cannot be asked in O . But she insists that such speculation is entirely idle, since there could not be any evidence that favored one answer over another one.

My *reductio* from 3.3 works only against an expressive skeptic, who appeals to premises 1a), 1b), and 1c) in addition to 2), 4), and 5). It has no force against an evidential skeptic, who denies 1a). Unless she tells us more about what she takes O to be, it is also difficult to evaluate whether the examples from 3.2 are effective against her. This raises the question whether the Replacement Argument is effective in the hands of the evidential skeptic.

The answer is negative, for the reasons laid out in Schaffer [2005]. If we can express different hypotheses about what the actual fundamental properties are, but O cannot express them, then so much the worse for the claim that only O -expressible propositions could bear on whether we should believe these hypotheses. Schaffer points out that the evidential skeptic's Replacement Argument is just another skeptical argument of the kind familiar from the tradition. Any epistemological theory that has a response to skepticism can likewise disarm that particular argument, as he shows in detail.³⁶

What about the exegetical question: is the author of "Ramseyan Humility" an expressive skeptic or an evidential skeptic? I already argued in 3.3 that he is an expressive skeptic. Lewis explicitly states that all terms in L_T are either also in O or defined in terms of O by the theory T . Hence he is committed to accept 1a), i.e. that the expressive power of L_T does not exceed the expressive power of O . Moreover, he explicitly takes T to be a complete theory. The intended sense of completeness is that it answers all the questions we can think of. (It is not meant to be complete in the sense of implying every true proposition; otherwise, its completeness would be incompatible with Humility.) Thus Lewis is committed to 1b) as well.

When taken in isolation, some passages in Lewis [forthcoming] may suggest that Lewis is an evidential skeptic:

O-language, we assumed, is rich enough to express all possible observations. Therefore any predictive success for *T* is equally a predictive success for the Ramsey sentence of *T*. Since the evidence for *T* consists of its record of predictive success, there is no way to gain evidence for *T* that is not equally evidence for the Ramsey sentence. ...

There is indeed a true contingent proposition about which of the possible realizations is actual, but we can never gain evidence for this proposition, and so can never know it. If there are multiple possible realizations, Humility follows. (p. 5/6)

But Lewis also makes clear that the allegedly unknowable propositions are not entertainable:

We cannot answer the question: which property occupies that role? But worse: not only can we not answer that question, we can't even ask it. (p. 16)

An answer to that question would be the sort of proposition that the thesis of Humility claims to be unknowable: one that is true only in worlds in which some fundamental property *F* is instantiated (and plays a given role), but not in worlds where *F* is replaced by a distinct *G*.

The passages do not show that Lewis is an evidential skeptic. We should note that anyone who is committed to 1a) and 1b) will also accept 1a') and 1b'), and is thus entitled to use the sub-argument for 1) presented in this section. For premise 1a') is uncontroversial if we take 'evidence' broad enough. Moreover, for a fixed *O*, 1b') seems weaker than the conjunction of 1a) and 1b)—we could not have evidence for a proposition that is not entertainable, presumably. Given that an expressive skeptic has the stronger commitments, she can still assent to these premises. Thus the hypothesis that the author of "Ramseyan Humility" is an expressive skeptic is not odds with what he says in these passages.

4.2 Two-Dimensionalism to the Rescue?

My reconstruction of the Replacement Argument appeals to a functional relation of expression between sentences and propositions. I often talk about “the proposition expressed” by a sentence, or about propositions “expressible in O .” It may be objected that this is problematic. Lewis himself appeals to what is called “two-dimensionalism” in a later stage of the paper, and according to two-dimensionalism, there are two salient expression relations between sentences and propositions, which we may call “primarily expressing” and “secondarily expressing.” In this section, I argue that while going two-dimensional adds complexity to the argument, it does not provide an answer to my criticism.

I will first describe the problem that motivates Lewis to wheel in two-dimensionalism, and then explain why this move does not help to get around the issue I raised for the Replacement Argument in this paper.

I claim that premise 2) is false: O -expressible propositions do not supervene on fundamental structure. For the discussion of the objection from two-dimensionalism, it is useful to localize more precisely where supervenience fails. Let the *simple O -fragment* consist of those sentences formed from variables, atomic property constants, quantifiers, and truth-functional operators. Excluded from the simple O -fragment are sentential operators such as ‘actually’ or ‘now’ and individual constants, for example.

2) can be expressed as the conjunction of 2a) and 2b):

2a) Propositions expressible in the simple O -fragment supervene on fundamental structure.

2b) O -expressible propositions supervene on those expressible in the simple O -fragment.³⁷

I have in effect attacked 2a), and complained that Lewis offers no defence of it. However, Lewis does respond to an objection that can be seen as targeting specifically 2b). This raises the question whether his response strategy could also be deployed to support 2a). I will argue that it could not.

Here is the objection against 2b): Let $T(P_1, \dots, P_n)$ be the true and complete theory of @, in a given (finite or infinite) axiomatization, and suppose that 2a) is true. Then T 's Ramsey-sentence $T_R =$

$$\exists X_1 \dots \exists X_n T(X_1, \dots, X_n)$$

is likewise true in world that is O -indiscernible from @. But

$$\exists X_1 \dots \exists X_n [T(X_1, \dots, X_n) \wedge \textit{Actually } T(X_1, \dots, X_n)]$$

is false in worlds where fundamental properties have been permuted or replaced relative to the actual world. Indeed, that sentence expresses a maximally strong proposition which is true only in @.

As mentioned above, Lewis responds by complicating the semantic picture in such a way that we can no longer speak of a sentence expressing a proposition *simpliciter*. Rather, we have to specify the way in which it expresses the proposition. Instead of claiming that we do not have sentences that express an answer to the question which fundamental properties are actual, Lewis then claims that we have no sentences “that express those alternative answer-propositions, and do so in such a way that we can know which sentence expresses which proposition” [Lewis, forthcoming, p. 15]). As a footnote makes clear, Lewis is appealing to two-dimensional semantics. For him, it is the primary intension that is expressed “in such a way that we can know which sentence expresses which proposition.”³⁸ ‘Expressible’, as I have used it, ought to be understood as “expressible qua primary proposition of a sentence or thought,” and 2) should be understood as 2’):

- 2’) If a proposition is the primary intension of a sentence of O , it supervenes on fundamental structure.

This move foils the objection against 2b) since the proposition that is true in @ but not in any other world is only expressed as the *secondary* intension of the above sentence. An actuality-operator makes no difference at all to the primary proposition associated with a sentence.³⁹

Consider the sentence “Things are as they actually are,” or if you prefer, “Every proposition is true if and only if it is actually true.” The primary intension of this sentence is necessary, while the secondary intension is true and maximally strong, i.e. true only in @. There is a good sense in which this sentence is uninformative and does not imply answers to questions about our world. Lewis seems at least *prima facie* justified in insisting that the primary intension of sentences is the relevant one for the Replacement Argument.

For the sake of the argument, I accept Lewis’s response to the objection against 2b). However, I do not think that invoking primary intensions can confer any plausibility on 2a). By definition, atomic *O*-terms do not contain actuality-operators, nor any other indexical expressions. There is a standardly accepted theory about how the primary and the secondary intension diverge in the case of indexical expressions. Some two-dimensionalists think that proper names and natural kind terms ought to be understood as descriptions involving rigidifying operators. If they are right, the primary and secondary intensions of those terms will come apart. But of course, proper names and natural kind are not *O*-terms on this view, but rather new terms introduced by the Ramsey-Carnap-Lewis method.

As far as I know, there is no developed account in the literature on which primary and secondary intensions of *atomic O*-terms come apart.⁴⁰ If they coincide, then the distinction between primary and secondary intensions is irrelevant for the discussion of 2a).

Of course, somebody could come up with a characterization of an intension that may diverge even for atomic *O*-terms from what is expressed in the ordinary sense, or expressed as the “secondary intension.” We might call such a hypothetical intension a “structural intension.” But such a strategy faces a dilemma: either it is meant to be ensured by stipulation that structural intensions supervene on fundamental structure, or by argument. If by stipulation, then it is difficult to see how the expressibility premise of the Replacement Argument is to be justified. It might be plausible that knowledge must be expressible, but why should be expressible qua structural intension

of a sentence? If it is meant to be ensured by argument that structural intension supervenes on fundamental structure, then we can ask for the argument to be produced.

Here is one argument that would not be effective: Since structural intensions can never differ between epistemically indiscernible scenarios, and since fundamentally isomorphic are epistemically indiscernible, structural intensions can never differ between fundamentally isomorphic scenarios. It is clear why such a defense of premise 2a) would not be of any use to the proponent of the Replacement Argument. The claim that all fundamentally isomorphic scenarios are epistemically indiscernible is not pre-theoretically obvious; I, for one, find it *prima facie* little more attractive than the claim that isomorphic mosaics look the same. Moreover, the claim is rather close to the thesis of Humility. If there were independent support for it, it would threaten to make the Replacement Argument redundant. If there is no independent support, then the Replacement Argument might be described as circular, or begging the question, or failing to transmit warrant, depending on what your favorite diagnostic tool is. In any case, it would be dialectically ineffective.

In the last paragraph, I went beyond discussing an argument that has actually been given, and speculated about how somebody might attempt to support the structuralist premise. I cannot discuss every possible argumentative strategy in favor of 2), but my money is on its negation. In contrast, I do not take Humility, the conclusion, to be too implausible. What I hope to have established here is that if we accept Humility, it ought not to be on the basis of Lewis's Replacement Argument.

Notes

¹Alternatively, the content of the theory is given by a variant of the Ramsey sentence that replaces existential quantifiers with uniqueness quantifiers ($\exists!$). I will disregard subtleties that arise if a theory has more than one realization in the same world.

²Lewis borrows 'humility' as a philosophical term of art from Langton [1998], who uses it to label an ignorance claim she attributes to Kant. Psillos [2006] was likewise inspired by Langton to coin the expression "Ramseyan Humility" for a similar thesis he attributes to Ramsey.

³For example, David Armstrong's combinatorial theory of possibility [Armstrong, 1989] would license an argument from permutation, but not from replacement.

⁴For critical examination of that thesis, see Schaffer [forthcoming].

⁵It is faithful, but not maximally fine-grained. There are sub-arguments for some of the premises that I skip over here. This will become relevant in 3.3 below.

⁶Here as elsewhere in the paper, I speak of properties rather than properties and relations, for the sake of simplicity. The definition of a fundamental isomorphism given here can straightforwardly be extended to relations.

If we are using the framework of *centered* possible worlds, then a fundamental isomorphism is also required to map the center of w to the center of w' .

⁷I here ignore the epistemic possibility, mentioned by Lewis in footnote 4, that there is no minimal supervenience base.

⁸For Lewis, a fundamental property is an idler at a world if it does "not play an active part in the workings of nature" (p. 3) of that world.

⁹2) is not the logically weakest assumption that would legitimize the transition. (The logically weakest such assumption is always equivalent to the material conditional with the other premises as antecedent and the desired conclusion as consequent.) But it is the logically weakest such assumptions that is not intolerably *ad hoc*. The transition might be legitimized by the assumption that all worlds fundamentally isomorphic to the *actual* world are *O*-indiscernible. It is hard to see what would motivate such a contingent structuralism. Moreover, it would go against the spirit of Lewis's argument to appeal to contingent features of our world. He complains that a view according to which no fundamental properties are alien, but some exist only contingently that it posits that "our world has a special distinction that some other worlds lack. Why should the world we happen to live in be special in this way? Very likely it isn't" (p. 10).

¹⁰Strictly speaking, this equivalence holds only if T says that its theoretical terms are uniquely realized. This is a very plausible assumption given that T is supposed to be a complete theory. See also note 1.

¹¹The same comment would apply, *mutatis mutandis*, to Lewis's statement of the permutation argument: "Suppose we have the actual realization of T . Maybe some members of the n -tuple that realizes T are not fundamental properties, or maybe some belong to single-membered categories. Hold those ones fixed. Permute the rest within their categories to obtain a new n -tuple. It too would realize T ." (p. 5)

¹²Of course, I am not claiming that 2) is essential to any possible argument for Humility. However, I do claim that by any reasonable standard for individuating arguments, an argument that does not rely on 2) would be distinct from any that is offered in Lewis [forthcoming].

¹³In particular, the last section of “Ramseyan Humility,” entitled “Humility about Qualia,” is a defence of the anonymity constraint.

¹⁴In my metalanguage, I use ‘C’ and ‘N’ as functional expressions applying to properties names; ‘ $C(F, G)$ ’ denotes the conjunction of F and G , and ‘ NF ’ the negation of F . I use these symbols instead of more familiar negation and conjunction symbols to distinguish these functors from the sentential connectives which are present in O .

¹⁵Suppose the ultrastrong anonymity constraint is coupled with the assumption that properties are sparse rather than abundant, such that there are no properties of the kind appealed to in the last paragraph. Then these two assumptions may indeed imply 2). But the proponent of the argument would pay an intolerable price: if they imply 2), they also imply that no properties and relations are denoted by atomic O -terms. Then O would basically only consist of logical vocabulary! Premise 1) would then become deeply implausible.

With or without auxiliary assumptions, the ultrastrong anonymity constraint rules out something that Lewis evidently does not want to rule out (as becomes clear in the section entitled “Spreading Humility”): that properties which are invariant under permutations and replacements, and thus supervene on fundamental structure, are denoted by atomic O -terms.

¹⁶Lewis restricts the quantification to worlds in the “inner sphere of possibility,” where there are no alien fundamental properties. But even without this restriction, Humean supervenience does not imply structuralism.

¹⁷It goes without saying that Structuralism is not implied by any combinatorial principles about fundamental properties. That O has predicates such as P_1 to P_4 is entirely compatible with F , G , and H satisfying combinatorial principles.

¹⁸Perhaps positive and negative charge are determinates of one determinable which may take negative values, and then mass and charge are not of the same category. However, Lewis allows that positive and negative charge are only nomologically incompatible [Lewis, 1986a, p. 155], in which case positive charge would be in the same category as mass.

¹⁹Of course, this assumption is compatible with the anonymity constraint. The term does not “name” F ; it applies to properties other than F as well.

²⁰Chalmers [2006, pp. 79-80] tentatively concludes that worlds with such “edenic” color properties are possible.

²¹It could be objected that on Lewis’s theory of possible worlds, it is arguably necessary that there is spacetime structure, such that there could not be a world such as w . However, Lewis is explicit that his replacement argument is not hostage to his views about possible worlds. Indeed, the argument would be of much more limited interest if it were presupposing these views.

²²In fact, Lewis’s anonymity constraint, discussed in 3.2, does not look all that plausible for funda-

mental spatial, temporal, or spatiotemporal relations. I will not develop that objection here, though.

²³To emphasize again a point made earlier, this would be entirely compatible with the supervenience of causation on fundamental properties and relations. In particular, it is also compatible with Lewis's accounts of causation as in terms of counterfactuals and indirectly in terms of laws of nature. Fundamentally isomorphic worlds may not have isomorphic laws, for the comparison of candidate systems in terms of strength may be sensitive to what the fundamental properties are. Likewise, similarity orderings among worlds, which determine which counterfactuals are true, may be sensitive to what fundamental properties are.

²⁴To echo Zimmerman [1999, p. 213]: "I am fortunate to have Lewis for challenger ...: Lewis ... is willing to take the fact that something seems plainly possible as weighty evidence for its actually *being* possible—not just 'epistemically possible', i.e. true for all we know right now."

²⁵Of course, it is a vexed question under what conditions one counts as having an attitude to a proposition. Clearly, not every relation to a proposition qualifies, but only fairly natural relations of the right kind. I will not attempt an analysis of what it is to have an attitude towards a proposition. While hard to analyse, the notion is understood reasonably well.

One can replace 'entertainable' by 'expressible' if preferred. It is an interesting question whether some propositions are entertainable but not expressible, but we can abstract from it for the purpose of the argument.

²⁶Since every proposition entails itself, 1a) is weaker than the claim that every knowable proposition is entertainable.

²⁷"The language of T contains *T-terms*: theoretical terms implicitly defined by T. And there is all the rest of our language, call it *O-language*." (p. 3)

²⁸Sometimes, this is expressed by saying that definitions need to satisfy an eliminability constraint. For discussion of logical features of definitions, see for example Suppes [1957] and Belnap [1993].

²⁹This definition takes 'being physical' as a term for a second-order property that is primitive, i.e. unanalysed. Of course, Lewis does have things to say about it.

³⁰Maybe not even all of those worlds are in the inner sphere; see Lewis [1994, section 1]. That issue does not bear on the present discussion.

³¹Suppose a world w has a non-physical fundamental property F . By a combinatorial principle, there is a world that differs from w in the distribution of F but not in the distribution of physical fundamental properties. Hence w is not materialistic.

³²Lewis himself uses a formulation of that sort in Lewis [1999, Reduction of Mind, p.292]: "[A]ll fundamental properties and relations that actually occur are physical. This is the thesis of materialism."

³³Since combinatorialism needs to be appealed to here, could the argument be construed as a

reductio of combinatorialism rather than Structuralism? In principle, this is a theoretical option. But it is a very unattractive one, because the *reductio* requires something far weaker than a general combinatorial principle for fundamental properties. What is needed is only that physical and non-physical fundamental properties can be instantiated in worlds with the fundamental same structure, which is a weak combinatorial principle indeed.

³⁴An objection: This argument only goes through if it is assumed that the second-order-property of being physical is essential to every property that has it, i.e. that no property can be physical in one world and non-physical in another. But this is a fair assumption to make, since Lewis's definition of materialism is inadequate without it.

For suppose α is the class of actual fundamental properties, and that all members of α are physical in @. Then intuitively, materialism should be true. But suppose there is a world w where some member G of α is non-physical, and where no fundamental property not in α is instantiated. By combinatorialism, there are many worlds that differ from w only in the distribution of G , but not otherwise (in particular, not in whether the other fundamental properties are physical or not). Surely, there is at least one world w' where G is likewise non-physical. Then w and w' are worlds without alien properties that differ without differing physically, and hence Lewis's definition misclassifies @ as non-materialistic.

³⁵Exceptions are provided only by claims to the effect that all actual fundamental properties and relations belong to a certain category. The Leibnizian doctrine that all relations supervene on monadic properties would not be susceptible to the argument, since monadic properties form their own category and thus cannot be replaced by non-monadic relations while preserving fundamental structure. Whether Lewis's doctrine of Humean supervenience is susceptible is unclear. Perhaps a case can be made that properties instantiated by point-sized things, or by mereological atoms, form their own category.

³⁶Plainly, though, the answers he surveys are not answers to the expressive skeptic's Replacement Argument, since they rely on the entertainability of the propositions whose knowability is in question.

³⁷2a) and 2b) entail 2) by the transitivity of supervenience. 2) entails 2b) by the monotonicity of supervenience. 2) entails 2a) by the principle that if A supervenes on B , then every subset of A likewise supervenes on B . (This principle is in turn a consequence of the reflexivity, monotonicity and transitivity of supervenience.)

³⁸"Primary intension" is David Chalmers' term, whose Chalmers [1996, pp. 52-71] is a good introduction to two-dimensionalism.

³⁹This follows immediately from the semantic clause: *Actually* S is true at $\langle v, w \rangle$ iff S is true at $\langle v, v \rangle$.

⁴⁰On Chalmers' account, the atomic O -terms would be those used in the canonical description of

scenarios, whose primary and secondary intensions coincide (ignoring the fact that primary intensions contain centered rather than uncentered worlds).

References

- David M. Armstrong. *A Combinatorial Theory of Possibility*. Cambridge University Press, 1989.
- Nuel Belnap. On rigorous definitions. *Philosophical Studies*, 72:115–146, 1993.
- David J. Chalmers. *The Conscious Mind. In Search of a Fundamental Theory*. OUP, 1996.
- David J. Chalmers. Perception and the Fall from Eden. In Tamar Szabó Gendler and John Hawthorne, editors, *Perceptual experience*, pages 49–125. Oxford University Press, 2006.
- John Hawthorne. Intrinsic properties and natural relations. *Philosophy and Phenomenological Research*, LXIII (2):399–404, 2001.
- Frank Jackson and Graham Priest, editors. *Lewisian Themes. The Philosophy of David K. Lewis*. Oxford University Press, 2004.
- Rae Langton. *Kantian Humility*. OUP, 1998.
- Rae Langton. Elusive knowledge of things in themselves. *Australasian Journal of Philosophy* 82, pages 129–136, 2004.
- David Lewis. How to Define Theoretical Terms. *Journal of Philosophy*, 67:427–426, 1970. Reprinted in Lewis 1983b (pp. 78-95).
- David Lewis. New work for a theory of universals. *Australasian Journal of Philosophy*, 61:343–377, 1983a. Reprinted in Lewis 1999 (pp. 8-55).

- David Lewis. Putnam's paradox. pages 221–236, 1984. Reprinted in Lewis 1999 (pp. 56–77).
- David Lewis. Humean supervenience debugged. *Mind*, 103:473–490, 1994. Reprinted in Lewis 1999.
- David Lewis. *On the Plurality of Worlds*. Blackwell, 1986a.
- David Lewis. Ramseyan Humility. In David Braddon-Mitchell and Robert Nola, editors, *Naturalism and Analysis*. MIT Press, forthcoming.
- David Lewis. Introduction. In Lewis 1986c. 1986b.
- David Lewis. *Philosophical Papers*, volume I. Oxford University Press, Oxford, 1983b.
- David Lewis. *Philosophical Papers*, volume II. Oxford University Press, Oxford, 1986c.
- David Lewis. *Papers in Metaphysics and Epistemology*. Cambridge University Press, Cambridge, 1999.
- Alyssa Ney. Physicalism and our knowledge of intrinsic properties. *Australasian Journal of Philosophy* 85 (1), pages 41–60, 2007.
- Stathis Psillos. Ramsey's *Ramsey-sentences*. In Maria Carla Galavotti, editor, *Cambridge and Vienna: Frank P. Ramsey and the Vienna Circle*, volume 12 of *Vienna Circle Institute Yearbook*, pages 67–90. Springer, 2006.
- Hilary Putnam. Models and Reality. *Journal of Symbolic Logic* 45, pages 464–482, 1980.
- Hilary Putnam. *Reason, Truth, and History*. CUP, 1981.
- Jonathan Schaffer. Quiddistic Knowledge. *Philosophical Studies*, 23:1–32, 2005. Reprinted in Jackson and Priest 2004.

Jonathan Schaffer. Knowing the answer. *Philosophy and Phenomenological Research*, forthcoming.

Patrick Suppes. *Introduction to Logic*. Van Nostrand, 1957.

Ann Whittle. On an argument for humility. *Philosophical Studies*, 130:461–497, 2006.

Dean Zimmerman. One really big liquid sphere: Reply to Lewis. *Australasian Journal of Philosophy*, 77:213–215, 1999.